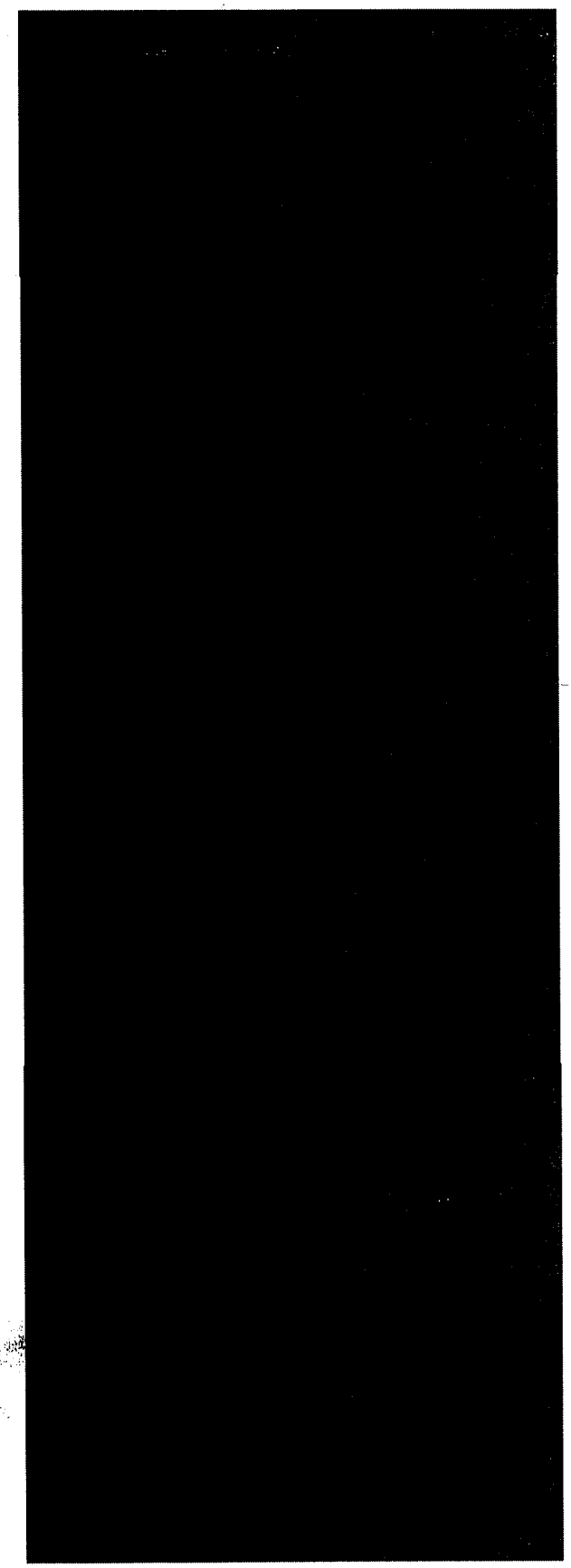

WORLD HEALTH ORGANIZATION

EUROPE

Support for the Development of a Framework for the Implementation of Water Safety Plans in the European Union

Version 4 October 2007

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Support for the Development of a Framework for the Implementation of Water Safety Plans in the European Union

EXECUTIVE SUMMARY

SUMMARY OF RECOMMENDATIONS

Nr	Recommendation	Basis
1	After due consideration of the scientific advice that led to the recommendation of a WSP-type approach during the formulation of the WHO Guidelines for drinking-water quality, and having assessed the application of WSP-type approach on location in a geographically representative number of water supply services of different size, the advice to the Commission is to proceed with a revision of the current drinking-water directive to include WSP-type approach within a wider holistic context of a Framework for Safe Drinking-water.	Credence for the inclusion of the WSP-type approach concept into the DWD found from: - Due consideration of the scientific advice that led to the recommendation of a WSP or similar approach during the formulation of the WHO Guidelines for Drinking-water Quality and - Favourable assessment of the application of WSP-type approach on location in a geographically representative number of water supply services of different size. Importantly, the WSP needs to fit within a wider framework of surveillance and support to enable health outcomes to be under surveillance and achieved.
2	Consider cost-benefits of implementation	Implementation of a WSP-type approach should be accompanied by consideration of the overall cost-benefits. Efforts should be made to maximize the societal and particularly the health benefits at minim costs. Introduction of WSP-type approach will best be accompanied by a strengthening of the economic evidence base. A least-cost planning approach weighted against different criteria should be applied, particularly if it becomes clear that significant interventions are required.

Nr	Recommendation	Basis
3	A number of circumstantial issues need to be borne in mind to ensure the success of any proposed legislative changes to ensure the highest possible chances of success. These include: a sufficiently long start-up time frame and the development of technical guidance documents on WSP-type approach which can then serve for the formulation of nationally adapted methodologies. The issue of control over the verification of the WSP-type process needs to be addressed, as well as the relative authority of the different stakeholders, particularly the water utilities, over the different components of the WSP-type process.	WSP implementation will require familiarisation with the process to be conducted. Other nations have allowed periods of consultation prior to implementation and up to three years for the development of management plans after the introduction of a mandate for the development of the WSP-type approach.
4	The Commission is advised to introduce legislation at the level of the European Union, but that its actions be limited to those tasks which cannot be performed effectively at a more immediate or local level.	The Commission is advised to introduce this revision of the legislation at the level of the Union, rather than leaving the responsibility with the individual Member States.
5	Integration of WSP-type approaches would require substantial revision of the current drinking water directive. It is not impossible that the revision would prove to be so complex that consideration ought to be given to repealing the current directive and issuing of a new one, in stead of merely amending the current text	Integration of WSP-type approaches will require substantive revision and/or amendment of the current drinking water directive. It is not impossible that the revision of the directive and the harmonization of other elements of the Community *acquis* will prove to be such a demanding task that repealing the current directive and issuing a new one might be more effective.

Nr	Recommendation	Basis
6	Review of the existing Community *acquis* is a standard procedure when new legislation is being considered. Nevertheless, certain elements will warrant special attention with a view towards harmonizing their provisions with any changes in the drinking water directive. This is particularly the case for legislation dealing with water policy, food safety, construction products, and protection of critical infrastructure.	Certain elements of the revised DWD will warrant special attention with a view towards harmonizing their provisions with other requirements under the Community *acquis.* This is particularly the case for legislation dealing with water policy, food safety, construction products, and protection of critical infrastructure.
7	The revised DWD should include either in itself or through linkages to other legislative instruments, a requirement for independent oversight.	The Commission is advised to recognise the need for independent review of the WSP-type approach, and to reflect this in the proposed revision of the DWD. It may be guided by WHO's Framework for Safe Drinking-water through which WSPs operate within a context of independent oversight.
8	The introduction of a WSP-type approach will also require new regulatory provisions for areas which hitherto did not benefit from regulatory provisions at the Community level, including the accreditation of workers who may interact with the water supply system post treatment**.**	There is a body of evidence, including findings in different European settings made under the present project, that unqualified personnel may create additional risk to water supply systems once the treated water is delivered to the distribution system. These issues can be controlled by introducing certifications of competencies, which will need to be supported by regulation.
9	A proposal for a new drinking water directive should contain a strong basis for inter-sectoral cooperation by recognizing the role of all stakeholders, and defining their areas of responsibility and authority in the context of WSP-type approaches.	A proposal for a new DWD should contain a strong basis for inter-sectoral cooperation by recognizing the role of all stakeholders, and by defining their areas of responsibility and authority in the context of the water safety plans or similar approaches. In the WSP-type approach, responsibilities and stakeholders will emerge from the system assessment element, and the control measures will be identified according to the identified responsibilities.

Nr	Recommendation	Basis
10	Guidance documents need to be developed and distributed to ensure consistent understanding of the principles of WSP-type approaches throughout the Union, and to serve as a common basis for the development of national standards. Training will need to be provided to national staff tasked with the review of WSP-type approaches or similar procedures, and specific training materials may have to be developed to this end. Outreach and information to the public at large will be an important element to ensure buy-in during the initial period of implementation.	Guidance documents need to be developed and distributed to ensure consistent understanding of the principles of WSP-type approaches throughout the Union, and to serve as a common basis for the development of national standards. Training will need to be provided to national staff tasked with the verification of WSP-type approaches, and specific training materials may have to be developed to this end. Outreach and information to the public at large will be an important element to ensure buy-in during the initial period of implementation and its possible impact on the cost structure.

Support for the Development of a Framework for the Implementation of Water Safety Plans in the European Union

PREAMBLE

TERMINOLOGY

PREAMBLE

In 2003, the European Commission begun preparation for the revision of the Council Directive on the quality of water intended for human consumption, the drinking water directive 98/83/EC. In 2004, the World Health Organization (WHO) released the 3rd edition of the WHO Guidelines for Drinking-water Quality. Key is the recommendation that countries apply a "Framework for Safe Drinking-water" approach to ensuring drinking water safety. This approach brings together a risk assessment and preventive management approach in a framework extending from water resource to consumer, applicable to all water supply systems independent their size.

Following the recommendations given by the EC organized "Drinking Water Seminar" (Brussels, Belgium, 27 – 28 October 2003) the Commission invited WHO in 2006 to cooperate in the development of a framework for the implementation of WSP-type approaches in the European Union through the project "Support for the Development of a Framework for the Implementation of water safety plans in the European Union" (EC Grant agreement 07-0201/200546174/sub/D2). The aims of the cooperation were:

- To review experience with implementation of water safety plans - or elements thereof - by public and private water enterprises of different sizes and operating under a variety of economic conditions within the EU and its accession and candidate countries. The review will concentrate on: the national legal context and the regulatory framework under which the water enterprise operates, the technical measures taken within the enterprise to install water safety plans, in whole or in part, the measures taken at company level to enforce water safety plans, and the control exercised by regulatory agencies (if any). Both success and failures recorded to-date will be recorded.
- To draft, based on the above and other information inputs, a guidance document containing elements supporting a (possible) development of a legislative proposal conducive to the implementation of water safety plans in Europe.

In order to achieve these objectives, the cooperation aimed to record both successes and challenges faced in three areas:

i. *Water services:* technical measures taken within water services to install WSP-type approaches, in whole or in part, and the measures taken at company level to enforce WSP-type approaches once in place.

ii. *Regulatory aspects:* regulatory measures for the installation of WSP-type approaches, as well as supportive enforcement and control measures, if any

iii. *Legal aspects:* review of the national legal context.

A team of independent experts, complemented by WHO and EC staff, visited water supply systems in Austria (Tulln and four smaller water supply units in the area), Lithuania (Klaipeda and

Neringos), Spain (Barcelona and Castellar de Valles), Switzerland (Lenzburg) and the United Kingdom (Anglian Water and Wessex Water). Utilities were selected to present a fair geographic distribution amongst the EU Member States, and to take into account the specific challenges originating from differences in size of the utilities and characteristics of the resource waters.

Information was also gleaned from additional visits, and previous meetings, while the libraries of WHO provided supported through identification and retrieval of published documentation. Table 1 below shows the list of the major visits made in the implementation of the present project. It should be noted that visits to major water supply systems were accompanied by visits to smaller water suppliers whenever possible.

Other data sources, including data collected under ongoing WHO activities, have also be taken into consideration in the performance of the work.

Technical meetings were held at the offices the WHO Regional Office for Europe (22 May 2006, Copenhagen, Denmark), at the offices of the European Commission (8 September 2006, Brussels, Belgium), at the WHO European Centre for Environment and Health, Rome Division (15 November 2006, Rome, Italy) and at the WHO Headquarters (22 – 23 January 2007, Geneva, Switzerland).

No systematic attempt was made to obtain the views of all stakeholders within the context of the present study, since extensive consultations between all stakeholders are a normal component of the preparation of any new legal initiative by the Commission. Nevertheless, some observers were invited to participate in the work on the basis of their unique knowledge. These observers are identified in the list of participants presented in Annex 2. Inputs by observers usually took the form of informal communications. The European union of national associations of water suppliers and waste water services EUREAU, however, sent in a detailed statement. In order to avoid any inadvertent misrepresentation, the statement is reproduced in full in Annex 3.

The final document was submitted for review by Water Futures Pty Ltd of East Killara, New South Wales, Australia. Comments were received on 28 March 2007 and integrated where appropriate.

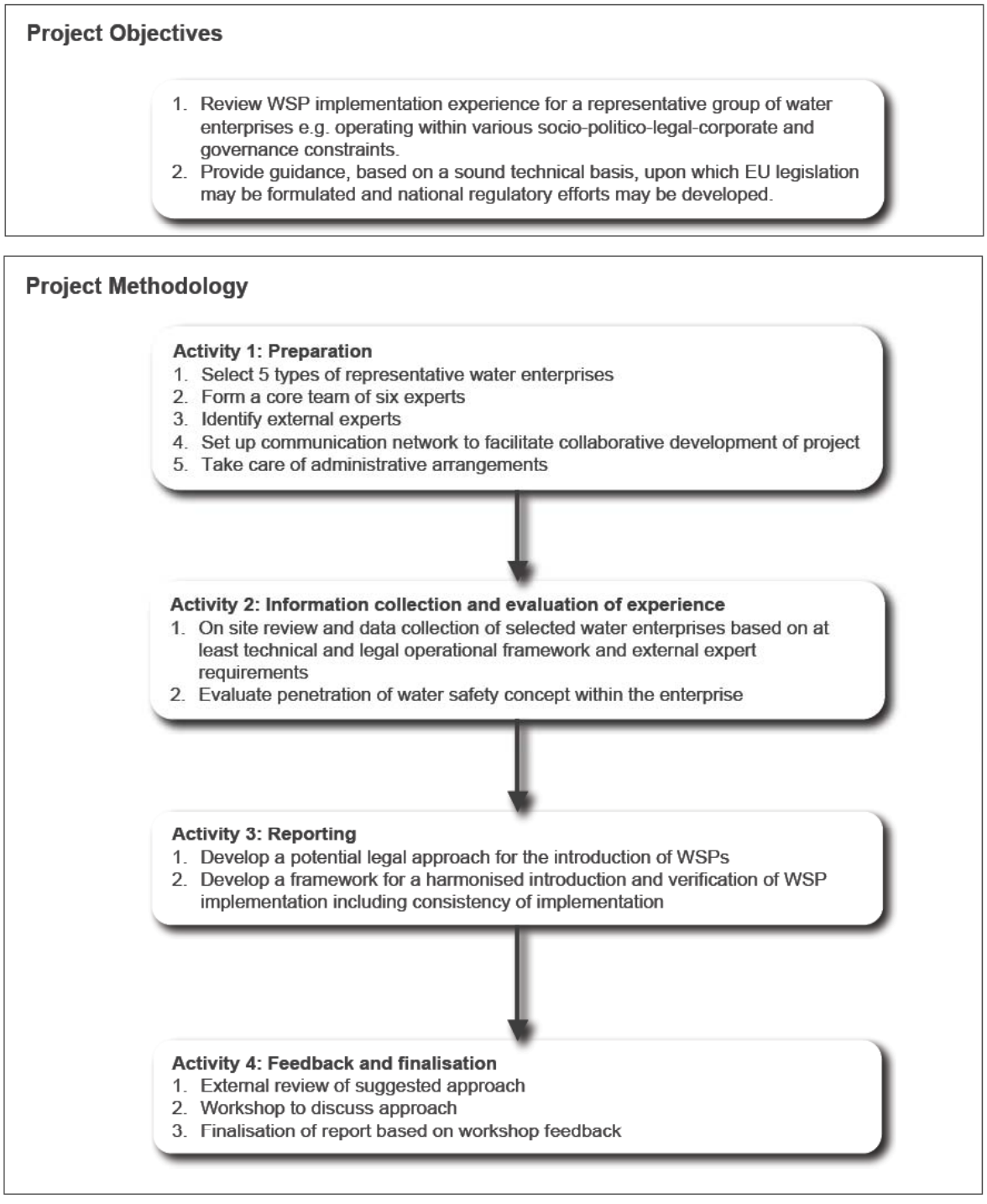
The Commission was regularly kept informed of progress, and feed back received has been answered to the extent possible within the framework of the current agreement.

Table 1. Water utilities visited in the implementation of the project

Name of the utility	***Tulln, Austria***	***SK Klaipedos Vanduo, Lithuania***	***Neringos Vanduo, Lithuania***	***Barcelona, Sant Joan, Spain***	***Castellar del Vallès, Spain***	***Städtische Werke Lenzburg, Switzerland***	***Wessex Water, United Kingdom***	***Scottish Water, United Kingdom***
Description	Municipal company, staffed by 5 people	Municipal company	Municipal	Private company with around 1,000 employees	Private company with seven workers	Public enterprise belonging to municipality, staffed by 9 people.	Statutorily Appointed Water company	Unique drinking water supplier for Scotland
Consumer	15,000	200,000	800 (increases to 4000 during tourism season)	2,923,733	20,000	7,500	1.2 million	5,000,000
Service Area	Tulln city	Klaipeda city	4 settlements on the Neiringa peninsula	23 townships covering 424 km^2	44.7 km^2	Town of Lenzburg (40% of production sold to neighbouring town)	South west England	Scotland
Rural/Urban		Urban	Rural	46% urban	Rural	Predominantly urban with some outlying farms	Mixed	
Number of treatment works	2	4 fields composed of 23 deep wells. 10% ground water and 90% river water.	3 water fields	2	2 well fields	Two groundwater and one spring pumping stations	88	333
Service reservoirs		4 with a capacity of 20,000 m^3		101 with a total capacity of 477,833 m^3	10 with a total capacity of 13,589 m^3	Two (5000 m^3 and 600 m^3)		
Aquatic resources	100% groundwater		Shallow aquifers but no sea water intrusion	89% surface water and 11% groundwater in the wet season, and 85% surface water and 15% groundwater in the dry season	100% groundwater	90% groundwater and 10% spring water	75% groundwater	
Km of mains	140	383.3		4,466	134.7	65	11,300	46,000
Period visited	21 – 28 Sep	29 – 30 Aug	29 – 30 Aug	2 – 6 Oct	2 – 6 Oct	25 – 27 Sep	20 – 21 Jul	

Figure 1 below shows a summary of the objectives and the methodology for the project.

Figure 1 Project objectives and methodology



The current report is structured in three main sections:

- *Section I* contains the formal recommendations and supporting arguments
- *Section II* contains a summary of the findings of the different site visits
- *Section III* contains photographic illustrations on the implementation of WSP-type approaches.

TERMINOLOGY

An important preliminary recommendation is to ensure that all terms are unequivocally defined at the beginning of any initiative for the revision of the drinking water directive.

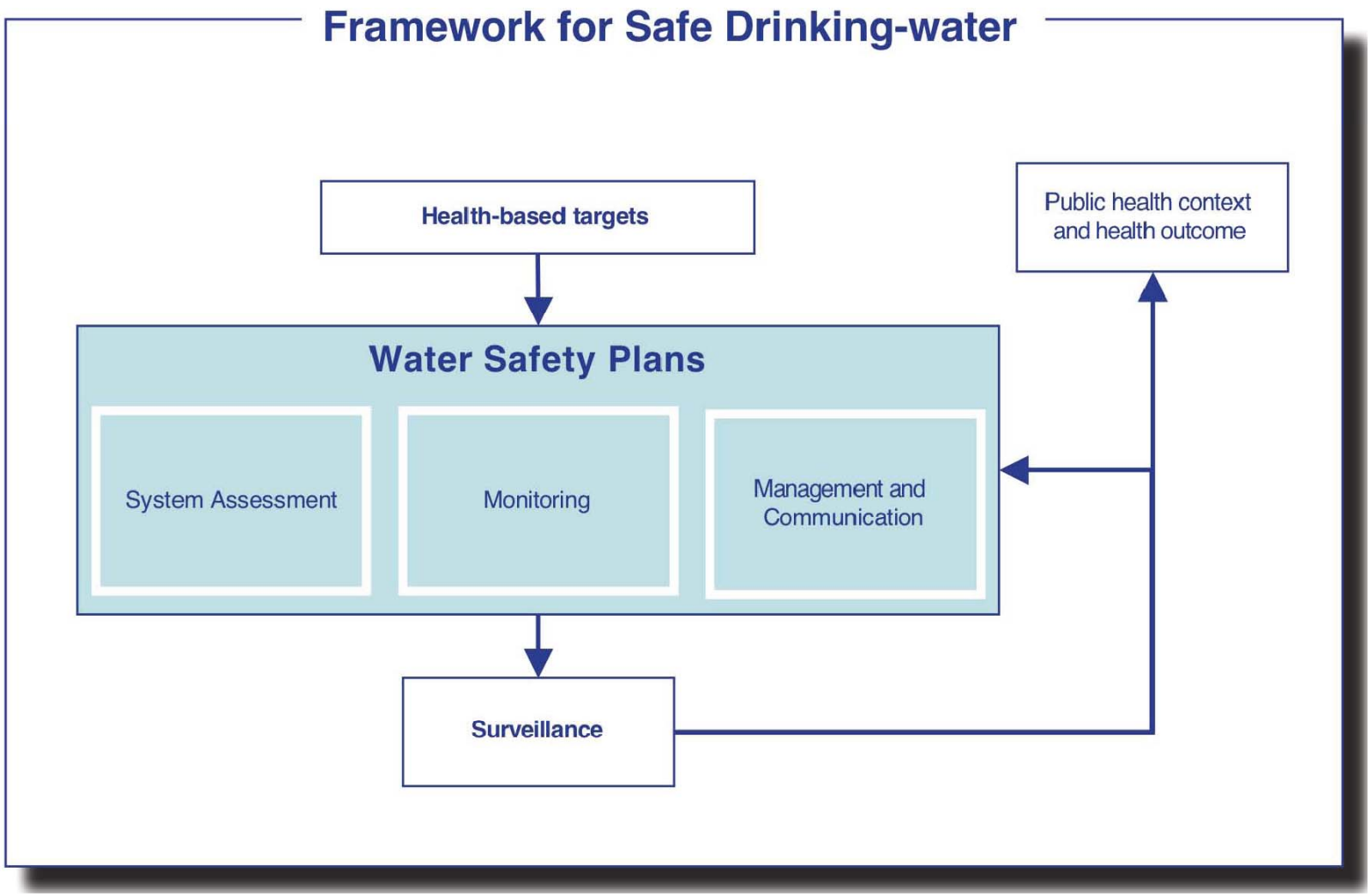
A water safety plan, as introduced by the WHO Guidelines for Drinking-water Quality, is a component of an overall Framework for Safe Drinking-water, the functioning of which is outlined in Table 2 below.

Table -2 Elucidation of the Framework for Drinking-water Safety (FWSP)

Component		Requirements
1.Setting health-based standards	⇨	Targets are based on an evaluation of health concerns and need to be set at tolerable levels for the community (e.g. are risk-based and can be coordinated with national guidelines, standards, or WHO guidelines)
2.System assessment	⇨	An assessment is conducted to characterize the water supply system, assess risks and to determine whether the drinking-water supply (from source through treatment to the point of consumption) as a whole can deliver water that meets the health-based targets.
3.Operational monitoring	⇨	Monitoring of the control measures in the drinking-water supply that are of particular importance in securing drinking-water safety. Monitoring at multiple points within the system, rather than relying on end-product monitoring, provides the supplier with assurance that unsafe products do not end up with the consumer.
4.Management plans	⇨	Management plans set up and encompass: ▪ Documentation of the system assessment ▪ Monitoring plans including normal and incident operations, upgrades, improvements and communications
5. Surveillance	⇨	A system of independent surveillance verifies that the above components are operating properly and effectively.

Graphically, the relationship between a Framework for Safe Drinking-water and a water safety plan can be represented as in the figure below:

Figure 2 Framework for Safe Drinking-water



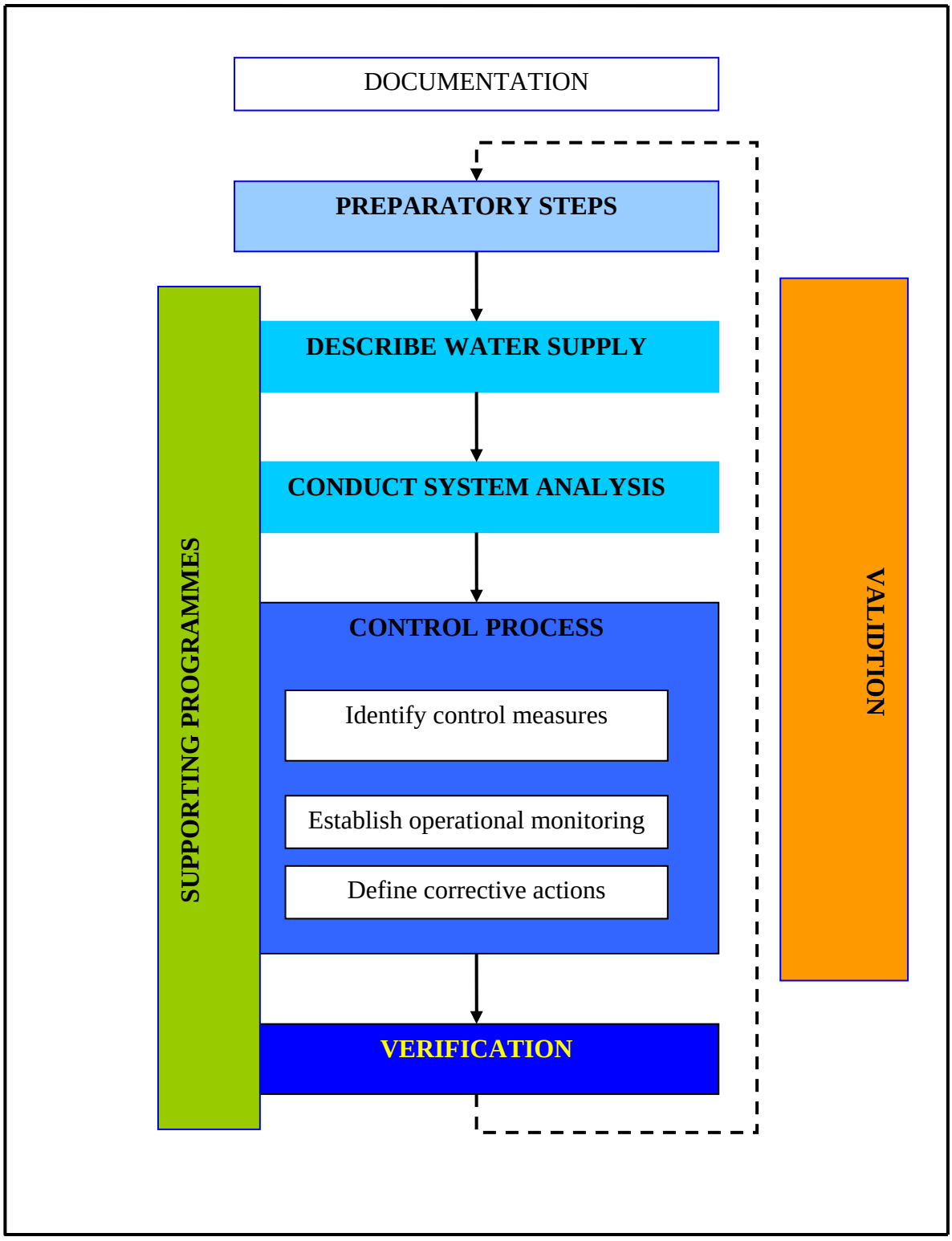
Health-based targets underpin the development of water safety plans and provide information with which to evaluate the adequacy of existing installations and assist in identifying the level and type of inspection and appropriate analytical verifications. Health-based targets also provide a means of benchmarking progress.

A water safety plan is a comprehensive risk assessment and risk management approach towards water safety management that encompasses all steps in water supply, from catchment to consumer. It usually takes the form of a documented plan (or a number of plans) that identifies credible risks from catchment to consumer, prioritizes those risks and puts in place and validates controls to mitigate them. It also requires processes to verify the effectiveness of the management control systems put in place and the quality of water produced.

It is recognized that this definition, or the more descriptive terminology used in the WHO Guidelines for drinking water quality, are not sufficiently unequivocal to be applied with legal rigor. In further acting on the recommendations contained in this report, the Commission will need to address the terminology either by seeking specialized legal advice to assess whether it is (a) possible and (b) desirable to develop a legally sound definition of a WSP-type approach for incorporation in the text of an eventual legislative initiative, or by using alternative but equivalent terminology.

A water safety plan comprises, as a minimum, the three essential actions that are the responsibility of the drinking water supplier in order to ensure that drinking water is safe. These are: a system assessment, effective operational monitoring, and management. Fig 3 below illustrates the structure of a water safety plan.

Figure 3 Structure of a water safety plan



A risk assessment and risk management approach focuses on ensuring that barriers in the water supply delivery chain are working

optimally, ideally 100% of the time, to achieve assurance in the quality and safety of the water product. Parametric compliance monitoring can be incorporated within the RARM context, as it provides the final verification that the barriers have worked. Compliance monitoring, as given in the current DWD, therefore has an important role within the WSP-type approach in the overall delivery of safe water. Although the term water safety plan has been defined in the official guidance literature published by WHO, its use in the current text refers to the general concept of risk assessment risk assessment (RARM).

It should be noted that many nations outside the European Union are now mandating their own versions of water safety plans. A commonly-sued terminology for WSPs is "Risk Management Plan" (example – Victoria, Australia) or "Public Health Risk Management Plan" (example – New Zealand). Notable is the legal definition of "Risk Management Plan" in the *Safe Drinking Water Act 2003 (SDWA) (Vic).* The definition is cited in the box below:

Figure 4 Example of a generic WSP definition

Section 9: Risk management plan

(1) A risk management plan in relation to the supply of water is a document –

a. That contains a detailed description of the system of supply; and
b. That identifies the risks to the quality of the water and the risks that may be posed by the quality of the water; and
c. That assesses those risks; and
d. That sets out the steps to be taken to manage those risks (including the development and implementation of preventive strategies); and
e. That contains any other matters required by the regulations

(2) A risk management plan must address any risks specified in the regulations.

Australian legislation also provides a description of the purpose of the Act, which is sufficiently generic to provide a basis for consideration by the EC, as shown in the box below:

Figure 5 Example of "purpose" for the revision of the DWD

Section 1: Purpose and outline.

(1) The purpose of this Act is to make provision for the supply of safe drinking water.

(2) In outline this Act –

a. *Requires water suppliers and water storage managers to prepare and implement plans to manage risks in relation to drinking water and some types of non-potable water; and*
b. *Provides for the auditing of those plans by approved auditors; and*
c. *Requires water suppliers to ensure that the drinking water they supply meets quality standards specified by the regulators; and*
d. *Requires water suppliers to disclose to the public information concerning the quality of drinking water; and*
e. *Provides for the variation, after community consultation, of water quality standards that relate only to aesthetic factors; and*
f. *Requires the reporting of known or suspected contamination of drinking water to the Secretary to the Department of Human Services; and*
g. *Empowers the Secretary to enforce this Act.*

The risk assessment risk management approach as a basis for a WSP-type approach still needs to sit within a regulatory/oversight framework such as the Framework for Safe Drinking-water to achieve good health outcomes.

Support for the Development of a Framework for the Implementation of Water Safety Plans in the European Union

SECTION I: FORMAL RECOMMENDATIONS AND SUPPORTING ARGUMENT

PART I: FORMAL RECOMMENDATIONS AND SUPPORTING ARGUMENTS

1 RECOMMENDATIONS FROM LESSONS LEARNED

Recommendation 1: After due consideration of the scientific advice that led to the recommendation of a WSP-type approach during the formulation of the WHO Guidelines for drinking-water quality, and having assessed the application of WSP-type approach on location in a geographically representative number of water supply services of different size, the advice to the Commission is to proceed with a revise the current drinking-water directive to include WSP-type approach within a wider holistic context of a Framework for Safe Drinking-water.

The following sections review the overall experience, benefits and costs, and remaining issues and their solutions that led to the formulation of the recommendation.

1.1 Overall ratio

The primary focus of the current EU drinking water directive is to rely on compliance monitoring against numeric water quality standards based on samples taken at specified minimum frequencies. In the light of the various limitations posed by over-reliance on end-product testing for guaranteeing safe drinking-water, the incorporation of a WSP-type approach into a future EU drinking water directive would complement current requirements of end-product testing by risk assessment and risk management principles, and thus has the potential to continuously safeguard drinking water safety and the protection of public health throughout the Member States.

1.2 Feasibility

Experience collected from visited utilities, parent authorities and elsewhere confirmed the feasibility of a risk assessment – risk management approach towards water safety, although significant differences were observed amongst the Member States.

The preparatory visits showed that in the visited countries a significant number of major water utilities have already implemented a full water safety plan (i.e. 33 have done so in the United Kingdom). This particularly applies to those countries where the regulatory background facilitates the implementation of a WSP-type approach

(e.g. Switzerland or the United Kingdom). The majority of major and mid-size supplies have implemented elements of a water safety plan scheme as part of their good management practices. Inconsistencies remain however, with different water suppliers operating different plans.

Small utilities, however, often have no, or very limited, knowledge of a WSP-type approach. They may nevertheless apply elements thereof. Yet, experience shows that these are the supply systems where most failures to comply with the drinking water directive have been observed, and which may therefore benefit most from introducing WSP-type approaches. Managers and operators of small water supply systems will need to be convinced of the value of this approach. Implementation of WSP-type approaches by small scale suppliers could be difficult due to relative weaker involvement with the protection of the resource, relative higher costs, and a narrower skills base amongst the staff of the utility. Therefore, special support measures will need to be developed to address the challenges encountered in these cases, particularly with regard to the availability of appropriate supporting tools as well as to education and training.

Utilities visited were generally positive towards the introduction of a WSP-type approach and its formal regulation.

Parent authorities such as municipalities were generally supportive towards the introduction of a WSP-type approach by the water utility, especially when such introduction could be seen to support other economic goals of the community. Such parent authorities have a special role to play in giving advice to water utilities and in raising awareness in individual customers of the benefits to be derived from the introduction of risk assessment and prevention management.

The potential role of industry associations was noted in facilitating the introduction of WSP-type approach, for example by preparing a tool box for use by individual utilities, in education of utility staff or in promoting the approach.

While the two paragraphs above show how parent authorities and established industry association can, based on established mandates, support the introduction of a WSP-type approach, it must be recognized that the usual legislative process foresees that the formal proposal by the Commission has been preceded by an extensive consultation process, which may include consultation of national and experts, international organizations, non-governmental organizations, formal consultation on the basis of formal papers etc. During this consultation process the views of all stakeholders can be heard and their opinions taken into consideration.

1.3 Benefits and cost considerations

<u>Recommendation 2:</u> In considering the inclusion of a WSP-type approach in the revision of the drinking water directive, the Commission is advised to consider the overall cost-benefits and to pursue maximization of societal and particularly health benefits at minimum costs. To strengthen the evidence base for the development of the cost benefit analysis, introduction of WSP-type approach will best be accompanied by a recommendation to strengthen the economic evidence base.

1.3.1 Benefits to the water utility

Amongst the benefits resulting from adapting a WSP-type approach, the following were identified by various drinking-water utilities:

- The introduction of WSP-type approaches is a "reality test" for the overall system, assessing and reinforcing the robustness of the process.
- Hazards and hazardous events in operational systems are more easily identified, and over-reliance on end-point testing is avoided.
- The approach formalizes and organizes existing procedures and good practices into one systematic and coherent quality management package, which easily be integrated into existing quality management systems (e.g. ISO 9001).
- It targets resources and attention toward the critical issues of drinking water quality and helps to focus water supplier's monitoring activities on critical parameters.
- The process ensures consistency in the identification of data requirements for future investments by promoting a sustainable investment approach over an *ad hoc* investment reaction to discrete improvements in treatment technology. This more robust investment process leads in turn to improved business confidence in the management teams responsible for the water supply, to the reinforcement of areas of accountability versus stakeholders, and to a business culture welcoming continuous improvements.
- The WSP-type approach offers an effective tool for identifying priorities in capital and operational expenditure and link business processes (investments) with the preventive control of clearly identified operational risks, thereby demonstrating "value for money".
- The introduction of WSP-type approach forms a valuable training tool for staff, provides a good understanding of hazardous events and risks, of process knowledge and of the

broader aspects of system management. The WSP-type approach provides a framework for the recognition of skill requirements and training needs.

- The process introduced by a WSP-type approach provides a platform for the management of existing knowledge, competence and experience within the utility.

1.3.2 Benefits to public health surveillance authorities

The introduction of water safety plans would include the following benefits for public (health) authorities that are responsible for surveillance of drinking-water quality:

- The WSP-type approach provides a framework that can be audited and assessed in a standardized way.
- The approach provides greater confidence in the continuous management of drinking water quality, particularly for the small, easily "overlooked" supplies.
- It provides improved understanding of operational aspects of supplying drinking water, the range of hazards and what can go wrong.
- It triggers more intensive cooperation and communication with water suppliers and with environmental authorities.
- Equitable societal benefits require that WSP-type approaches apply to all water supplies, regardless of organizational or managerial structures, size and water source.
- Risk assessment and management also includes evaluation of intentional and non-intentional disruptions to system integrity.

While epidemiological evidence is desirable in providing proof of the health benefits of water supply interventions, even in countries with mature surveillance systems, it is often difficult to witness health impacts, unless there is an actual outbreak. Health effects which may manifest below the outbreak level may never be picked up but will still impose a health burden on a community.

The WSP-approach therefore concentrates on a diligent operational and regulatory focus for delivering health benefits that is a quality assurance rather than a quality control approach. In summary, the following points would be implemented under a WSP-type approach and followed-up with routine operational and verification monitoring to achieve a holistic approach for reaching health outcomes:

- Understand and document the appropriate health-based guideline values for achieving a 'fit for purpose' product;
- Translate values into either performance or technology ('barrier') targets; and

- Validate the barriers for their effectiveness at removing the health-based hazards under both routine and event-based conditions.

1.3.3 Benefits to consumers

For customers, the following benefits were noted:

- A systematic management approach, such as WSP-type approaches, provides a means for continuously safeguarding and improving drinking water quality. This will lead to a reduction in the number of incidents causing interruptions in the supply or failure of the microbial and/or chemical water quality.
- Problems in the plant and the distribution system will come into the open, increasing consumer confidence but also business-to-business confidence when a water company delivers water, e.g. to the food industry.
- Increase in consumer confidence knowing that drinking water quality is continuously managed through an open, transparent and auditable process.
- Preventative risk management provides greater protection than product compliance monitoring. While compliance monitoring is a post-facto approach, preventative risk management is a complementary, pro-active approach which addresses not only the quality of the product but also the quality of the management system. With 27 member states in the European Union, the WSP-type approach, implemented within a Framework for Safe Drinking-water, approach therefore affords a much greater protection for the safety of drinking water and the protection of consumers than any percentage compliance figure of individual parameters.

1.3.4 Costs

While the visited utilities were generally not able to provide detailed accounting on the costs incurred for the design and implementation of the WSP-type approach, costs were considered a self-regulatory issue. However in general, it is likely that well-run utilities encounter less short-term investment (e.g. staff time for the development of the water safety plan, implementation of new control measures or additional monitoring equipment, internal and external review of procedures) and additional operational costs, while less well-run utilities are likely to encounter more such short-term costs.

There seems to be a misapprehension associated with the implementation of WSP-type approaches that is, the introduction of WSP-type approaches will increase the cost of water production and

distribution. In fact, experiences in other countries have shown that the benefits far outweigh the costs and in some cases, paying attention to operational monitoring (which is promoted by the WSP-type approach) compared to end-point testing, can actually save money in the longer term.

Smaller utilities are however likely to encounter initially a higher financial burden, for reasons explained earlier. They are more likely to see a reduction of the disease burden related to water. In order to remedy this situation, a number of accompanying actions may be considered together with the legislative initiative under consideration. Such accompanying actions may include specialized training, awareness building, communication, workshops bringing together smaller water utilities with bigger companies etc.

There is currently limited evidence to support the consensus that the development and implementation of a WSP-type approach was cost effective for both water utilities and the society in the long run. New regulations ought to encourage utilities to build up the argument of cost effectiveness associated with the introduction of risk assessment and risk management principles. These should, however be complemented by targeted studies analyzing the economic burden of waterborne disease at EU, country or regional levels, taking into account different scenarios such as in normal operating conditions as well as for outbreak situations as a consequence of non-recognized or poorly managed peak events.

1.4 Additional concerns

Recommendation 3: A number of circumstantial issues need to be borne in mind to ensure the success of any proposed legislative changes to ensure the highest possible chances of success. These include: a sufficiently long start-up time frame and the development of technical guidance documents on WSP-type approach which can then serve for the formulation of nationally adapted methodologies. The issue of control over the verification of the WSP-type process needs to be addressed, as well as the relative authority of the different stakeholders, particularly the water utilities, over the different components of the WSP-type process.

Amongst the issues that remain to be taken under consideration the following were considered to be sufficiently important to be recommended for special attention during the drafting of any new legislative initiative.

1.4.1 Lead time

The process to deliver reliable and robust water safety plans is time consuming, requiring the mobilization of additional resources if it is to be completed in within a reasonable time frame. Consequently, an adequate time line for the implementation of risk assessment and risk management needs to be allowed in all future legislation.

The time it will take to establish a water safety plan will depend upon a number of factors. These include:

- The experience of the staff: staff experience is critical, with time needed to prepare plans decreasing by approximately 50% with increase in experience and maintenance in quality. The degree to which experience can reduce time required will also depend on whether a dedicated individual or team are assigned to the project and how many other duties they must perform. In the longer term, internal auditing will also require a significant allocation of staff time to ensure that processes are being followed and actions taken to secure water safety.
- The amount of data available on the water supply. In water supplies where there are a lot of data on the supply, particularly the distribution system, the water safety plan is not only more comprehensive, it can also be prepared more rapidly. Where data is lacking, the quality of the water safety plan may be compromised, necessitating additional data collection. In such circumstances, draft plans may be developed and linked to an ongoing process of improvement and data collection.
- The size and complexity of the supply. Large and complex systems, with more than one source, multiple treatment works and/or large and complex distribution systems will inevitably require a greater time input than small, simple systems. However, at the same time larger systems typically have more comprehensive data on the supply and more skilled staff and therefore although the time taken may be greater, if calculated on a per capita or volume of water produced, the plan preparation may be more efficient.
- Other systems that have already been adopted

These factors are all inter-related and it is clearly difficult to define exactly what length of time is required to establish a water safety plan in all circumstances.

1.4.2 Need for guidance

While a revised or newly-issued Directive will provide the water supplier with obligations that it *has* to meet, guidance provides an example on *how* WSP-type approaches might be achieved but it not prescriptive per se.

To avoid major inconsistencies in risk assessment and subsequent development of water safety amongst Member States of the Union, guidance on minimum requirements defining the elements of a WSP-type approaches as well as the process of developing and implementing it is important to ensure a homogenous approach amongst all Member States. Guidance is particularly required on the final shape and scope of a water safety plan, the methodology of the risk assessment and risk management, and supporting methods for engaging the wider audience outside the water industry. Great care will need to be exercised, however, in the drafting of these guidelines in order to allow for sufficiently flexible adaptation of national legislation and regulations to specific local conditions.

Guidance is also required for defining minimum requirements for approving water safety plans, in particular whether this should be a responsibility of the Member State, or whether it should be entrusted to an independent reviewer appointed by the Member State.

1.4.3 Distinction between approaches

Some of the visited water utilities based elements of their water safety process on application of HACCP; in certain countries, this was in line with national legislation which defined drinking water as a food.

In its original incarnation, HACCP as applied in the food industry involved 5 steps and 7 principles to achieve product safety. While the HACCP paradigm was based on prevention through process control, it facilitated the focusing of resources at Critical Control Points in the process at which control was essential to prevent or mitigate contamination.

The HACCP process has evolved to become 'Food Safety Plan' (FSP) upon which the WSP term is based, and which encompasses a more holistic approach to food safety incorporating elements such as training, understanding legislative obligations and emergency preparedness and response procedures.

Bothe the WSP and the FSP are risk-based. The major point of difference between the WSP and FSP approach is one of terminology – the WSP does not include the concept of critical control points, rather it seeks to underline the concept of multiple barriers by

focusing on the need to implement control measures at each barrier in the water supply chain (catchment to consumer) without assigning the concept of criticality.

The definition of the term control measure, within the context of the WSP approach, reflects the importance that WHO places on all control measures within a water supply chain "*Those steps in a drinking-water supply that directly affect drinking-water quality and that collectively ensure that drinking-water consistently meets health-based targets. They are activities and processes applied to prevent hazard occurrence".*

The HACCP Principles therefore focus on what the food or beverage supplier specifically determines to be product *critical* steps but the FSP is the umbrella document that encompasses the supporting programmes to ensure that overall risk is managed in its entirety. For example, there is not much point in having a "state of the art" production process if staff members are not trained in how to use it. The WSP-type approach works in entirely the same fashion.

In considering the revision of the DWD, clarification is needed on the HACCP and WSP-type approach in the existing food legislation and the legislation related to drinking water production to ensure a consistent and homogenous approach by all Member States of the European Union.

1.4.4 Responsibility and authority

The division of the responsibility of different stakeholders over the different components of the water safety plan remains a matter of concern. While the water utility is encouraged to assess risks in the supply system from source water to tap, carrying out control will be limited to those steps of the supply chain that are under the utility's responsibility. The implementation of control measures for those supply steps that are outside the responsibility of the supplier (e.g. in the catchment area or in buildings) would need to be carried out by other stakeholders.

Identifying hazards in the catchment does not make the water supplier responsible for their cause, but will bring transparency to the process and enable stakeholders to work together on catchment protection in conjunction with the Water Framework Directive. Within the treatment works the water safety plan approach will ensure that water suppliers identify all the potential hazards that an affect safety of the supply. Controls or barriers need to be identified for each hazard and where these are identified as not in place or not sufficient a gap analysis will identify where improvement (and investment) is needed. A similar approach can be applied to the distribution network. If validated controls are in place to act as barriers to all the

identified significant hazards, this goes a long way to ensuring the safety of the water produced and distributed.

It should be noted that hazards affecting a water supply are not just parameters, but will cover areas such as flooding, availability of alternative supplies, reliance on other stakeholder data, reliability of power supplies and telemetry, training and security.

Clarity needs therefore to be created on whether control should extend from "source-to-tap", or be limited to the section(s) under the authority and control of the water utility. The definition of the responsibility and authority of the different stakeholders in the development and implementation of river basin management plans as foreseen under the water framework directive will need to be reviewed in order to match responsibility with authority.

2 BASIS FOR AN INITIATIVE BY THE COMMISSION

Recommendation 4: The Commission is advised to introduce legislation at the level of the European Union, but that its actions be limited to those tasks which cannot be performed effectively at a more immediate or local level.

Several considerations support action at the level of the Union in stead of initiatives by the individual Member States:

- The current drinking water directive, Council Directive 98/83/EC, takes into account the subsidiarity principle particularly in the preambular paragraphs (1) (3) and (4). The subsidiarity principle is intended to ensure that decisions are taken as closely as possible to the citizen and that constant checks are made as to whether action at the Community level is justified in the light of the possibilities available at the national, regional or local level. Specifically, it is the principle whereby the Union does not take action (except in areas which fall within its exclusive competence) unless it is more effective than action taken at national, regional or local level. As introduction of a WSP-type approach will require modification to the drinking water directive, the same regard to the principles of subsidiarity and proportionality should be given as under the current legislation.
- A change in the drinking water directive is necessary at the level of the Union in order to allow all Member States to complement their compliance monitoring oriented drinking-water legislation to the application of WSP-type approaches in a consistent manner.

- Initiative by the Commission under the subsidiarity and proportionality principles offers the added value of ensuring homogenous approach across all Member States of the European Union while allowing for sufficient flexible implementation in the Member States.

3 LEGAL ADVICE

The need for a review of the DWD was first discussed in detail during the "Seminar on the European Directive for Drinking Water 98/83/EC" (Brussels, 27-28 October 2003[1]).

The Seminar advocated a revision in the following areas:

i. *Risk assessment and management:* recognizing the validity of the concept, problems remain with finding the right balance between health considerations, consumer confidence in the water safety produced with emphasis on a less parametric approach, acceptance of the water safety plan concept by water suppliers, development of definitions that would allow production and operational management, and description of the process from a regulatory and legal point of view.

ii. *Chemical parameters:* DWD 98/83 is less stringent in relation to chemicals than in relation to micro-biological parameters while recent international gatherings have increasingly drawn the attention to the health risks posed by chemicals. A survey conducted in 2005 showed that at least 20 chemical parameters cause concern in more than one EU Member State. Fluoride, nitrates, and arsenic are problematic in more than eight EU Member States. Emerging problems include new substances (pesticides, endocrine disruptors), areas where the state of the art of risk assessment or risk control has evolved (F, Cu, Pb, Ni); and chemicals used in water treatment.[2]

iii. *Construction products in contact with drinking water:* A review of legislation in this area is important in order to take into account new information on chemicals used (Cu, Pb, Ni, cements, plastics, endocrine disrupting chemicals (EDCs), and the efforts to establish a European Acceptance Scheme (EAS).

iv. *Microbiological parameters:* Although the JRC operates a European Microbiological Advisory Group (EMAG) dealing with equivalence of methods and supports the revision of the drinking water directive, issues remain pending in the areas of parameters, indicators, methods with special attention to Legionella, Cryptosporidium and

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[1] The outcome of this Seminar is published as a Commission document. At the time of writing, the document was not available on the website of the Commission. The version used was: Hulsmann A (2003) *draft Scientific Synthesis Report Drinking Water Seminar (Brussels, Belgium, 27 – 28 October)* KIWA `

[2] Hulsmann A. (2005) Implementation of the Drinking Water Directive in Europe KIWA Water Research available from URL: http://www.weknow-waternetwork.com/uploads/booklets/01_implementation_drw_directive_v5.pdf

Giardia. Therefore the Seminar advocated the water safety plan concept as the way forward for the drinking water directive.

v. *Small supplies:* The European Union has incomplete knowledge on the number of small supplies (less than 5,000 people served or 1000 m^3/d) and even less knowledge on very small supplies (less than 50 people served or 10 m^3/d). Data on the percentage of the population depending on such supply are unreliable in most countries. Information is incomplete on the number of (very) small supplies used for public or commercial activities. Although there is probably no way to regulate all (very) small supplies, thresholds for regulations (quality standards, sampling, information…) need to be identified, guidelines to the public formulated, and a water safety approach for (very) small systems developed.[3]

The basic approach for the revision should be the complete coverage of resource and distributed water from catchment-to-consumer. Principles and level of protection should be the same, independent of size, source water, complexity of operations or the organizational or managerial setup of the water supply enterprise.

3.1 Comments on the current drinking water directive

Recommendation 5: Integration of WSP-type approaches would require substantial revision of the current drinking water directive. It is not impossible that the revision would prove to be so complex that consideration ought to be given to repealing the current directive and issuing of a new one, in stead of merely amending the current text.

Different pieces of the Community *acquis* have a bearing on the ultimate quality of drinking water that reaches the consumer. A WSP-type approach should become the instrument to complement the current drinking water directive and to integrate legal requirements already laid down in different components of the Community *acquis*. Without any attempt at comprehensiveness, the expert group identified the following elements of the current legislation for further review by the Commission. It stresses, however, the advisability for the Commission to obtain specialist legal advice on this matter.

Council Directive 98/83/EC, the Drinking Water Directive (DWD) concerns the quality of water intended for human consumption. The current DWD follows a parametric approach, setting standards for the most common substances that can be found in drinking-water. In the DWD a total of 48 microbial and chemical parameters need to be monitored and tested regularly. In principle, WHO Guidelines for Drinking-water Quality are used

[3] Source: Hulsmann A. (2005) Small systems, large problems. A European inventory of small water systems and associated problems WEKNOW/ENDWARE

as a basis for the standards in the DWD. For some parameters such as pesticides, others considerations were taking into account.

While translating the DWD into their national legislation, Member States of the European Union can include additional requirements e.g. regulate additional substances that are relevant within their territory or set higher standards Member States are not allowed to set less stringent standards as the level of protection of human health should be the same within the whole EU.

Member States have to monitor the quality of the drinking water supplied to their citizens and this has to be done mainly at the tap inside private and public premises.

Member States report to the European Commission at three yearly intervals the results of quality monitoring against the standards of the DWD for the water supply zones more than 5,000 inhabitants.

In some ways, the DWD already encompasses the main water safety plan principles, particularly in requiring that safe water is provided to consumers and recognizes through check and audit monitoring that different parameters require different monitoring systems. The main drawback is that the DWD puts so much emphasis on meeting parametric values for mandatory and indicator parameters in the treated water at the consumers' tap. It is recognized that reliance on end-point monitoring to protect health is too little, too late because invariably the water has been consumed before the results of testing are known. Under a water safety plan framework end-point sampling would be for validation and verification of all the steps and procedures put in place from source to tap to ensure the safety of the water. The emphasis on ensuring safety should be pushed right back to the source and applied as barriers to each stage of production and distribution.

The adaptation of the WSP-type approach in a revision of the DWD will require a detailed revision of a significant number of articles in the current drinking water directive. Without being comprehensive, the following articles are amongst those that will require careful review:

- Article 5 (Quality objectives), Article 6 (Point of compliance) and Article 7 (Monitoring) will need to be amended to reflect changes in the definition of the point of compliance and the end-point monitoring.
- Article 9 (Derogations) needs to be revisited to reflect the applicability of the risk management approach irrespective of the size of the water supply enterprise.

- Article 10 (Quality assurance of treatment, equipment and materials) needs review to address risk management required during works executed by workers with different levels of qualifications.
- Article 13 (Information and reporting) requires review to reflect the change from end-point parametric compliance monitoring to confirmation of risk management throughout the production chain. The present reporting scheme under the drinking water directive does not allow the assessment of success or failure of the implementation of the risk assessment and risk management approach; this will need to be addressed.
- All Annexes to the original directive need to be reviewed.

To be successful, a WSP-type approach must be flexible to fit in with different circumstances and how a water supplier operates; it cannot be imposed too prescriptively. However, the basic principles will always be the same and health-based and other targets (or standards) will be required for validation and verification purposes. Therefore, a Directive should be as simple and straightforward as possible, laying down principles, requiring the application of water safety plans and specifying health-based targets and reporting requirements.

3.2 Relation to Community acquis

Recommendation 6: Review of the existing Community *acquis* is a standard procedure when new legislation is being considered. Nevertheless, certain elements will warrant special attention with a view towards harmonizing their provisions with any changes in the drinking water directive. This is particularly the case for legislation dealing with water policy, food safety, construction products, and protection of critical infrastructure.

While not being restrictive, the following components of the Community *acquis* will need to be scrutinized with particular attention when proposing the inclusion of the WSP-type approach in any revision of the current drinking water directive.

- *Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for the Community action in the field of water policy – the European Union Water Framework Directive*, Current legislation provides for the establishment and maintenance of drinking water protection zones around water capture areas. Human health criteria ought to be taken into account in the designation of such protection zones. Special attention to be given to Article 7 of the EU Water Framework Directive foresees the identification of safeguard zones for the abstraction of drinking water (surface and groundwater).

- *Council Directive 89/106/EEC* of 21 December 1988 on the approximation of laws, regulations and administrative provisions of the Member States relating to construction products. Proposals for the revision of the drinking water directive ought to include provisions in the appropriate legal instruments governing community-wide certification of materials, devices and consumables. Particular attention is to be given to Article 10 considering the notification of European approval bodies. The scope of the provisions should include the quality of the materials in industrial procurement and retail markets.
- *Council Directive 75/440/EEC of 16 June 1975* concerning the quality required of surface waters for the abstraction of drinking water in the Member States, as repealed by Article 22 of the Water Framework Directive by end of 2007. The directive defines parameters and values for surface water abstraction zones.
- *Council Directive 80/68/EEC of 17 December 1979* on the protection of groundwater against pollution caused by certain dangerous substances, as repealed by the new groundwater directive 2006/118/EC of the European Parliament and of the Council of 12 December 2006 on the protection of groundwater against pollution and deterioration. This directive requires member states to define quality objectives for groundwater bodies, monitoring and implementing measures for the achievement of the objectives. A "Stand-still" clause exists.
- *Council Directive 91/676/EEC of 12 December 1991* concerning the protection of waters against pollution caused by nitrates from agricultural sources – the Nitrate Directive. The Directive defines nitrate values in the surface and groundwater. It foresees restricted use of nitrogen by farmers in case of exceeding nitrogen concentrations of 50 mg/l.
- *Council Directive 91/414/EC of 15 July 1991* concerning the placing of plant protection products on the market, and
- *Directive 98/8/EC of the European Parliament and of the Council of 16 February 1998 concerning the placing of biocidal products on the market.*
- *Council Directive 89/106/EEC of 21 December 1988* on the approximation of laws, regulations and administrative provisions of the Member States relating to construction products.
- *Regulation (EC) No 178/2002 of the European Parliament and of the Council of 28 January 2002 laying down the general principles and requirements of food law, establishing the European Food Safety Authority and laying down procedures in matters of food safety.*
    - Differences in the national legal frameworks between the different EU countries, particularly the issue of applying food safety legislation is a matter that needs to be explored further. Certain countries of the Union were

found to apply a HACCP approach for drinking water supply, and indeed treat drinking water production and supply as one element of food production.

- Clarification is required on the commonalities and differences between the HACCP approach used to ensure food safety and the approach used in water safety plans. Particular attention needs to be given to Article 2 Par. 2 of the regulation which defines 'food business' as 'any undertaking, whether for profit or not and whether public or private, carrying out any of the activities related to any stage of production, processing and distribution of food'.
- Regulation EC 852/2004 of the European Parliament and of the Council of 29 April 2004 on the hygiene of foodstuffs. Foodstuff operators have to comply with hygiene standard rules, which encompass application of HACCP principles by food business operators.

- *Green paper on a European programme for critical infrastructure protection (COM (2005) 576 final dated 17 November 2005).* Assessment of the risks posed by unforeseen and unforeseeable events, such as malicious tampering with water supply systems, is an integral part of a comprehensive risk assessment – risk management process. Experience gained by many water utilities shows that intrusion in water supply enterprises by unauthorized individuals is a recurrent event.

It should be recalled that the WHO Guidelines for Drinking-water Quality state that "the quality of the water defined by the Guidelines is such that it is suitable for all normal uses in the food industry". Therefore, new provisions which increase compliance with the provisions of the WHO Guidelines, such as the implementation of a WSP-type approach, should also increase confidence not only in the public at large but also in the industry which uses drinking water as part of its manufacturing process, such as the food industry.

3.3 Regulatory aspects

Recommendation 7: The revised DWD should include either in itself or through linkages to other legislative instruments, a requirement for independent oversight.

Independent review and surveillance are needed to confirm that the procedures of a WSP-type approach are applied correctly, are of high quality, are operating successfully, and have effect in terms of increasing the public health status. The Commission is advised to recognize the need for independent review of the WSP-type approach, and to reflect this in the proposed revision of the DWD. Provisions for review and surveillance may be guided by WHO's Framework for Safe Drinking-water through which WSPs operate within a context of independent oversight.

As to the implementation of such programmes, the advice is to leave the selection of implementation mechanisms (e.g. professional associations, government public health surveillance organizations or other bodies) to national decisions. Also for this reason, the term "review" was chosen over the term "audit" during the drafting of this recommendation in order to avoid confusion with formal audits available to the water industry on a commercial basis.

Audit systems should be in place, but in accordance with procedures developed by the individual Member States.

3.4 New requirements

Recommendation 8: The introduction of a WSP-type approach will also require new regulatory provisions for areas which hitherto did not benefit from regulatory provisions at the Community level, including the accreditation of workers who may interact with the water supply system post treatment.

General drinking-water safety is assured by maintenance protocols, regular cleaning, temperature management and maintenance of a disinfectant residual. For these reasons, authorities responsible for building safety should be responsible for developing and implementing WSPs. Regulatory or other appropriate authorities may provide guidance on the development and application of WSPs for large building drinking-water systems.

It has furthermore been observed that significant health effects have been associated with inadequate plumbing systems within public and private buildings arising from poor design, incorrect installation, alteration and inadequate maintenance. In order to minimize or, indeed, avoid these health risks, it is important that plumbers are appropriately qualified, have the competence to undertake necessary installation and servicing of plumbing systems to ensure compliance with local regulators and use only materials approved as safe for use with drinking-water.

While in no way restrictive, the following areas of activity were consequently identified as potential beneficiaries of new regulatory efforts:

- *Accreditation of plumbers.* There is a recognized body of evidence that activities on plumbing systems by unqualified personnel past the point of supply but before the point of consumption frequently constitutes a considerable risk to health for the consumers. The Commission is therefore advised to consider the advisability of creating an accreditation scheme for plumbers. Such scheme should not prevent residents from effecting work on the water system inside their dwelling but should subject such works to inspection if carried out by people lacking appropriate accreditation. Concurrently, in order to minimize risks to health, only materials and devices certified

as appropriate for use in contact with drinking water should be available in the marked.

- *Accreditation of building managers*. The role of building managers in ensuring the water quality in premises under their management has been recognized by WHO. The Commission is invited to consider promotion of education / awareness raising of the water safety issue in general, and of the position of building infrastructure in particular, in WSP-type approaches. WSP-type approaches for large buildings may usefully address not only drinking-water systems but also other water systems such as cooling towers and evaporative condensers of air conditioning devices.
- *Protection of vulnerable populations.* Specific aspects of the management of major buildings, such as the complexity of water systems in high-rise buildings, the specific vulnerability of populations in schools, hospitals, care facilities etc may require the development of specific risk assessment and risk management approaches for such environment.

4 SUPPORTING MEASURES TO FACILITATE ACCEPTANCE

4.1 Relationships with other stakeholders

Recommendation 9: A proposal for a new drinking water directive should contain a strong basis for inter-sectoral cooperation by recognizing the role of all stakeholders, and defining their areas of responsibility and authority in the context of WSP-type approaches.

It is recognized that comprehensive risk assessment and risk management requires active involvement of various stakeholders to ensure inter-sectoral collaboration. Authorities responsible for the development and implementation of river basin management plans, including source water quality management, and other stakeholders in the production and distribution of drinking water, including European drinking water production and distribution enterprises, have a recognized role to play

4.2 Outreach

Recommendation 10: Guidance documents need to be developed and distributed to ensure consistent understanding of the principles of WSP-type approaches throughout the Union, and to serve as a common basis for the development of national standards. Training will need to be provided to national staff tasked with the review of WSP-type approaches or similar procedures, and specific training materials may have to be developed to this end. Outreach and information to the public at large will be an important element to ensure buy-in during the initial period of implementation.

Changes in the Community *acquis* will create a need for specific guidance. Documents should be developed setting forth general principles at the level of the Union, with the aim of facilitating practical and more homogenous implementation. These documents can serve as a basis from which more detailed guidance can be developed for use under national circumstances. Such documents should recognize the size and type of the supply system in defining the level of complexity in the determination of an appropriate risk management approach.

As stated earlier in recommendation 7, Independent surveillance of the quality and status of implementation of a WSP is seen as a core element of any revision of the drinking water directive. The new, complementary approach of WSP verification and end-point testing will require retraining of current inspectors. It is recognized that different Member States of the Union have different inspection regimes. It is therefore appropriate to place training functions at the Member States level. Such training should also aim to increase the knowledge and awareness of inspectors on water management, production and distribution issues, particularly if the inspectors are drawn from other sectors such as public health.
The importance of effective information and communication is recognized as an essential element to ensure acceptance and buy-in from all stakeholders.

Support for the Development of a Framework for the Implementation of Water Safety Plans in the European Union

SECTION II: REPORT OF SITE VISITS

1 INTRODUCTION

This section of the report summarizes salient features of the common report submitted by the visiting experts after each mission.

2 COUNTRY VISITS

2.1 Austria

2.1.1 Legal Aspects

Water utilities fall under the provisions of the Federal Ministry of Health and Women, competent for food safety.

Transposition of Council Directive 98/83/EC was done by the Drinking Water Ordinance (Trinkwasserverordnung – TWV, BGBI. II Nr 254/2006), subject to the food law (Lebensmittelgesetz 1975 – LMG 1975, BGBI. Nr 86/175 as amended by BGBI. I Nr 157/1999). The Food Law was revised in 2006 as the Food Security and Consumer Protection Law (Lebensmittelsicherheits- und Verbraucherschutzgesetz (LMSVG) BGBI. I Nr. 13/2006) which entered into force on 21st January 2006.

The LMSVG (= federal law) identifies the head of the provincial government as the responsible person for enforcement and implementation of food control.

Austrian food law requires the application of HACCP, although water safety plan are not included in water control regulations.

Food inspectors of the nine Austrian provinces are authorized to verify compliance. Inspection of water supplies has to be caused by water suppliers under the principle of self-responsibility. Sampling and analysis must be done by authorized institutions in certified laboratories. Monitoring programmes need to be developed and approved by the competent authority. Testing results need to be sent by water suppliers to the provincial food inspectors.

The TWV includes a provision for controlling the catchment area in addition to the provisions of CD 98/83/EC.

2.1.2 Tulln water works

The Tulln water utility serves a mainly urban population of some 15,000 inhabitants from two water works through a distribution network of some 140km. The utility sells 1.2 to 1.5 million m³ treated water with an estimated loss of 15%. Both water works draw well water from a depth of 10m with six horizontal catchment pipes. The water protection

zone of the first water works extends for 10 ha, the second for 80 ha. Water is blended to reduce potentially high concentrations of nitrates. Chlorine is used for protection during transportation prior to mixing, otherwise no chlorine is used but treatment with UV is applied to the blended water.

The utility started planning for a water safety plan from 2002. Introduction followed in 2004 with full support from the Mayor and Deputy Mayor. The first phase of the introduction of the water safety plan involved:

- Inclusion of generic risk factors using the Risk Priority Number (RPN) technique for analyzing risk associated with potential problems identified during a Failure Mode and Effects Analysis (FMEA)[4].
- Identification of the practical application of water safety plan in Tulln.
- Adaptation of software to incorporate water safety plan requirements.
- Re-issuing hygiene guidelines including water safety plan requirements.
- HACCP/water safety plan are mandatory for water bottling plants, as a result of the Austrian legislation resulting from the transposition of the EU food safety regulation. Mandatory training is provided for staff working in such plants. A complete risk assessment plan is required to be set up and to be reviewed every four years. However, water supplying plants are not covered by this provision as drinking water plants are regulated by the drinking water directive at the EU level.

The following elements were identified as the added value resulting from the introduction of water safety plans:

- *Improved control over the catchment areas:* Sampling probes were installed allowing the monitoring of resource water during steady state conditions sixty days before it will enter the production process. The risks associated with extreme are covered by the water safety plan, so that pumping is stopped during flooding and reduced not to exceed natural ecological balance during drought.
- *Improved microbial control:* Update and upgrade the disinfection process of wells and storage tanks.

[4] Further information on RPN from http://www.sixsigmaspc.com/dictionary/RPN-riskprioritynumber.html and http://www.reliasoft.com/newsletter/2q2003/rpns.htm

- *Improved consumer relations:* Information on the introduction of water safety plans to the consumers led to a reduction in the number of queries, and a more positive perception of the utility.
- *Improved information management:* Information becomes available in real time, while complete documentation makes the system more transparent. Information on water quality during the whole process becomes available to the internal control centre. However, the data are not made directly accessible to the public. The drinking water plant at Tulln uses a fully integrated process controlling system: outtake from wells, pumping stations, plant and distribution system. The program makes it possible to monitor and control pumping performances and tank capacities. Flow measurements are possible as well; monitoring of take-outs of water quantities from wells and the retainer conditions is done constantly ("available complete documentation" in real time). All data are sent and stored within one control centre. In addition to permanent self-control, the utility laboratory also obtains samples in selected placed for the measurement of temperature, pH value, electrical conductivity, and UV permeability. Those data are determined and fed into the data acquisition program for electronic storage.
- *Further chemical parameters are analysed and by external labs such as iron, manganese, nitrate and nitrite*. A modern photometer is used that can bring all the measurements directly into process control software. Faulty measurements through e.g. dilution during the sample preparation will be recognized by the system and would cause a repeat sampling since otherwise automated alarms are released that will inform the control centre All measurement results achieved by different on-line measurements and laboratory analysis serves for monitoring "critical limits" in the sense of the water safety plan. The process control software can also be served from outside by the controllers via Internet.
- *Increased system efficiency:* System efficiency increased due to the availability of treatment and process diagrams in computerized format including the provisions of the water safety plan. Automated alarms alerting staff by Short Message System (SMS) reduced the reaction time when CCP were exceeded. Analytical data generated by the laboratory are transferred automatically by the software system to the database, thus making the data management process more robust.
- *Increased worker efficiency:* The efficiency of individual workers increased. Additional staff was however needed during the introductory phases.

It was noted that approximately 10% of the population of Lower Austria has their own wells. Owners of private wells are obliged to deliver one sample per year to authorities. If the quality of their self-produced water does not comply with the Austrian drinking water regulations, private water wells are to connect to centralized supply and hence be covered by the water safety plan of the centralized supply.

2.1.3 Small suppliers

In order to appreciate the difficulties of smaller water works, three small water works were visited by the expert team in Kirchberg, Neudegg, and Tulbing. A private well for a soft drinks producing company in Tulbing was also visited.

No water safety plans were operational in these small utilities, except in Tulbing where the municipality employed a student to elaborate plans for maintenance and other water safety plan-based documentation.

All utilities had alarm protected entrances. All utilities had automated monitoring of water levels and of some operational parameters (e.g. iron removal). All utilities could be supplied by others utilities should emergencies occur; special attention was being paid to ensuring fire security, as the utility supplies all fire hydrants with potable water.

2.2 Lithuania – Klaipeda water works

2.2.1 Legal Aspects

Water utilities fall under the provisions of the Lithuanian Food Safety Act which requires the development and implementation of a HACCP. The water utility took the initiative, supported by the regulator, to develop HACCP in 2003.

HACCP covers catchment areas, treatment and distribution for each water field (see later).

The HACCP team was formed by department heads of the utility, and is headed by the Head of Laboratory. Only top managers of the utility, including the general manager and the local regulator are aware of the plan. Visiting experts pointed out that other personnel also ought to have been made aware of such a team and plan.

All biological, physical and chemical hazards have been identified during the formulation of the HACCP based on past experience and not on the basis of a risk categorization/risk matrix system. A number of CCP have been identified, including quality of the raw water, quality of the treated

water before entering the reservoir. Measures to deal with flooding, flood prevention, electrical malfunction and chemical accidents are available, but are not included in the HACCP Plan. Accident plans were developed as an independent section by a third party.

The HACCP does not set specific health-based targets, but implements the national and the DWD standards as outbreaks of water-related diseases are extremely rare

The utility stated that ISO certification had been detained, which implied independent audit of the HACCP.

2.2.2 Klaipeda water works

SC Klaipédos Vanduo, the utility supplying water to 200,000 inhabitants of the city of Klaipeda and immediate surroundings, is a municipal enterprise with both ISO 9001 and ISO 14000 certification.

The utility operates four well fields, including 23 deep wells, 24 booster pumping stations and 383.3 km water supply network. The utility also operates a wastewater treatment plant, 21 wastewater pumping stations and a sewerage piping network of 370.6 km. 11% of the network is less than 10 years old.

The utility produced 12.3 million m^3/y of water and supplied 10.9 million m^3/y. The utility uses mainly groundwater with one exception where river water is used to supplement groundwater in an infiltration field. Two service reservoirs of 6000 m^3 are being used.

Some water quality problems exist with regard to fluorides, turbidity, ammonia and hydrogen sulphide. Water aeration equipment was added in 2002 as part of an improvement programme to remove H_2S.

The utility has the responsibility over the canal that carries river water to the infiltration field. This responsibility is shared with the Lithuanian Environmental Protection Agency (EPA) which also has the responsibility over the management of the Minija River.

2.2.3 Neringos Vanduo

The utility supplies water, and treats waste water, for the four settlements of the Neringa region – a total permanent population of 800 which can however increase to 8000 during the tourism season. Two plants are in operation, the Juodkrane water field and the Preila water field.

All water is groundwater pumped through boreholes at a depth of 20m. Location of boreholes is regulated by national legislation. A water

source must be located at least 50m away from any settlement. This distance requirement coupled with the expansion of the settlements on the peninsula will soon cause a forced relocation of some water sources.

The water is not treated at present but the municipality has not ruled out disinfection by chlorination in the future.

The distribution network has an overall length of 25km.

Sampling at tap is done as part of the HACCP plan. Most customers have installed individual filters to eliminate rust from the drinking water supplied by the utility. The utility has no control over these filters, but laboratory results confirm their effect on colour, turbidity, ammonia, and iron.

At present wastewater is discharged to the lagoon. It does not represent a risk to drinking water sources but environmental considerations led to plans for the construction of 3 sewage treatment plants at an estimated cost of 13 million Litas.

The Preila water plant has a basic HACCP plan as required by local legislation.

The utility reports on drinking water quality to the Regulator, and has its HACCP Plan audited by the Regulator. The current HACCP plan was written in 2005 and will be upgraded to take into account the current expansion of the utility. An agreement with Klaipédos Vanduo is in place for sampling and water analysis.

Non-parametric hazards such as flooding, interruptions in the electricity supply, etc are not covered by the HACCP but are taken up in the Civil Protection Plan (CPP).

Top management is aware of the HACCP, but this is not the case for all staff.

2.2.4 Issues with regard to the implementation of water safety plan

2.2.4.1 Klaipeda water works

Implementation of a full HACCP brought quality control of the applied chemicals under the attention of the Klaipeda utility as a possible control issue.

The Klaipeda utility found the lack of practical guidance on "how to" do a HACCP a serious hindrance, and requested that formal guidance on

this matter be prepared and made easily available. There was difficulty in fully understanding the WHO Guidelines for Drinking-water Quality and its recommendations relating to water safety plans because, at present, these were available only in English.

Non-parametric hazards have been included in the HACCP such as flooding, electrical failure etc. The Klaipeda utility does not have alternative sources of water supply to deal with any gross contamination of the river, but feels that that it could handle any disruption in this supply source by increasing supply for its own other sources.

Water works processes have been computerized and automated operations installed to benefit from cheaper energy prices at night time. The possibility of electricity interruptions has also been taken up in the HACCP and back-up generators are in place.

As the plan is based on treatment barriers as defined in HACCP, operations and critical limits do not form part of the HACCP Plan but are documented as Standard Operating Procedures (SOPs). Such SOPs ought to be integrated in the HACCP if the latter is to be upgraded to a proper water safety plan.

Distribution network maintenance form part of the SOPs and not of the HACCP.

Sampling of water is done at consumers' tap, but there is no proper liaison between the competent authorities and the water utility.

It should be noted that the water utility can be required to carry out a health surveillance study by the regulator for any changes in the water quality. The Ministry of Health, for example, can request the water utility to implement an epidemiological study on fluoridosis in the context of a proposed revision of the fluoride standard.

2.2.4.2 Neringos Vanduo

SOPs have been in place for individual procedures and the utility is working these up into a comprehensive operations manual.

The management has not seen the WHO Guidelines for Drinking-Water Quality but as a large number of elements of a water safety plan are already in place, they did not foresee substantial problem with their integration into a comprehensive water safety plan.

This small water supplier had not carried out hazard identification and risk analysis, due to a lack of sampling and analytical equipment. It has however located its boreholes in remote areas away from obvious potential sources of contamination, in keeping with national legislation,

and has an agreement with the water works at Klaipeda to analyze water quality.

2.3 Switzerland

2.3.1 Legal Aspects

Drinking water is covered by the Swiss federal food legislation, with considerable autonomy being divulged to the cantonal authorities. The main legal instruments for the control of drinking water quality are:

- Federal Act on Water Protection
- Federal Act on Foodstuff
- Ordinance on Drinking Water and Natural Mineral Water
- Ordinance on Hygiene and Ordinance for Foreign Substances and Components. The Ordinance on Hygiene regulates the microbiological parameters, and the Ordinance on foreign substances and components regulates the chemical and physical parameters.

Cantonal public health authorities are responsible for drinking water surveillance. Such surveillance consists of inspection of facilities, water quality, and quality assurance measurements.

Regulators are guided by published inspection guidelines "Anfordering an die Dokumentation der Qualitätssicherung". Regulators approve the plans by which certified laboratories perform water analysis.

2.3.2 Lenzburg water works

SWG Energie AG, the municipal water authority at Lenzburg, supplies water to 7600 inhabitants using a network of 60 km of pipelines with an average age of 30 years. A continuous programme of network renovation is in operation, with 1.2 km of pipeline being renewed each year.

The Lenzburg water utility is responsible for all steps of drinking-water production, starting from protection zones in catchment areas through pumping, treatment, storage, and distribution till the counters at the entry of consumers' dwellings. However, monitoring of drinking water quality is performed at tap.

Water is supplied from 2 water treatment works using groundwater from two 30m-deep wells (86%) and three springs (14%). The spring catchment area is protected. Spring water undergoes UV disinfection to protect from potential microbial pollution after heavy rains, and has on-

line checks for turbidity with automated cut-off. Drinking water consumption stands at 0.9 million m³/year.

Two water reservoirs can supply water for one day and have video surveillance.

A case was made for the delineation of groundwater protection zones based on hydrogeological mapping and experimentally determined aquifer characteristics, rather than merely surface area especially when the capture area offers aquifer types with significant differences as to transportation and filtration capacities.

Water treatment works are computerized, incorporating automated alarms connected to alerts in the offices of the utility and to mobile telephones of key staff. Alarms are also fitted at the entrance to the water catchment zone and the treatment buildings. Back-up supply possibility exists through connection to another water utility.

Although elements of a water safety plan are in place, the utility did not operate a formal water safety plan.

2.3.3 Aargau Food Safety–Consumer Inspectorate

The Consumer Protection Agency of the Aargau region is mandated in areas of consumer protection and food safety within the canton, and serves as the Regulator to the Lenzburg water utility. The Regulator inspects water quality, including:

- *Microbial quality:* aerobic mesophilic bacteria, E. coli, enterococci spp.
- *Physical and chemical quality:* colour, odour, turbidity, conductivity, pH, carbonate hardness, general hardness, Ca/Mg, and Na/K, Cl-, NO3-, SO42-, Fe, Mn, ammonium, nitrate, nitrite, oxygen, oxygen saturation, TOC
- *Complementary parameters:* Pseudomonas aeruginosa, Br- , F-, volatile halogenated hydrocarbons, herbicides and their decomposition products, heavy metals, further inorganic and organic compounds, pathogenic micro-organisms.

Inspection of quality assurance includes: personnel (organization chart, tasks and responsibilities), facilities (inventory, hydraulic scheme, plants), procedures (precise work instructions for the staff), operational data (protocols, records, performance data, reports).

Official surveillance of drinking water supplies places emphasis on enhancement of quality assurance systems, and on risk-based surveillance.

Other tasks of the Regulator include: support to the water utility in terms of analysis and expertise, expert opinion on construction projects, participation in national surveillance programmes, regional and national collaboration and exchange of information with regard to particularly difficult analytical procedures (MTBE, herbicides…), period cantonal seminars for persons in charge of drinking water management. This support is essentially dedicated to small suppliers, but as there are 2700 drinking water suppliers in the country, cantonal authorities face a considerable workload.

The Regulator pointed out that there is a clear shift towards automated analysis at night, due to the great number of samples. Cantonal laboratories are fulfilling their control function, but also request utilities to assume "self-control" schemes.

After the visit, the WHO Regional Office for Europe received the following statement from the Regulator:

> *"[…]having a water safety plan would be a fine thing for all water suppliers, and could complete already existing requirements of the Swiss legislation. As to surveillance by the authorities, a water safety plan could promote a close collaboration of the different work groups involved in the protection of consumers and environment, respectively. However, […] implementing a water safety plan could become an excessive demand, financially and in terms of professional skills, for small suppliers…*
>
> *A water safety plan should be […] a simple but effective mean, that helps ensure consumers' welfare. Emphasis should therefore be placed […] on a thorough assessment of the local risks rather than regulating hazards in an extensive general way. Moreover, it should allow for best possible consideration of epidemiology and specific health relevance in the diverse regions it will be implemented.*
>
> *[…] I think for drinking water the local assessments and management systems adapted to these assessments really makes sense."*

2.3.4 Issue with regard to the implementation of the water safety plan

The Lenzburg water utility produced a handbook for quality management which covers all possible risk related to: water quality, water availability, quality of services, economy, consumer satisfaction,

energy/incidence issues, worker safety, environmental protection, and public relations.

The handbook was produced by one staff member on his personal initiative, and took one year to produce. Selected parts of the handbook are made available to staff according to their assignment in the water utility.

Risk identification in the handbook was based on experience gained inside the utility. Prioritization of risks was based on health impact and on financial considerations. The utility did not find "surprises" after the risk identification stage, and therefore did not change the technology applied.

The main advantage of the handbook and the integrated plan was the establishment of clear links between particular risks and particular activities.

2.4 Spain

2.4.1 General

The Barcelona drinking water production averages 11 – 12 m^3/s, supplying 3 million people in 23 municipalities. The expert team visited the Sant Joan Despí treatment facility, and the Castellar del Vallès supply.

2.4.2 Planta de Tractament del riu Llobregat a Sant Joan Despí

The private company serves 2,923,773 consumers, 1,335,899 of which are urban residents. It operates two treatment works, 101 service reservoirs with a capacity of 477,833 m^3, and 4,466 km of network. Resources are 89% surface water and 11% groundwater (2004, wet) but can change to 85% surface water and 15% groundwater (2005, dry).

The plant applies a quality management approach codified in ISO 9000, and sees the water safety plan as a complementary element, particularly valuable for including the health risk dimension.

A discussion on water safety plan has started in Spain in 2005, and the central water authority is evaluating the implementation of water safety plans.

Research on emerging water quality issues informs risk management decisions including decisions to upgrade treatment facilities, and to prioritize pipe investments/replacement.

2.4.3 Castellar de Vallès

The utility serves 9292 customers from one treatment works through 134.7 km of distribution network. The utility uses mainly groundwater.

The concept of water safety plan has not been formally adopted although there are various elements of a water safety plan in the system descriptions, operating protocols or monitoring and verification plans used by the parent company.

2.4.4 Conclusions

Neither system operates a formal water safety plan, possibly due to the current lack of legal incentives. Nonetheless, many elements of the water safety plan are already in place, especially in the treatment system and the catchment protection of the large system. The implementation of the ISO 9000 has professionalized treatment operation and control to a high level. Elements of the water safety plan are least developed for the distribution system.

Health targets for both systems are taken from the EU drinking water directive (water quality standards). The presence of a health surveillance system to evaluate the efficacy of the drinking water risk management was not evaluated.

In the large system visited, source water is highly variable in quality and in quantity, and vulnerable to industrial and agricultural contaminations. The treatment is operated very strictly to match the actual source water quality. This is done by frequent monitoring and adjustment of the treatment system on the actual water quality. The system has extensive laboratory facilities on the premises to feed treatment control. The setting and operation of this system makes a water safety plan particularly attractive.

Hazard identification was done by evaluating the contamination sources in the catchment, and by contaminant monitoring. For microbiological contamination (e.g. viruses), the system has more site specific data available than most other European water utilities. Hazard prioritization is based on experience (no formal risk ranking, for pathogens a quantitative risk assessment was conducted). Operational limits have been set, based on experience and a monitoring programme is operational, including on-line monitoring of several aspects of the treatment. Corrective actions were taken; tailored to the actual problem and based on experience, not according to prescribed action plans. Verification was done using end-product monitoring.

Larger utilities in Spain were therefore found to be using a water safety plan approach, regardless of the term used. They are likely to have the

resources, knowledge and commitment to continue to develop along these lines, regardless of the regulatory impetus.

In smaller utilities, there are also various elements of current practice and procedures that would serve as building blocks for water safety plan development. Smaller utilities do not necessarily have he resources to undertake water safety plan, although they recognize the benefits and have aspirations to move in this direction. It is clear that, should the water safety plan approach become part of the obligations of smaller utilities obligations within the national regulatory framework, then such smaller utilities would have a more effective case for requesting or mobilizing additional resources to comply with the regulatory requirements for a water safety plan. Without the regulatory framework to require the water safety plan, it is unlikely that smaller utilities will be able to develop the water safety plan.

A further difference between larger and smaller utilities is the level of guidance and assistance needed to develop and implement water safety plan. While bigger utilities usually have skilled staff from different areas of expertise (i.e. microbiology, chemistry, and engineering) required to develop a meaningful water safety plan, and may indeed dispose of laboratories equipped to undertake system-targeted research, smaller supplies may not cover the range of expertise needed to develop a water safety plan.

It is therefore recommended that strategies for effective provision of guidance and assistance must be developed, e.g. on the level of the member state, to facilitate practical implementation of the (potential) regulatory instrument.

2.5 United Kingdom

2.5.1 Legal aspects

Legislation in the four constituting countries of United Kingdom (England, Wales, Scotland and Northern Ireland) is based on the transposition of the EU Drinking Water Directive 98/83/CE but still has local differences.

In England, drinking water quality standards are set out in statute in the Water Supply (Water Quality) Regulations 2000 (England) and 2001 (Wales). Regulations set standards for each parameter and state how often each one should be tested for and where the samples for testing should be taken. The Regulations are currently in the process of being amended to widen the current requirement to risk assessment for Cryptosporidium to a risk assessment for any potential danger to public health.

The Drinking Water Inspectorate (DWI) was formed in 1990, with the aim to provide independent reassurance that public water supplies are safe and drinking water is acceptable to consumers. The DWI regulates 26 water utilities in England and Wales. It is responsible for enforcing the Water Supply (Water Quality) Regulations on behalf of Ministers but the Chief Inspector acts independently. The main powers are: (i) to obtain information from the water utilities; (ii) power of entry or inspection; (iii) power of enforcement; and (iv) power of prosecution. Water utilities are self regulating, DWI carries out an audit, or verification, of this process.

Private water supplies are those not provided by statutorily appointed water utilities. They serve about 2% of the population. Local authorities are responsible for checking the safety and sufficiency of all water supplies in their area, including private supplies but take very few samples of public water supplies. The role of the DWI in respect of private water supplies is to provide technical advice to local authorities.

Current regulations in England and Wales do not include specific requirements for water safety plan. However, the Chief Inspector has stated that drinking-water improvement programmes from 2009 onward must be identified through the water safety plan approach.

Drinking water quality standards in Scotland are set out in statute in the Water Supply (Water Quality) Regulations 2001.

The Drinking Water Quality Regulator (DWQR) for Scotland was set up under the Water Industry (Scotland) Act 2002. It regulates Scottish Water and is responsible for enforcing the Scottish Water Supply (Water Quality) Regulations independent of Ministers. The DWQR has three main powers: (i) to obtain information from Scottish Water; (ii) entry or inspection; and (iii) enforcement.

Private water supplies are the responsibility of local authorities, which exercise a regulatory function using the Private Water Supply (Scotland) Regulations 2006 and the Water (Scotland) Act 1980. A "private water supply" is by default any supply of water which is not provided by Scottish Water as part of its core functions. All private water supplies are required to be registered with the local authority where the source of the supply is located. Approximately 150,000 people rely on private water supplies in Scotland. Strengthened regulation on private water supplies came into force in Scotland on 3rd July 2006. The DWQR makes available technical guidance, including a 640-page manual[5] entitled "Private Water Supplies – Technical Manual". Scottish authorities also set up a grant scheme for private supplies.

[5] The manual can be downloaded by following this URL:
http://www.privatewatersupplies.gov.uk/private_water/files/Full%20Doc.pdf

Current regulations in Scotland do not include specific requirements for water safety plan. However, the Scottish Ministers have funded Scottish Water to implement water safety plans.

2.5.2 Presentation by Scottish Water

Scottish Water is the unique drinking water supplier for the whole country. This publicly-owned body manages 338 different water treatment works and 46,000 kilometres of water pipes. The utility is in the process of applying the water safety plan framework to its operations.

Risk assessment is based on seven nodes, and stretches from catchment to consumer. Risk assessment models take into account the detectability of the hazard. Ascertainment of priorities of interventions is done every two years.

2.5.3 Wessex Water

2.5.3.1 Utility overall

Wessex Water is a regional water and sewerage company in the south-west of England, ISO 9000 certified since 1992. It supplies 1.2 million customers with up to 380 million litres of water per day from 88 water treatment plants and 309 network service reservoirs mainly using groundwater (75%). The company manages a network of 11,300 km of water mains. In 2005, compliance with parametric values was 99,9%.

The company also evacuates and treats 482 million litres of sewage from 2.5 million customers daily.

Water safety plan is seen as an "umbrella" for the different existing quality systems implemented by the utility. The implementation of the water safety plan has the backing from directors. A project manager and two assistants have been tasked with the completion of the plans, using methodology based guidance from WHO, UK Water Research Industry and HACCP. At the time of the site visit Wessex Water had completed water safety plans for approximately 50% of its 88 water supply systems, and had a programme to complete them all by April 2007.

2.5.3.2 Ashford Water Treatment Works

The Ashford water treatment work handles surface water. Two reservoirs supplying the plant are located in the centre of an intensive agricultural area. Hazard identification, including contamination sources, is done for each catchment. Hazardous events including

accidental and malicious contamination have been identified and are considered as non-parametrical "high risks" hazards.

HACCP methodology has served for establishing documentation in the form of a reference booklet used by all operational and maintenance personnel.

Visiting experts were able to check the existence of some parts of the water safety plan on site (monitoring procedures, control measures, operator training …). They noted the change in approach whereby, rather than making big investments themselves, Wessex Water tries to convince other stakeholders to properly protect resource water and, in some cases, provides assistance to this effect. This approach was deemed noteworthy also for use in other locations – an illustrative example would be a paying a farmer to relocate a farmyard, rather than install treatment to remove pesticides and rebuilding a spring to protect it from surface run off rather than install treatment to remove Cryptosporidium.

2.5.4 Anglian Water

Anglian Water (AW) was visited by a restricted mission composed of EC and WHO specialist in March 2006.

Anglian Water is the fifth largest supplier of drinking water in England and Wales by population, supplying some four million customers. The total service area covers some 27,500 km^2 km. The company delivers over 1 billion litres of drinking-water daily through 36,000 km of pipelines and operates 1075 wastewater treatment plants.

The company has developed and operates a pilot water safety plan for one of its largest water supply systems, and is currently working to implement the water safety plan approach across all of its drinking water supplies. Amongst the major incentives for the adoption were cited:

- The overall approach towards a water safety plan builds the current risk and control systems.
- A better definition of investment needs, and hence a better basis for discussion between operational managers and the Board.
- The development of common ground for negotiations with the drinking-water regulator (Drinking Water Inspectorate DWI) and with environmental regulators.
- Increase in consumer confidence.

It was stressed that a water safety plan cannot be seen as a management tool at the unit level, but must be designed, developed

and implemented developed on a corporate scale. This is especially important in drought-prone areas where resources are swapped between service areas within one corporate structure, and where company offer mutual assistance when required.

Introduction of water safety plan required a shift in corporate polity: whereas prior to the introduction of a water safety plan the "company hero" was the person bringing an incident under control, under a water safety plan the "company hero" is the person who prevents occurrence of the incident. Accompanying measures are required to ensure a smooth cultural shift, such as the institution of company awards for prevention, and the cancellation of awards for repairs.

The impact of the introduction of a water safety plan was a reduction of the number of incidents, and the reduction of the magnitude of the incidents that did occur. Water utilities in England and Wales are legally required to publicly report on incidents that result in a breach or potential breach of regulatory requirements, which could cause public alarm or result in publicity. These range from treatment failure to major bursts to algal blooms in source water affecting taste to valving operations causing discoloured water.

2.5.5 Conclusions from the visit to the Wessex utility

Scoring system Visiting experts are of the opinion that it is more relevant not to fix a rigorous frame for the risk analysis, but to have a scoring system justified by the drinking water suppliers.

Third party audit: Visiting experts considered that approval of water safety plans could be difficult for auditors in view of the characteristics of the different system components. While catchment and water treatment works may present easily identifiable hazards, and many systems will present generic hazards in their distribution mains, medium or minor hazards may be identifiable only by the supplier. Moreover, checking the relevance of each control measure or monitoring procedure might be difficult.

Experts also wondered whether water safety plan should be the exclusive responsibility of the supplier, or whether there is a role for a third Party as final approval authority. If third Party approval is required, approval conditions have to be described.

Furthermore, the nature of the third Party can be discussed: independent organizations (e.g. organisms approved by national

authority) or public organisms (surveillance agency, local or national health authority).

Water safety plan or risk assessment/ risk management approach Plans presented by Wessex Water could be applied to larger utilities. For small or indeed private suppliers, an approach based on risk assessment and risk management should be considered. The preparation of a technical manual to serve the specific needs of small scale suppliers should be encouraged.

2.5.6 Small supplies

Private water supplies are regulated by local authorities using the Private Water Supply (Scotland) Regulations 2006 and the Water (Scotland) Act 1980. A "private water supply" is any supply of water which is not provided by Scottish Water as part of its core functions. All private water supplies are required to be registered with the local authority where the source of the supply is located. A private water supply can serve a single household or many properties or commercial or industrial premises. 150 000 people in Scotland rely on private water supplies. Strengthened regulations of private water supplies came into force in Scotland on 3rd July 2006. Regulations implement the Directive 98/83/EC and include other recommendations on drinking water quality. Regulations consider two types of supplies:

i. Type A supply includes: - supplies that provide 10m3 or more of water a day ; - supplies that serve 50 or more people ; - supplies serving commercial and/or public premises irrespective of the volume or number of persons served.

ii. Type B supplies include: smaller private water supplies providing less than $10m^3$ of water per day or serving less than 50 persons are defined as type B. These supplies will almost exclusively be to domestic properties. Type B supplies are exempt from the full provisions of the Drinking Water Directive and are subject to national water quality standards.

The DWQR made a support package (soil leaching potential maps, comprehensive technical manual, website and toolkit) in order to help for the implementation of 2006 regulations. The DWQR with collaborations of many organizations published a guide in 2006. This manual is intended to assist professionals regulating and maintaining private water supplies. This reference document is based on a risk assessment approach. It provides guidance about: - contaminants of water - risk assessment (with some case studies) - water treatment processes - monitoring procedures - legislative information etc.

More details are available on the website: http://www.privatewatersupplies.gov.uk/private_water/CCC_FirstPage.jsp

EC/WHO experts were impressed by this work. This document is clear, complete and very useful for private water supplies.

3 FINDINGS RESULTING FROM THE VISITS

At the end of the visit, experts were satisfied that they had visited the "best student" in each Member State. At the conclusion of the series of visits, experts were of the opinion that in many major water enterprises steps had been taken that could be identified as partial implementation of water safety plans. Although the need to special attention to the specific challenges of smaller water supply enterprises was recognized, the material collected seemed to indicate that introduction of water safety plans was both feasible and advisable.

Also, while major utilities seemed to share sufficient characteristics to be broadly comparable across the European Union, this was not necessarily so for the organization and the means available to smaller utilities.

However, as there is no comprehensive comparative study on the current status of the water industry in the European Union suitable for the purposes of the current task, the possibility remains that the structural organization and the means employed in the implementation of water safety plans in the utilities visited are perhaps not representative of the overall national situation.

Attention should be given to of supporting measures that could facilitate the introduction of water safety plans. Elements of this discussion include: the role of (inter-)professional organizations at the local, national and international level, the possible synergy with existing WHO training modules and the potential development of more specific training packages, and the possible support by the EC in this work

While recognizing the need to ensure that the introduction of water safety plans is accompanied by an appropriate communication campaign towards the consumers, it is recognized that such communication campaign will need to be prepared carefully. Communicating about water safety plans implied communicating about "risks" and "hazards", and care will need to be exercises to avoid baseless concerns in the population at large.

Support for the Development of a Framework for the Implementation of Water Safety Plans in the European Union

ANNEXES

ANNEX 1: ACRONYMS

AW	Anglian Waters
CCP	Critical Control Points
CP	Control Points
CPP	Civil Protection Plan
DWD	Drinking Water Directive (of the European Commission)
DWQR	Drinking Water Quality Regulator (of Scotland)
DWI	Drinking Water Inspectorate (of the United Kingdom)
EAS	European Acceptance Scheme
EC	European Commission
ECD	Endocrine Disrupting Chemicals
EMAG	European Microbiological Advisory Group
EPA	Environmental Protection Agency
EU	European Union
FMEA	Failure Mode and Effect Analysis
FSDW	Framework for Safe Drinking-water
FSP	Food Safety Plan
GDWQ	Guidelines for Drinking-water Quality (of WHO)
HACCP	Hazard Analysis and Critical Control Points
JRC	Joint Research Centre
LMG	Lebensmittelgesetz (Austrian) Food Law
LMSVG	Lebensmittelsicherheits-und Verbraucherschutzgesetz (Austrian) Food Security and Consumer Protection Law
OMC	Operational Management and Control
RARM	Risk Assessment Risk Management
RPN	Risk Priority Number
SMS	Short Message System
SOP	Standard Operating Procedure
TOC	Total Organic Carbon
TWV	Trinkwasserverordnung – (Austrian) Drinking water ordinance
UV	Ultra Violet
WHO	World Health Organization
WSP	Water Safety Plan

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ANNEX 3: STATEMENT BY EUREAU

Eureau Note on the Development of a Framework for the Implementation of Water Safety Plans in the European Union

1 - Introduction

The Directive 98/83/EC on the quality of water intended for human consumption (DWD) is mostly a product directive, with standards for 48 microbiological and chemical parameters that can be found in drinking water. 'End of pipe' monitoring has resulted in significant improvements in drinking water quality across Europe and has improved our understanding of risk.

However it is recognised that relying solely on 'end of pipe' monitoring means that incidents resulting in contamination of drinking water may, in some extremely rare circumstances, not be identified until after the water has been consumed. In most cases water suppliers already manage their supply systems using risk based approaches taking into account the existing framework of European legislation that is designed to protect the environment. 'End of pipe' monitoring is not and never has been the sole means of managing the quality of drinking water.

In 1994, these observations lead experts to consider the implementation of preventive risk management concepts (PRM) in drinking water legislation, as does the food sector with the Hazard Analysis and Critical Control Point approach (HACCP). The concept of Water Safety Plans (WSP) was introduced in 2000 as an adaptation of HACCP to the specific requirements of the drinking water sector. It was incorporated in the WHO Guidelines on drinking water quality in 2004, where it is described in an appreciable amount of detail. In relation to these technical developments, consideration was also given to the institutional arrangements deemed necessary to manage water quality issues, with by example a requirement to assign precise responsibilities to the different bodies involved, or to share knowledge and to cooperate with different bodies involved (e.g. farmers, municipalities, building owners) to prevent the risks of pollution of water. These arrangements were debated at two conferences held in Bonn, which resulted in the 'Bonn Charter' (BC), promoted by the IWA[6] since 2004.

[6] EUREAU has a position paper on the Bonn Charter.

2- Benefits of the application of PRM in the water sector

The concept of PRM is increasingly used in the sector, in the more general framework of the water quality management systems (e.g. ISO 9001). For the future, EUREAU firmly supports the further development of PRM, with the aims of limiting the regulatory burden of 'end of pipe' monitoring, and of identifying the most appropriate and efficient means of managing water contamination, taking account of such issues as the polluter pays principle and the effectiveness/relevance of other legislation that affects or is designed to protect the environment e.g. marketing and use directives, WFD, the Common Agricultural Policy.

In practical terms, PRM is seen as a cross-checking built on existing quality management schemes which focuses the attention of operators on the reliability of water protection measures, and allows the water supplier to formalise existing procedures into a systematic package that can be used in contact with authorities (municipal, regional or national), either to demonstrate the protection level already achieved, or to justify the requirements for investment, in light of public health based standards. Eureau believes this approach will result in more cost effective operation and monitoring, and ultimately will limit the cost of failure through the promotion of more proactive and documented reaction to events.

The PRM approach will also allow MS and suppliers to take account of new information outside the timetable for revising the Drinking Water Directive. An example is WHO's relaxation of the health based guideline for nickel. MS and suppliers should not and would not then have to wait several years for the next revision of the Drinking Water Directive.

For a wide number of specific issues like Cryptosporidium, Giardia and other pathogens, Eureau is recommending adoption of a PRM as an alternative to the adoption of new numerical standards together with expensive monitoring requirements. The same applies to other water quality issues like algal toxins or emerging substances such as endocrine disruptors and pharmaceuticals: By itself monitoring does not reduce risks, it is better to spend the money and resources on management actions that reduce risks.

3- Organisational needs

Subsidiarity - The governance and structure of drinking water supply varies considerably across member states (MS). The responsibilities for organisation and control rest with bodies which can be at state, regional, county or municipality levels. There is also considerable variation in the arrangements for managing and protecting water resources and implementing environmental legislation.

Another appreciable difference lays in the use of due diligence, codification, standards, check-lists, obligation of means (e.g. disinfection) and qualification of personnel. These differences strongly determine the way audits, verification and monitoring are carried out through the EU. For a cost effective implementation in different MS, PRM requirements

laid down in a revision of the DWD must leave enough flexibility to MS to build upon their existing systems for the demonstration that fit for purpose principles are followed and that barriers are intact.

Responsibility - The final responsibility for the delivered water quality rests with the suppliers up to the point of delivery. Eureau believes responsibility for PRM also rests with the water suppliers, and not with authorities or government. Therefore we do not want responsibility for 'approval' of PRM plans to rest with regulatory authority(s). This would lead to creeping regulation and micro-management of water suppliers by the authorities.

Beyond the plants and networks, water suppliers are being given responsibility for developing PRM, including the responsibility for taking the PRM message out to other stakeholders (farmers, customers, other regulators). However water suppliers have no power to enforce other parties in the water supply chain to take action. And none of these other stakeholders have any obligation to participate in such discussions. While some might be willing to cooperate they inevitably ask where the funding is coming from to change their practice. Without this and with no regulatory powers of enforcement the benefits of such liaison are limited in effect. Eureau believes that this activity should be picked up through the WFD; the designated Competent Authority for the MS is in the lead. Funding for other stakeholders in the supply chain is still going to be an issue.

Funding - There needs to be explicit recognition that implementation of a PRM involves additional costs:

- Development of plans and integration in existing management systems
- Development of new PRM tools
- Additional liaison and coordination with other stakeholders
- Extra monitoring on raw water to deal with risks that are not sufficiently understood
- Reporting on PRM to authorities
- Validation & verification

The costs incurred should be balanced against the overall savings on the current monitoring expenditure required under the current DWD.

4-Components

Safety level - Eureau supports the position set out in the WHO Guidelines that safety levels should be set out at European or National level. In the current DWD, not all standard values are health-based, but have been set on the basis of other criteria, such as the precautionary principle (e.g. pesticides), consumer acceptance (taste and odour) or the protection of technical integrity of supply systems (e.g. chloride, conductivity, sulphate). The reason(s) for standard setting, when it is not a direct consequence of health based target, should be made transparent, justified for each standard, and properly taken into account in other EU legislation.

PRM- Eureau believes that the DWD must be based on the best scientific evidence and references. The chapter 4 of the current edition of the WHO Guidelines, dealing with Water Safety Plans, provides a starting point to this process. However, the use of the terminology "Water Safety Plans" in the EU legislation would entail a strong reference to the WHO Guidelines and thus go beyond the DWD text itself, leading to potential misunderstandings in any transposition to MS legislation or any subsequent drinking water quality litigation. It is therefore recommended not to use this precise and pre-defined "Water Safety Plan" terminology. In addition, the terminology "Water Safety Plan" has unhelpful negative connotations from a consumer's view - i.e. that drinking water is currently unsafe and we need a plan to make it safe.

Integral approach - Eureau also acknowledges the need to address security and resilience measures (natural disasters, technical failures or deliberate attacks) as hazards in a similar PRM approach. Water suppliers will already have emergency plans and security and response measures in place which will be linked with aspects of the PRM. These detailed measures cover exceptional circumstances rather than the day to day operation of the water supply chain. To maintain effective security these security plans will have restricted access and will be kept separate from the PRM documentation.

Continuous improvement - The assessment of risk will develop over time, independent of any legal requirement. Particular care should be taken to respect the continuous improvement cycle. As an example, some MS may seek to use PRM primarily to enhance the current level of compliance with parametric values, whilst others will be using PRM as a complementary tool to secure and reinforce existing compliance: The risk approach must reflect these differences.

The process must not become overly bureaucratic and reactionary, e.g. provoking knee-jerk requirements for extra monitoring and other studies whenever a "new" chemical is reported detected in water.

Flexibility in Monitoring - The operational monitoring should result in a relaxation of some requirements of the DWD in terms of end-product testing. The DWD should require the MS to establish the procedures which would enable such changes and adaptations, and enable site-specific flexibility to be taken into account.

Validation & verification - Validation and verification are critical activities that should be undertaken by both the water supplier and the surveillance agency, or designated third parties. Verification should employ a mixture of end-product testing and audit of performance, and build on national Quality Management Systems. MS should make certain that the bodies responsible for the validation and verification of PRM have the necessary level of qualification and expertise which may require time to develop.

5- Size of supply system

Small systems - Small and large systems have different risks and solutions. It is well recognized that small systems have specific problems in meeting the drinking water standards. The implementation of PRM must provide improvements to the quality and reliability of small systems. This presupposes that the level of resources in terms of skilled personnel or investments are acknowledged and properly funded. Eureau does however not think that PRM should *per se* be applied differently for small systems, medium or large systems;

Large systems - Conversely, large systems are often integrated and involve several water sources with complex interconnections and distribution networks. This sophistication must be taken into account in the development of the PRM, where standard models can be too simplistic or unduly burdensome e.g. requiring every single abstraction point to be monitored, irrespective of the monitoring at adjacent sites. European obligations to implement PRM should not compromise the need to adapt the principles to the size of the systems.

6- Resource protection: benefits of the WFD

The application of PRM to water supplies needs to be integrated with the principles, practice and timing of the WFD, e.g. Article 7. This will avoid duplicate and abortive effort. Member States have to designate water bodies used for drinking water supply, establish safeguard zones for water catchments areas and provide for measures to protect the water bodies used for drinking water abstraction, in order to reduce the need for treatment.

A revision of the DWD should recognize that the protection of the catchments and water bodies is beyond the responsibility and control of water suppliers. Moreover, the DWD should ensure clarity with regard to the WFD Article 7 requirements such that:

- The administrative and monitoring burden (including land management or inspection provisions) for designated catchments clearly rests with river basin authorities or the relevant competent authority.
- Any transfer of new responsibilities to water suppliers must be transparent, properly funded and accompanied by appropriate enforcement powers.
- River basin authorities should make available to water suppliers, and give proper prioritisation to, the target and programme of measures specifically designed to meet WFD-Article 7 requirements, with regards to all types of pollution, including diffuse pollution.

- Under the WFD Article 7.3, Member States shall ensure the necessary protection for the bodies of water identified with the aim of avoiding deterioration in their quality in order to reduce the level of purification treatment required in the production of drinking water. Member States may establish safeguard zones for those bodies of water. MS should inform water suppliers of the measures they decide to take.

7- Necessary arrangement in the field of plumbing systems

Plumbing systems are responsible for an increasing percentage of non compliance with drinking water standards. There is little European legislation addressing the issue of water quality in buildings. The main requirement is laid down in the DWD itself, which stipulates that quality standards for water supplied to customers through a distribution network have to be met: "At a point within premises or an establishment, at which it emerges from the taps that are normally used for human consumption". MS mostly transfer this responsibility to the water suppliers, who despite the lack of means, in turn have to prove their due diligence when involved in any non-compliance or failure from samples taken from properties[7]. Eureau believes in a source to tap PRM approach, which must therefore include a specific PRM set-up for the plumbing systems, using international standards such as EN 1717 and EN 806, harmonized norms, national standards, codes of practices and qualification of personnel

[7] with a notable exception in Germany, where the building owners obligations clearly covers water

The revision of the Drinking Water Directive should make clear that

- In each MS, a body should be designated as responsible for the implementation of PRM for plumbing systems, in public or private buildings. The water suppliers are willing to share their expertise and information but are not able to take responsibility for this role. Should the obligations of water suppliers exceed knowledge and information sharing, MS must establish the exact nature of these obligations together with appropriate cost-recovery measures;
- In order to verify the effectiveness of PRM set-up in buildings, a legal inspections framework has to be developed at European and MS levels;
- The retrospective implementation of Norms, codes of practice etc. is difficult. Access to private property for inspection can also be an issue. These difficulties should be recognised within PRM systems.

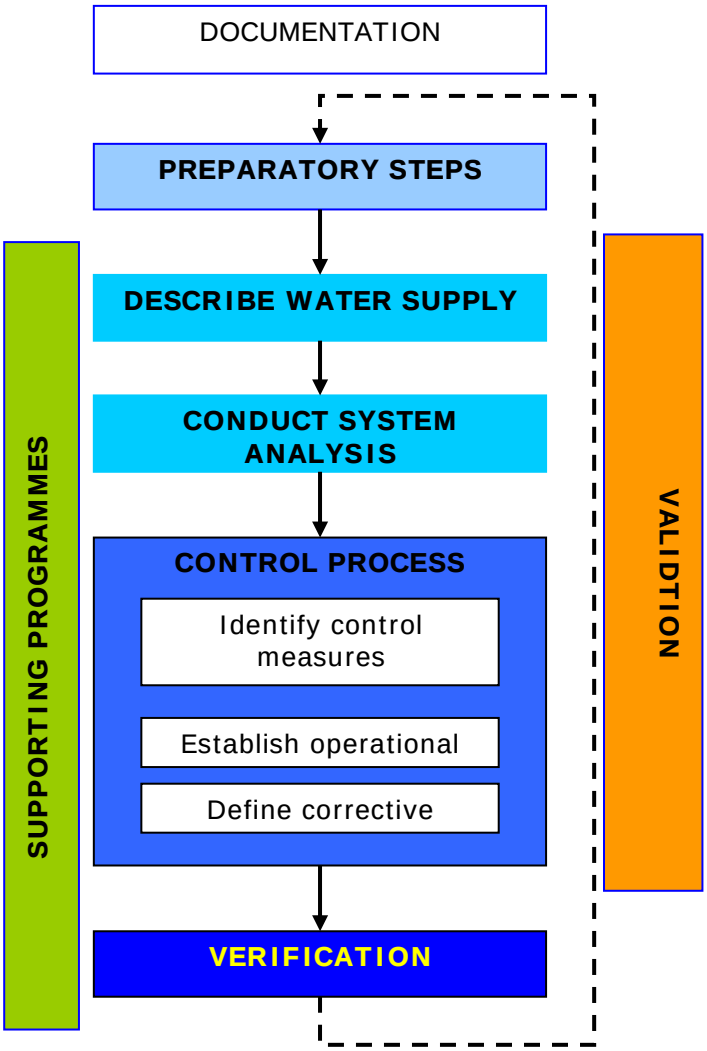
Support for the Development of a Framework for the Implementation of Water Safety Plans in the European Union

SECTION III Photographic illustrations on Implementation of WSP type approach

TABLE OF FIGURES

1. STRUCTURE

Figure 1.1 Components of a Water Safety Plan



2. PREPARATORY STEPS

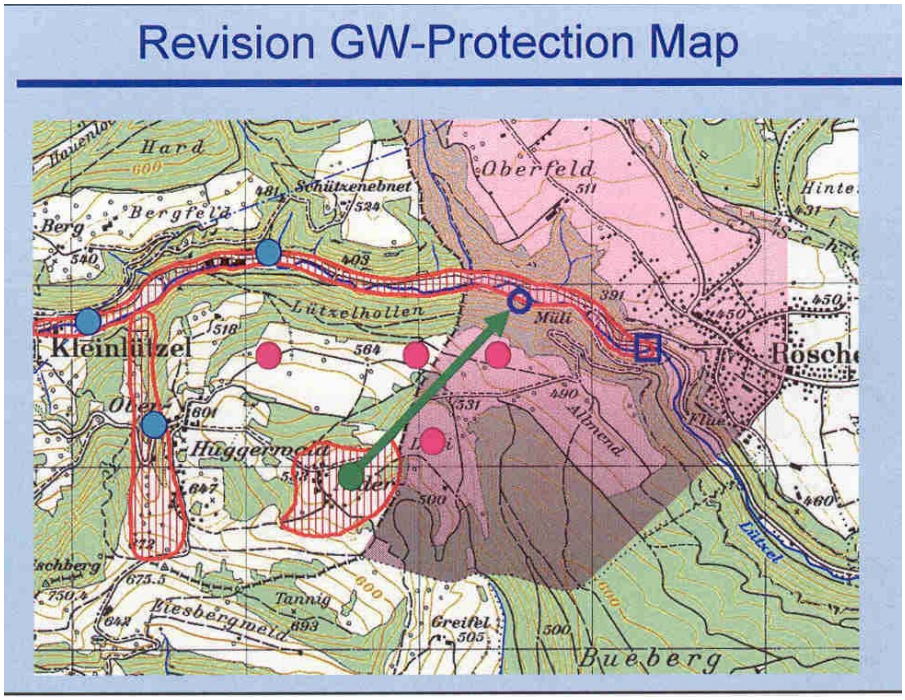


Figure 2.1 Geohydrological delineation of water protection zone

Geohydrological studies can determine a better delineation of the water protection zone than a mere surface area around the water point. (Lenzburg)

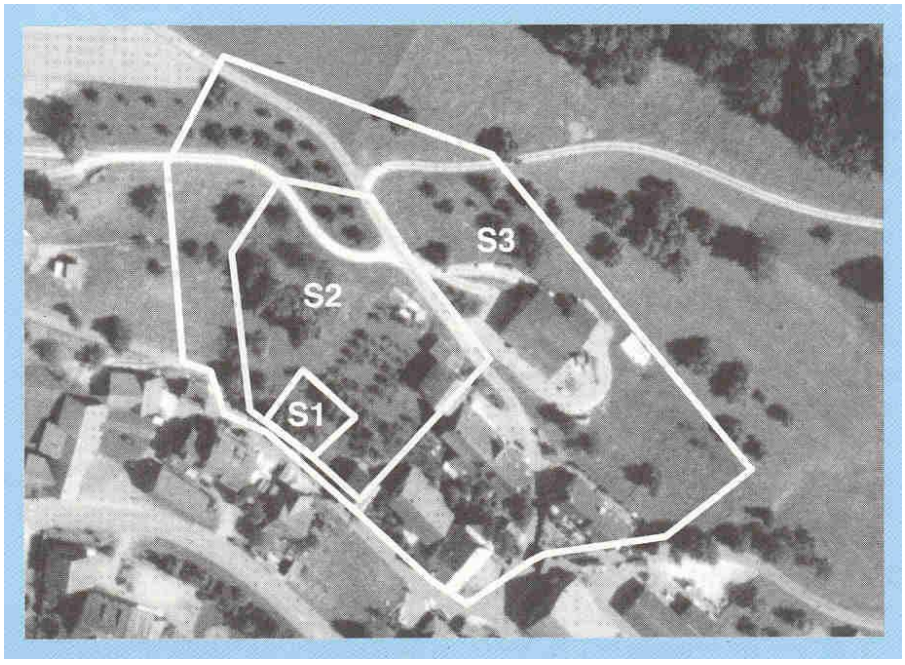


Figure 2.2 Zoning with increased control

(Lenzburg)

3. DESCRIPTION OF THE WATER SUPPLY

Figure 3.1 Feeder Canal of the Klaipeda water works

Analysis of the water supply led to an agreement between the department of the environment and the water utility for common alarm system in case of contamination in the canal feeding the infiltration field. (Klaipeda)

Figure 3.2 Encroachment of recreational housing in a water protection zone

Environmental changes in the such as expansion of permanent or tourism settlements may encroach on the water protection zone, forcing a relocation of the water point to maintain the integrity of the protection zone.
(Negiros)

Figure 3.3 Protection of water abstraction point

Protection of the water supply needs to be assured at all times – construction of temporary protection housing over a water abstraction point and intial treatment. (Negiros)

4. SYSTEM ANALYSIS

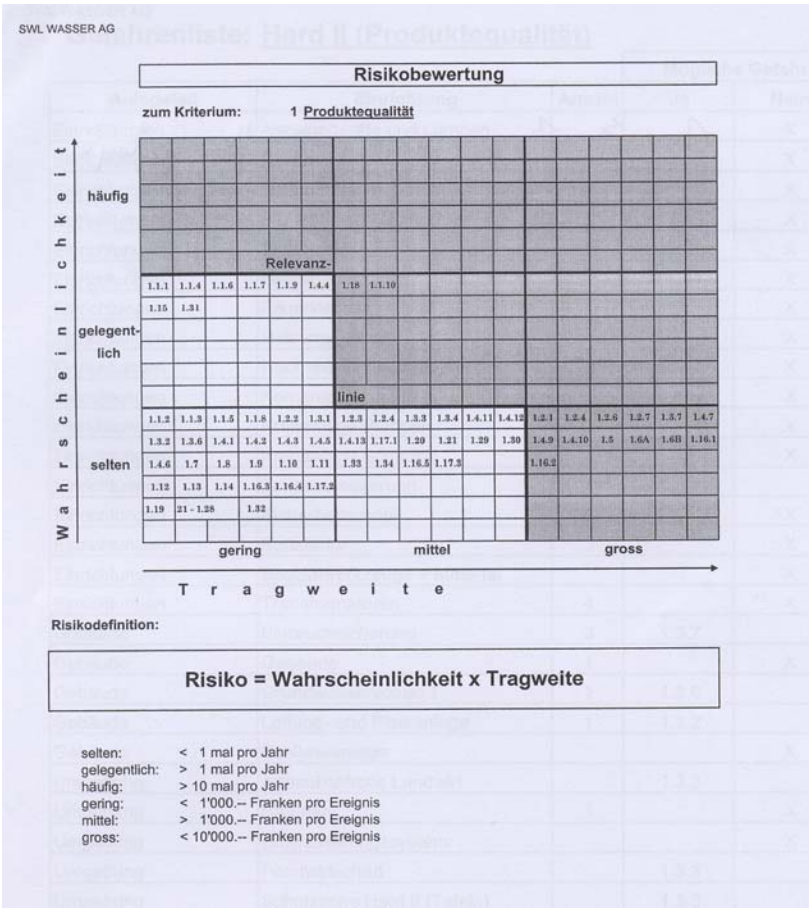


Figure 4.1 Hazard analysis and risk assessment

Formal risk assessment matrix used in major water supply systems. (Lenzburg)

5. CONTROL PROCESS

Figure 5.1 Delineation of water protection zone

Information to the public on the existence of water protection zone is an important first line of defence against contamination of the resource.
(Barcelona)

Figure 5.2 Delineation of groundwater protection zone

(Lenzburg)

Figure 5.3 Integration of feeder lines in existing water structures creates specific hazards, to be managed appropriately.
(Tulln)

Figure 5.4 Access Control

Water treatment plants hold dangers for unqualified people and attractions for some with criminal intent.
(Wessex)

Figure 5.5 Storage of hazardous chemicals

Toxic products need to be secured at all times
(Barcelona)

Figure 5.6 Storage of Chlorine cylinders

While the building provides protection, loose tubing creates unnecessary risks.
(Cyprus)

5.1 CONTROL MEASURES
5.1.1. Physical Control

Figure 5.7 Control measures of unit access

Multiple barriers to access to water.
(Negiros).

Barrier n.1

Barrier n.2

Barrier n.3

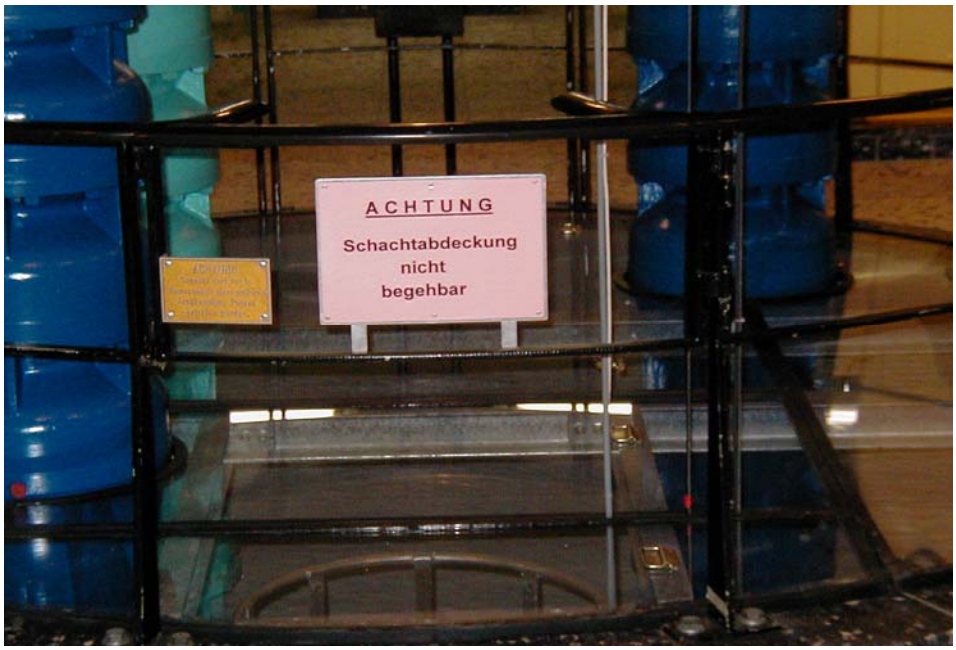


Figure 5.8 Control of access to individual units

Control measures on access reinforce personal safety: markers prohibit access to the well shaft of all unaccompanied persons, including staff. (Lenzburg)

Figure 5.9 Control of access to individual units

Figure 5.10 Control Measures - spring

WSP-type approaches start as early as possible: protection of a spring which became an integral element in the water supply system of the city. (Tulln)

Figure 5.11 Control Measures – safety and access control

Measures for personnel safety may be an integral part of a Water Safety Plan: mandatory change of footwear when accessing areas close to the resource water. (Tulln).

5.1.2. Administrative control

Figure 5.12 Control of memory lapses

Reminders throughout the plant recall the obligation to register each entry and exit in a record book – an obligation that applies to workers and senior managers alike. (Lenzburg)

Figure 5.13 Control of entry and exit
(Lenzbug)

Figure 5.14 "Blue Box" containing all operational manuals for all unit operations in one location

At each unit operation, complete manuals of equipment available on location and record books are kept in a clearly identifiable manner on a pre-determined location. (Anglian Water)

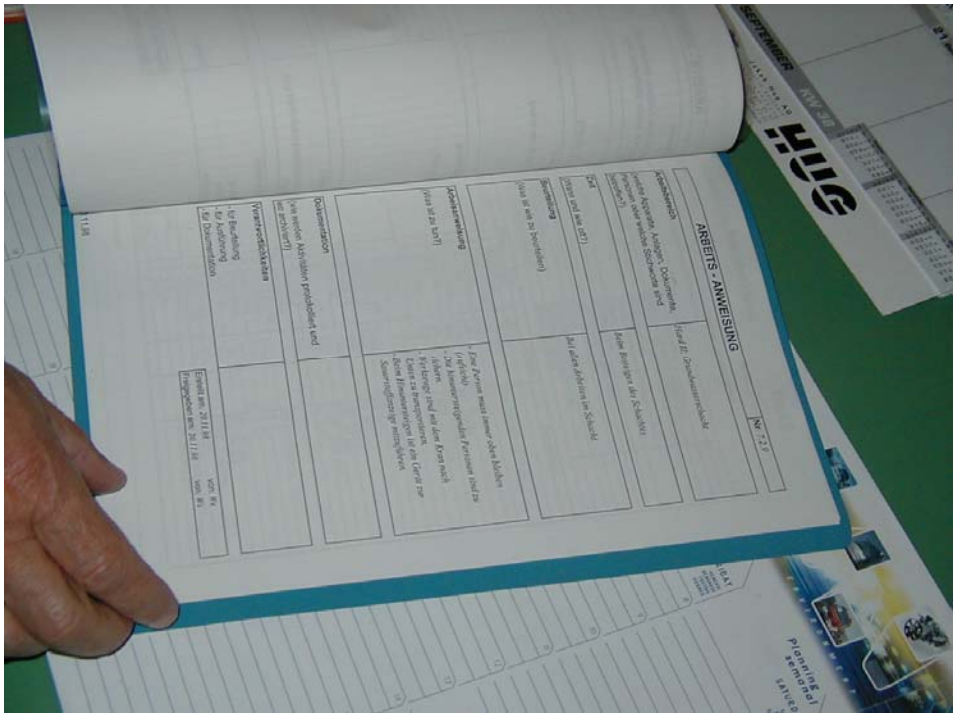


Figure 5.15
Operational monitoring

Chapters of operational manuals next to unit operations.
(Lenzburg)

5.2 OPERATIONAL MONITORING

Figure 5.16 Automated on-line monitoring

(Wessex)

Figure 5.17 Dual validation of automated monitoring

(Anglian Water)

Figure 5.18 Centralized sampling points allow easy access to all unit operations

(Anglian Water)

5.3 CORRECTIVE ACTIONS

Figure 5.19 Coverage of filters protects from algal growth at Wessex

Coverage of unit operations protects from air borne pollutants and/or ecological change.

Figure 5.20 Placement of filters in closed building protects from bird intrusions and stabilizes temperature (Klaipeda)

5.4 PREVENTIVE MEASURES

Figure 5.21 Control measure against power failure

(Wessex)

Figure 5.22 Equipment protection measures

(Lenzburg)

Figure 5.23 Controlled reservoir access

Control measures against unlawful intrusion can be of amazing simplicity: access door at the BOTTOM of the reservoir. Attempts to open will cause the reservoir to empty upon the intruder. (Lenzburg.)

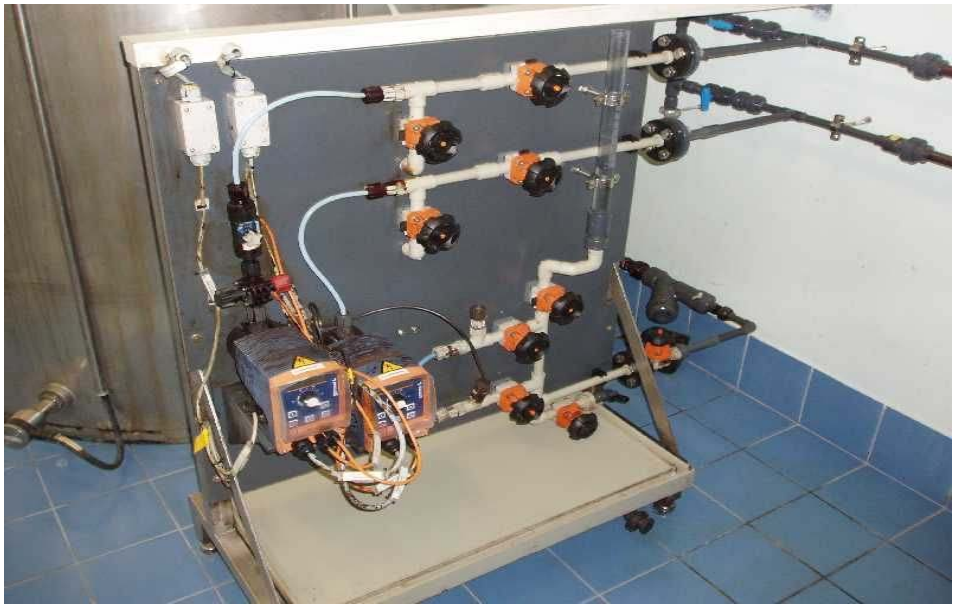


Figure 5.24 Polymer Dosage

Critical treatment units are installed with dual capacity, so that treatment can continue uninterruptedly in case of failure of one treatment line. (Klaipeda)

Figure 5.25 UV disinfection

(Lenzburg)

Figure 5.26 Air Filter

Air filters are installed to prevent airborne contaminant entering the air above the water as the main reservoir empties. (Lenzburg)

Figure 5.27 On-site Pipe storage

Contamination of pipes prior to or during placement is a major problem for water companies. Preventive measures include closing pipes as long as possible, and avoiding contact with soil until placement.
(Tulln)

Figure 5.28 History is a hazard

Legacy infrastructure which is not longer properly maintained such as this water tower initially intended for a now defunct state farm can become a hazard to the overall water supply network (Lithuania)

Figure 5.29 Phosphoric Acid Dosage

Injection of phosphoric acid to reduce lead concentration. (Wessex)

Figure 5.30 Treatment with activated carbon to reduce organic pollution

(Barcelona)

6. VERIFICATION

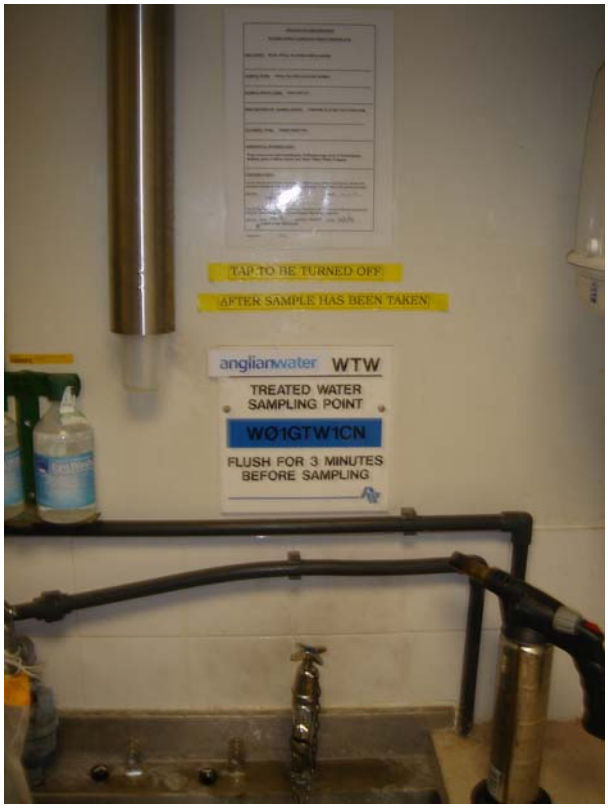


Figure 6.1 Sampling instructions readily available

Each sampling tap has clear identifier, clear operating instructions to ensure representative sampling, and all necessary equipment in immediate vicinity of the sampling point. (Anglian Water)

Figure 6.2 Verification laboratory Manual

Laboratories can be organized in a progressive manner: by matrix for relatively easily determined parameters, and by parameter when more advanced analytical techniques are required. (Cantonal laboratory Aargau)

Figure 6.3 Verification Laboratory Advanced instrumental

Analytical laboratory (Cantonal laboratory Aargau)

Figure 6.4 Daily monitoring of Cryptosporidium is a legal requirement in a "high risk" site

(Wessex)

7. SUPPORT

Figure 7.1 Mission statement

Mission statement of the regulator and proof of successful participation in intercalibration exercises, ISO certification etc. must be passed by staff on the way to work.
(Cantonal laboratory Aargau)

Figure 7.2 Compliance certificate with international standards

Proof of successful participation in intercalibration exercises, ISO certification etc. must be passed by staff on the way to work.
(Aargau cantonal laboratory)

Figure 7.3 Verification laboratories have a control function that may require immediate intervention.

Example of “stand-by bucket” at the (Cantonal laboratory Aargau)

8. DOCUMENTATION

Figure 8.1 Result documentation

By tracking monitoring results, an operator can detect that a process is approaching its operational limit (Wessex)

Figure 8.2 Documentation and Communication material

Establish documentation and communication procedures is the final step in developing a WSP Case of Wessex

9. SPECIFIC CASES OF SMALL SUPPLIES

Figure 9.1 Well in the Netherlands

Figure 9.2 Small well in Estonia

Figure 9.3 Small well in Estonia

Figure 9.4 Small well in Lithuania

Figure 9.5 Small well in Lithuania