



MAINSTREAMING WATER SAFETY PLANS IN ADB WATER SECTOR PROJECTS

LESSONS AND CHALLENGES

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I. Why Water Safety Plans are Important for ADB Water Projects

Asia and the Pacific Region is rapidly developing but the region is challenged to manage increasing demand for safe drinking water amidst its fast economic growth and urbanization. By 2010, the world succeeded in meeting the target of Millennium Development Goal 7.C to halve the number of people without access to improved drinking water sources. And additional 2.3 billion more people gained access to improved drinking water sources with the largest gains in eastern, southeastern and south Asian regions between 1990 and 2012.¹ However, there is still a significant challenge remains on securing the quality of water throughout its supply system, from water sources to the consumer tap and point of use.

Access to unsafe drinking water entails large economic loss associated to public health. Improving water supply and sanitation, as well as water resource management, could prevent one-tenth of the global disease burden.² It is well-documented that overall health benefits gained by providing safe water to communities can be many times more than its costs of

water safety measures.³ More importantly, waterborne diseases impact the poor the most by exacerbating malnutrition through chronic diarrhea, inhibiting children's mental development, reducing school attendance, and impeding on the ability and availability of time for economic productivity and basic social functions. The need to purchase medicines to treat the disease also places additional financial burden on household budgets.

Water Safety Plans (WSPs) change the way water supply systems are managed. Traditional drinking water guidelines are reactive, based on infrequent testing that detects contamination only after exposure and fails to completely protect water consumers from harm. In contrast, the WSP, which adopts a preventive approach, tests on frequent—often continuous—process monitoring. Failures are detected early and predefined corrective actions are completed in response to process failures to protect consumers before they are exposed to contamination. Through the preventive approach, the WSP also enables the water service operator to look into the efficiency of its whole water supply system, leading to better overall management for water conservation and quality improvement.

Summary of Key Points

- The World Health Organization (WHO) has been promoting Water Safety Plans (WSPs) since 2004. The WSPs are becoming the international good practice for assessing and managing public health risks from drinking water supplies.
- A key conclusion from the pilot demonstration activity in Chongqing Municipality, People's Republic of China (PRC) was that WSPs could be effectively integrated into the project preparation of Asian Development Bank (ADB) with careful scoping, planning, and evaluation.
- Lessons from the pilot demonstration activity include selecting appropriate WSP guidance, identifying target water quality, and introducing the WSP concept early in the project.
- Potential challenges for ADB-funded projects are mismatched WSP and project scopes, complex economic and financial evaluations of avoided public health risks, and long-term sustainability of the WSP.
- Various trainings and reference materials are available to address general challenges of WSP implementation. Challenges specific to ADB can only be addressed by accumulating more WSP experience and successful cases in ADB.

¹United Nations. 2014. The Millennium Development Goals Report. New York: United Nations. .

²A. Prüss-Ustün et al. 2008. *Safer water, better health: costs, benefits and sustainability of interventions to protect and promote health*. Geneva: World Health Organization.

³L. Haller and G. Hutton. 2004. *Evaluation of the costs and benefits of water and sanitation improvements at the global level*. Geneva: World Health Organization.

The idea is particularly relevant in the rapidly developing Asia and the Pacific Region. Water infrastructure needs to expand to meet widespread need for safe drinking water. Simultaneously, industrial development and population growth are reducing the availability of water resources and deteriorating the quality of existing water supplies. Investment in the Water Financing Program, which ADB launched in 2006, earmarked \$10 billion at the end of 2010 and will total over \$20–25 billion by the end of 2020 in the region. It is increasingly realized that investment on infrastructure does not readily mean safe drinking water is being delivered to households. It is vital to strengthen the capacity of local water system operators to ensure improved water supply services for the region's poor is safe and affordable. WSP is a powerful tool to enhance ADB's project outcome by systematically assessing and managing water safety risks as part of the infrastructure construction and its operation.

II. Overview of Water Safety Plan

What is a Water Safety Plan?

The first mentioned in its *Guidelines for Drinking-Water Quality, 2004*,⁴ the World Health Organization (WHO) referred to WSPs in many of its publications. The WHO recognizes it as a comprehensive framework to assure the quality of water through systematic assessment and management of health risks.⁵

The WHO also defines WSPs as management plans that are developed and implemented by water suppliers. These plans were introduced because the traditional curative approach was no longer reliable in addressing the public health aspects of managing the quality of drinking water. Action was taken only after results of adverse water quality tests, consumer notification of water quality problems, or even disease outbreaks.

Box 1: Water Safety Plans in various organizations

National and international organizations have produced WSP guidance documents that take a slightly different interpretation compared to WHO. Depending on the partner organizations, it may be necessary or appropriate to use those slightly different models. ADB is preparing a Guidance Note: "Mainstreaming Water Safety Plans in ADB Water Projects". The ADB Guidance Note describes how to implement WSPs as part of ADB projects. The ADB Guidance Note is compatible with any of the mainstream WSP models and does not provide a reinterpretation of the WSP itself.

This approach was considered technically and financially practical, as it has helped to reduce the risk of decline in drinking water quality. Its major limitation, however, is that water quality test results were only available to consumers after exposure has taken place.

Further, not all contaminants can be reliably monitored using the curative approach. For example, most chemical contaminants and many microbial contaminants are not readily monitored using affordable, practical methods of water testing. Few laboratories are able to test for any more than a small number of pathogens and toxicants. Most contaminants also do not have standards against which to compare results.

Waterborne disease outbreaks can be avoided with a more preventive approach through WSPs, which encourage a fundamental shift in the way we manage water safety. A WSP is primarily a tool used to address the safety and quality of water, while its measures for control and improvement address the quantity of water and water security, including water resource management to minimize system losses.

⁴ Currently the guideline is superseded, but largely unchanged, in the 2011 updated version.

⁵ J. Bartram et al. 2009. *Water safety plan manual: step-by-step risk management for drinking water suppliers*. Geneva: World Health Organization.

How is a WSP developed and implemented?

Most suppliers provide adequate drinking water quality in the absence of a formalized WSP. However developing a WSP has major benefits. A WSP's approach can (i) systematically identify potential hazards and frequency of exposure to those hazards; (ii) translate hazards into risks and prioritize them; (iii) operationally monitor barriers or control measures; and (iv) improve documentation. Moreover, a WSP provides for an organized and structured system to minimize the chance of failure based on oversight or lapse of management. And it provides contingency plans to respond to system failures or unforeseen events that may have an impact on water quality, such as severe droughts, heavy rainfall, or floods.

Adopting WSP is becoming a standard practice in supplying drinking water to better protect public health by reducing endemic waterborne disease and preventing outbreaks. Management plans need to be developed to control the microbial and chemical quality of drinking water. When these plans are implemented, they provide the basis for systematic protection and process control, ensuring that concentrations of pathogens and chemicals present a negligible risk to public health and that water is acceptable to consumers. The elements of a WSP build on the multiple-barrier principle to risk management, the principles of hazard analysis and critical control points, and other systematic management approaches.⁶ The WSP addresses all aspects of drinking water supply, including the control of abstraction, treatment, and distribution of water. A WSP is comprised of five main aspects:

- Establishment of a WSP team
- System assessment and design
- Operational and verification monitoring
- Management plans, documentation and communication
- Auditing and feedback

Establishment of a WSP team. A WSP team that is technically sound and represented by multiple stakeholders determines the quality and practicality of a WSP. The team will develop, implement, and improve the WSP. In many cases, regulators, individuals from the water utility, and local governments are selected to initiate the WSP activity. However, every effort should be made to access a wide range of stakeholders, including representatives from financiers, local communities, and private firms as consumers and competitors for water resources. In some cases, additional external expertise may be helpful. It is also important to engage senior management to gain their organizational buy-in to the WSP and secure sufficient financial resources for the WSP. A WSP team should not have fixed membership. It should be flexible enough to respond to emerging water safety risks and water supply requirements.

System assessment and design. A drinking water supply system assessment should cover water sources, the intake facility, and the entire distribution network up to household taps and water tanks of buildings. The assessment can be modified to suit large utilities with piped distribution systems; piped and non-piped community supplies, including hand pumps; and individual domestic supplies and rainwater. The complexity of a WSP varies with circumstances. Existing infrastructure, plants for new supplies, or upgrades of existing supplies can be assessed. Drinking water quality varies throughout the system, so the assessment should determine if the final quality of water delivered to consumers will always meet established guidelines and other health-based quality targets. Understanding source quality and changes throughout the system requires expert knowledge. The system assessment should be reviewed periodically.

The system assessment should consider the behavior of selected constituents or groups of constituents that may influence water quality. A WSP's risk assessment process

⁶Hazard analysis and critical control points (HACCP) is the same system that is generally and routinely used in the food sector.

can be a traditional quantitative approach or a semiquantitative approach. Adoption of these approaches is based on judgment of experts and stakeholders. After potential hazards—such as events and scenarios that may affect water quality—have been identified and documented, each hazard’s level of risk can be estimated and ranked through scoring, based on the likelihood and severity of the consequences (Box 2).

Validation is an element of system assessment. It ensures that the information supporting the plan is correct and incorporates scientific and technical inputs. Evidence to support a WSP, such as quantified risks, can come from varied sources, including scientific literature, regulation and legislation, historical data, water and/or environment monitoring entities, and suppliers.

Operational monitoring. As part of operational monitoring, planned observations or measurements are conducted to assess whether the control measures in a drinking water system are operating properly. It is necessary to set limits for control measures, monitor performance against those limits, and take corrective action in response to a detected deviation before the water reaching the consumer becomes unsafe. Operational monitoring can include requirements to rapidly and regularly assess whether the structure around a hand pump is intact and undamaged; the turbidity of water following filtration is below a certain value; or that the chlorine residual after disinfection or at the far point of the distribution system is above an agreed value.

Box 2: Risk Scoring

Risk scoring is integral part of the WSP. It can be a simplified quantitative approach based on expert judgment or a semiquantitative approach that is more specific, comprising estimation of likelihood/frequency and severity/consequence below. In Australia, the matrix is considered useful because it formed the basis of the Australian and New Zealand Risk Management Standard.

		Severity or consequence				
		Insignificant or no impact - Rating 1	Minor compliance impact - Rating 2	Moderate aesthetic impact - Rating 3	Major regulatory impact - Rating 4	Catastrophic public health impact - Rating 5
Likelihood or frequency	Almost certain / Once a day - Rating 5	5	10	15	20	25
	Likely / Once a week - Rating 4	4	8	12	16	20
	Moderate / Once a month - Rating 3	3	6	9	12	15
	Unlikely / Once a year - Rating 2	2	4	6	8	10
	Rare / Once every 5 year - Rating 1	1	2	3	4	5
Risk Score		<6	6–9	10–15	>15	
Risk Rating		Low	Medium	High	Very High	

Several case studies, however, indicated difficulty in forming agreement on risks and their frequency and severity. These may include different perceptions in: (i) short-term acute health consequences and long-term chronic health impacts, (ii) severity and/or frequency scores of some hazards, and (iii) weights for categories (e.g., catastrophic public health impact should be given 10 ratings rather than 5).

Source: D. Deere et al. 2001. Management Strategies. In: J. Bartram and L. Fewtrell, eds. Water quality: Guidelines, standards and health: Assessment of risk and risk management for water-related infectious disease. London: World Health Organization, IWA Publishing.

Operational monitoring is usually carried out through simple observations and tests to rapidly confirm that control measures are working. Control measures are actions implemented in the drinking water system that prevent, reduce, and eliminate contamination or reduce exposure to hazards. They include the risk management actions related to the catchment (the immediate area around a well), filters and disinfection infrastructure, and piped distribution systems. If collectively operating properly, these control measures would ensure that health-based targets are met.

The frequency of operational monitoring varies with the nature of the control measure, for example, checking structural integrity monthly to yearly, monitoring turbidity online or as frequently as possible, and monitoring disinfectant residual at multiple points daily or continuously online. If monitoring shows that a limit does not meet specifications then there is the potential for water to be, or to become, unsafe. The objective is timely monitoring of control measures, with a logical sampling frequency, to prevent the distribution of potentially unsafe water.

Verification monitoring. More complex or costly microbial or chemical tests are generally applied as part of verification activities rather than as part of operational monitoring. Verification increases confidence that the chain of supply is operating properly and confirms that water suppliers are achieving and maintaining safe water quality. Verification monitoring typically involves the weekly or monthly testing of final, treated water, as supplied to the consumer against legal and nonlegal standards.

Management plans, documentation, and communication. A management plan documents the system assessment, operational

monitoring, and verification plans and describes actions during normal operation and incidents where a loss of control of the system may occur. The management plan should also outline procedures and other supporting programs required to ensure optimal operation for the drinking water system.

The management of some aspects of the drinking water system often falls outside the responsibility of a single agency. It is, therefore, essential to define the roles, accountabilities, and responsibilities of the various agencies to coordinate their planning and management. Appropriate mechanisms and documentation should be established to ensure stakeholder involvement and commitment. These may include establishing working groups, committees, or task forces with appropriate representatives and developing partnership agreements such as a signed memorandum of understanding.

It is essential to document all aspects of drinking water quality management. Documents should describe activities that are undertaken and how procedures are performed. They should also include detailed information on the assessment of the drinking water system, control measures, operational monitoring and verification plans, and performance consistency.

Documentation and record-keeping systems should be kept as simple and focused as possible. The level of detail in the documentation of procedures should be sufficient to provide assurance of operational control when coupled with suitably qualified and competent operators. Mechanisms should be established to periodically review and, where necessary, revise documents to reflect changing circumstances. Documents should be assembled so they can be easily modified when needed. A document control system should be

developed to ensure that current versions are in use and obsolete documents are discarded.

Appropriate documentation and reporting of incidents or emergencies should be established. The organization should learn as much as possible from an incident to improve preparedness and planning for future events. A WSP should continuously improve and evolve based on new experience and information. Review of an incident may indicate necessary amendments to existing protocols.

Communication is one of the advantages of a WSP. In general, public investment plans, system assessment results, risk rating and prioritization, and operation and verification monitoring results are not necessarily effectively communicated to stakeholders. A WSP offers a platform for information sharing. Where possible, effective communication channels among the WSP team and local communities should be established in the form of focus group discussion, public hearing, and paper and visual materials (e.g., brochures). It will raise community awareness and knowledge on the issues of drinking water quality and the various areas of responsibility. This helps consumers understand and contribute to decisions about the service provided by a drinking water supplier or land use constraints imposed in catchment areas. It can develop community buy-in and encourage the willingness of consumers to finance needed improvements. A thorough understanding of the diversity of views held by individuals or groups in the community is necessary to satisfy community expectations.

Auditing and feedback. A WSP is not a single planning activity but rather an evolving system of water safety management. It guarantees periodic auditing to check whether a scope of system assessment is still valid, risks are identified, and their rating and actions are appropriate. Local champions are necessary to supervise audit, identify feedback and constantly improve the WSP.

III. Experience from the Chongqing Urban–Rural Infrastructure Development Demonstration II Project in the People’s Republic of China

Water Safety Plan for a water supply system in Wanzhou District, Chongqing

In 2012, ADB conducted a pilot and demonstration activity to implement its Water Safety Plan Guidance Note in an ADB urban sector project.⁷ The subject of the case study was the urban water supply infrastructure of the Wanzhou district under ADB’s Chongqing Urban–Rural Infrastructure Development Demonstration II Project (Box 3).

WSP Team. A WSP team was formed to create the plan and consisted of 14 persons, including representatives from the water utility, the ADB-appointed project preparatory consultant team, two independent WSP facilitators, ADB, the World Health Organization, and the Wanzhou district government. The team’s role was to develop the initial WSP, which will be the basis of the WSPs in subsequent stages. All WSP team members took part in activities including a system design review, existing system inspections, site visits, and risk identification and assessment workshops. Following the design stage of the project, the WSP team was further refined to include Chongqing municipal government, key Wanzhou district government bureaus (e.g., water resources, public health, and housing and urban–rural development), project management consultants, and contractors. Ultimately, a WSP team consisting of local water utility staff and Wanzhou district government’s responsible bureaus would take long-term ownership of the WSP as it becomes an operational management document. In Wanzhou, local reservoirs and small tributaries are managed by the district water resources bureau, while Yangtze River is primarily managed at the

⁷J. Bartram et al. 2009.

municipal or the national level. Building owners and local communities are responsible for in-house plumbing and water storage tanks. Wanzhou district government’s ownership and Chongqing municipal government’s support are essential for the WSP to evolve and become more effective because they bring in key stakeholders and local communities related to the water supply service.

Box 3: Chongqing Urban–Rural Infrastructure Development Demonstration II Project

The Wanzhou Yangliu water supply subproject is part of ADB’s Chongqing Urban–Rural Infrastructure Development Demonstration II Project. The water supply system in Wanzhou district currently serves about 750,000 people via 11 municipal public water plants. However, some of the plants are outdated and can only provide poor levels of service.

The ADB loan will support the construction of a new water treatment plant with capacity of 200,000 m³ per day and associated infrastructures including water intake and sludge treatment facilities. Total subproject cost is approximately \$59.4 million, of which ADB financing covers \$21.5 million (36.1%). ADB’s support also covers capacity building for smooth water sector reform. These reforms plan to move from 11 small plants with 3 system operators to 3–4 centralized plants with 1 operator in Wanzhou district. (i.e., Wanzhou Water Supply Co. Ltd).

Following completion of the ADB project and associated works, improved water supply system will cover double the population to 1.5 million persons by 2020. During preparation of the project, Chongqing municipal government and ADB agreed to pilot a water safety plan to systematically improve the quality of tap water, while enhancing resilience of the whole water supply system against adverse impacts.

Source: Asian Development Bank

System description. The WSP facilitators prepared a detailed description of the water supply system based on the information provided by the project preparatory consultant team, engineers from a local engineering design institute, and local water utility. The system description summarizes the process flow diagram and a summary table that provided important details on water quality. In addition, local historical drinking water quality was gathered from the existing water supply system and used to improve the risk assessment.

Risk assessment. The WSP team completed a detailed drinking water quality risk assessment. They combined their knowledge with the information from the flow diagram, system description, system inspection, water quality data analysis, and other background documents. A facilitated workshop helped assess the likelihood and consequence of all significant drinking water quality risks. The assessment identified and rated risks by scoring them from 1 (rare and insignificant) to 25 (almost certain and catastrophic public health impact). Once grouped and logically structured, approximately 30 risks were identified and tabulated along with their required management controls:

Very High Risk (risk score ≥ 15)

- Fecal waste matter entering into the water source leading microbial contamination (risk score 25)
- Backflow of contamination into the network from hazardous facility (risk score 20)
- Contamination of consumers’ roof water tanks by animals or sabotage (risk score 20)
- Groundwater ingress into consumers’ underground water tank (risk score 20)
- Excessive turbidity after rain events overwhelms filtration capacity of the water treatment plant (WTP) and leading pathogen contamination (risk score 16)
- Mechanical failure of the filtration system of WTP leading to high turbidity (risks score 15)

High Risk (risk score ≥ 10)

- Use of inappropriate materials in consumer plumbing leading heavy metal and other contaminations (risk score 12)
- Inadequate chlorine dosing due to system failure leading pathogen contamination (risk score 10)
- Contamination of water storage and service reservoir by animals defecating (risk score 10)
- Malicious contamination in water storage and service reservoir (risk score 10)
- Groundwater ingress into service reservoir and underground water storage (risk score 10)
- Pumping station/booster pumping station mechanical failure leading loss of pressure and back-siphonage contamination (risk score 10)

Medium Risk (risk score ≥ 6)

- Use of contaminated coagulant leading chemical and other contaminations (risk score 8)
- Distribution network pipes burst (risk score 8)
- Unplanned wastewater discharge from factories beyond permitted levels at the water source (risk score 6)
- Mechanical failure of chemical dosing system leading high turbidity (risk score 8)
- Chlorine overdosing leading to chlorinous taste, odor and by-product contaminations (risk score 6)

Low Risk (risk score ≤ 5)

- Unplanned chemical spill event at the water source leading to chemical contamination (risk score 5)
- Planned routine chemical discharge at the water source (risk score 5)
- Algae blooms in the sedimentation basins (risk score 4)
- Water transfer channel clog due to sedimentation (risk score 1)

Control measures. Following the workshop phase, six important routine management

controls were identified in full detail with the local water utility and the project preparatory consultant team:

1. Provision of alternative water sources in addition to Yangtze River
2. Routine solids removal from pre-sedimentation, coagulation, sedimentation and filtration facilities
3. Routine monitoring and patrol of service reservoirs, water storage tanks and pipeline bursts
4. Appropriate dosage of chlorine to meet the PRC national standard (GB5749–2006)
5. Monitoring residual chlorine at the tap and ensuring sufficient level
6. Establishment of communication among government agencies and stakeholders

The operational target criteria were defined, along with the monitoring required, to detect deviations early enough so that corrective actions could be taken to protect consumers from unsafe final water quality.

Improvement measures. The general design criteria were reviewed to guarantee that the designs were theoretically capable of adequately mitigating identified risks to drinking water quality. There were 25 improvement measures identified, including those pertaining to the catchment, intake, pretreatment, transfer channel, filtration, disinfection, storage, distribution, and consumer connections.

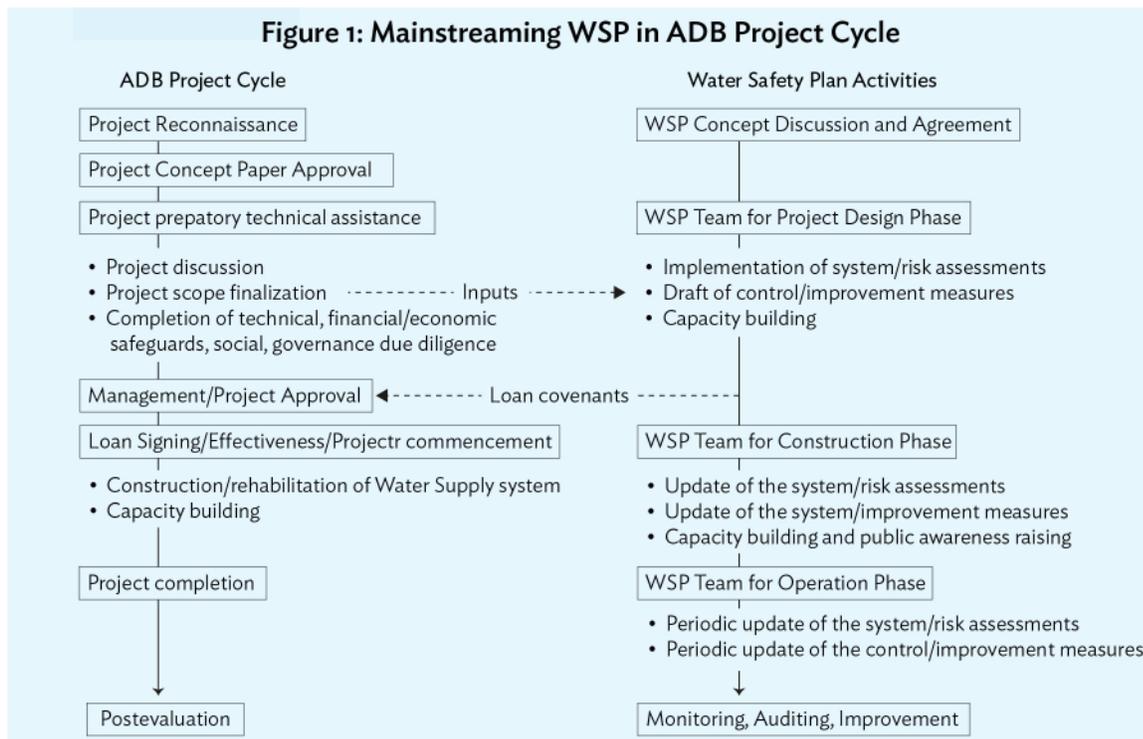
The pilot demonstration activity verified and improved the designs for the water supply plant and related infrastructure to be funded by ADB. An operational monitoring plan was developed to form the heart of the WSP. The water utility company, as an operator once the infrastructure is under their management, would implement and submit reports based on this plan. The pilot activity also led to capacity building activities related to the WSP to ensure continuous improvement and evolution of the plan and management of water safety.

Timelines of WSP activity and ADB-funded project preparation

Proper timing of activities during project preparation allows the WSP to be incorporated into ADB project design. The WSP concept can be explained and agreed on as early as the first contact with the borrower and local governments in project reconnaissance. A WSP team can be formed when the project preparatory consultant team is engaged. The assessment of hazards and risks to water safety under the WSP can take place alongside the feasibility assessment for the project. Ideally, water safety risks are considered along with other safeguards and economic aspects when alternative engineering options are compared (e.g., site location). The WSP document itself can be prepared in parallel or embedded to the development of final designs, safeguards, and social plans. Once the project is approved, the composition of the WSP team, the initial system and risk assessments, and the initial control and improvement measures may be updated. This process is illustrated in Figure 1. In the case of

the Wanzhou Yangliu water supply subproject, separate WSP experts were only engaged and mobilized in the middle of project preparatory activities. This required the experts and the local governments to review the proposed designs together in light of the risk identified during risk assessment in a relatively short time between inception and interim stages of the project preparation.

In general, the WSP activities will be integrated into project processing timelines without causing delays. However, since a WSP is a risk assessment and management plan, there may be a need to address any major risks identified during the WSP process. This may cause revisions to engineering designs, project locations, and increased costs, new physical engineering controls, or further documentation and management controls. There may be a need for additional data and information collection and due diligence (e.g., economic and financial analysis) and consultations with key stakeholders and local communities.



Resource requirement for WSP in project preparation

Although a WSP does not necessarily increase project costs, some important needs as part of the WSP process entail costs. The WSP is bound to add WSP preparation and project processing costs along with the additional personnel costs (e.g., WSP experts or facilitators, utility staff, government officials, project preparatory consultants). Although these operating costs are minor compared to overall financial inputs for project preparation, they need to be carefully planned into the project processing costs. Capital and operating costs associated with addressing major health and safety concerns, design modification, feasibility studies, location change, changed physical engineering controls, and additional documentation and management controls are some of the potentially larger WSP related costs. Additional data collection may also be required, particularly water quality monitoring data, which may need additional equipment and laboratory facilities and technical capacity building and training. Additional consultation with other stakeholders may incur additional costs to refine the control and improvement measures more feasible and practical. Ongoing costs for technical support may arise to ensure proper WSP implementation during the operational phase. In addition, due diligence associated with design change (i.e., economic, financial, community, analysis) may entail additional costs. In the

Wanzhou case, separate individual WSP experts were engaged for project preparatory consulting service to provide capacity building training and guidance through the executing and implementation agencies for the WSP steps.

IV. Lessons and Challenges Identified through the Water Safety Plan Pilot Application

The WSP and its concept offer key value addition to ADB water sector projects. The following challenges and lessons learned during the pilot demonstration activity should be considered when mainstreaming WSPs into ADB water sector projects.

Lessons

Selecting a WSP guidance document. It is important to select the appropriate document to guide the WSP. There is a wide range of guidance documents available, including several different versions from WHO and those from many jurisdictions, counterparts, and agencies (e.g., Australian AID, United States Agency for International Development (USAID), Drinking Water Inspectorate of England and Wales). A project manager should clarify precisely what is meant by a “WSP” for the project to find the right guidance



document. The latest WHO WSP guidance documents provide a basis, but lessons from Australian AID and USAID programs in developing countries also provide useful insights.⁸

Identifying water quality requirements.

Setting a clear target or objective for the project is another crucial requirement. It is essential to clarify which water quality standards and guidelines will apply since risks to water quality need to be assessed with that scope in mind. In some cases, blindly adopting the national water quality, effluent discharge, and river and lake water quality standards may not be appropriate because they may be politically influenced (e.g., pressure from key industry groups) rather than primarily considering human health and ecological reasons. The basis of WSP risk assessment needs to look at the water quality requirement in the target areas from a holistic viewpoint, sometimes beyond the national and regional water quality standards. Further, it is important to clarify the scope of the WSP. The WSP in ADB's developing member countries should cover at least bacterial aspects. The project owner and ADB should discuss other aspects that will depend on the local context, such as viruses, parasites, chemical, physical, radiological, and aesthetic aspects. Potential health impacts and general consumer acceptability may have to be considered on case-by-case basis.

Early introduction and mobilization. Another finding suggests introducing the WSP early and mobilizing WSP experts early, if necessary. This requires the ADB processing team communicating and agreeing the importance of WSP with its counterpart at the initial contact. Ideally, the WSP approach is covered within the project concept and incorporated into the project preparatory technical assistance. Using the same team of experts to work on project design and WSP activities will minimize any potential coordination risks.

Challenges

Some challenges and issues were identified during the pilot demonstration activity and after its completion.

New water supply system. WSP guidance is written around existing water supply systems, their actual water safety risks, and likelihood of occurrence. However, most ADB projects are looking at new or substantially modified water supply systems. This can make it difficult to apply WSP guidance since many speculation is required around infrastructure, operational systems and situation, risks, and process performance. During the Wanzhou case, the proposed water intake point had not been historically used for water supply so the associated risks were poorly understood. This required revisions and updates during the later stage of improving the WSP.

Sustainability. In principle, a WSP should be an evolving, living management system that counterparts and stakeholders own, maintain, follow, and improve. In projects, however, ADB can only take steps to ensure the WSP is adopted during its estimated 5 years of direct influence and, possibly, at project completion and a few years later at evaluation. Ownership beyond the financing period is in the hands of the counterpart(s), indicating that ADB's role is associated with the early startup phase, which makes it challenging to develop a self-evolving WSP. ADB should seek to identify a strong ongoing champion (usually a local government or regulator) that is committed to the long-term adoption of the WSP. Otherwise, the WSP may become merely a design-stage risk assessment. In the Wanzhou case, the challenge remains whether the local counterpart, with assistance of the project implementation consulting service, will be able to determine who would own the WSP after 5 years, once the ADB financed component of the project is finished.

⁸ As of October 2014, ADB is planning to draft its own WSP guideline in collaboration with WHO.

Uncomfortable truths. The WSP includes an overt summary of risks to public health. Some risks remain high or unmitigated, particularly those that are linked to rare events or require unaffordable treatment solutions. Other risks are unknown. Uncomfortable truths may emerge throughout WSP implementation as high or unknown risks are documented during activities. During the Wanzhou case, for instance, it was noted that the risk associated with chemical spills from factories in the upstream water catchment was being poorly managed, but this was not easy to open discussion for district or municipal level governments if the factories belong to national level state-owned enterprises. Until those factories are fully committed to the WSP, that risk will have to be mitigated by robust monitoring and the use of an early warning system by the water service operator.

Duplication. The implementation of a WSP will not always identify a need for changes and improvements. It may, therefore, appear as a duplication of existing technical due diligence of project design work. It is important to minimize duplication, as well as manage the perception of possible duplication, between project preparation work and WSP activities. Existing or subordinate documents, e.g., emergency response plan, should simply be cross-referenced and not recreated to meet two objectives. Ideally, whether mainstreaming a WSP under the project or not is discussed at the very first project identification stage based on the detailed review on ongoing efforts.

Gaps in system coverage. ADB projects often have tightly defined boundaries (e.g., major infrastructure) and do not cover the full water supply process from catchment to consumer. In contrast, a WSP is intended for the entire system process. This can create challenges in linking it with the distribution system, (particularly if not continually pressurized), household connection, plumbing and storage systems within properties, water carting and receptacle, storage, and treatment at point of use. During the Wanzhou case it was noted

that the risks associated with the distribution system financed by local government and point of use in the household premises were not under the direct control of ADB.

Cultural considerations. A WSP often takes an objective, highly rational standpoint on water safety. However, in practice, it is important to consider local culture and trust. Factors such as willingness to pay for safe, or safer, water as well as cultural and habitual norms should be considered. The Wanzhou case identified that the community has traditional knowledge and customs for adapting to the risk of drinking water quality by boiling tap water or using bottled water for cooking and drinking. This would result in weak incentive to appreciate and pay more for safer water once they are provided access to reasonable level of water quality.

Evaluation and feedback mechanism. Evaluating the WSPs implementation brings up many of the challenges previously mentioned. For instance, a decision needs to be made on which guidance document to evaluate the WSP against. Another challenge relates to the quality of the WSP. It is easy to write a WSP but, experienced professional judgment is still required to assess its technical validity and adequacy. There are various audit and assessment tools, approaches, and systems but all are still somewhat subjective and qualitative. In the longer term, some measures need to be adopted to assess how effective a WSP was under the ADB financed project.

It is difficult to define the point of comparison for such an assessment. How many of the activities identified within the WSP would have happened regardless of the WSP? And how much economical loss would have been avoided through implementation of the WSP? The benefits of having the WSP may not be realized until incidents have occurred. Apart from implementing a WSP, mainstreaming a WSP in ADB water sector projects requires a specific auditing and feedback approach to evaluate the effectiveness of the project.

Conclusion

Water resource and supply management in Asia and the Pacific Region is transitioning its focus from access to water resource, by increasing water service coverage, to access to safe drinking water. This increasingly requires a strong policy framework, an appropriate allocation of financial and human resources, and an institutional setting with clear roles and responsibilities for all stakeholders at national, provincial, and city levels.

The WSP pilot demonstration activity in Wanzhou allows ADB to demonstrate better technical due diligence by applying current international good practice to public health-related aspects of water supply planning. Although the financial benefit was not quantitatively assessed, the additional cost of developing an initial WSP was small. Theoretically, valuable benefits of WSP implementation include improved productive time, reduced health care costs, and increased credibility with commercial and industrial users of water. Both the Chongqing municipal government and Wanzhou district government realized these.

Meanwhile, the pilot demonstration activity also identified some lessons, and more importantly, issues and challenges. Some issues are more specific to ADB projects (e.g., sustainability, system coverage gaps), while others are challenges associated with the WSP itself (e.g., evaluation). The lessons drawn from the demonstration activity are general and cannot fully deal with those challenges. Several nongovernmental organizations and the WHO offer various WSP capacity building programs that could prove valuable insight for WSP specific challenges. However, more experience should be accumulated to address issues related to some contexts of ADB's assistance.

The Wanzhou case confirmed that the WSP will be one of the useful tools for ADB to scale up its role in water supply in the region, aligning with the ADB's Water Operation Plan 2011–2020.⁹

The increasing number of ADB financed water sector projects should play a strong supportive role, working with counterpart agencies, in the development and the implementation of the WSP.

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⁹ Asian Development Bank. 2012. ADB's Water Operational Plan 2011–2020. Manila

Mainstreaming Water Safety Plans in ADB Water Sector Projects *Lessons and Challenges*

The Water Safety Plan (WSP) is about protecting water quality from catchment to the tap. Promoted by the World Health Organization, WSP has changed the way water supply systems are managed. This report documents the pilot application of the guidance note for mainstreaming WSP in water projects supported by the Asian Development Bank as piloted in the Chongqing Municipality in the Peoples' Republic of China. The guidance note seeks to promote systematic assessment and management of water safety risks from infrastructure construction to operation. The pilot concluded that WSP could be effectively integrated into the Asian Development Bank's project preparation with careful scoping, planning, and evaluation. The report also summarizes challenges and lessons learned from the pilot.

About the Asian Development Bank

ADB's vision is an Asia and Pacific region free of poverty. Its mission is to help its developing member countries reduce poverty and improve the quality of life of their people. Despite the region's many successes, it remains home to approximately two-thirds of the world's poor: 1.6 billion people who live on less than \$2 a day, with 733 million struggling on less than \$1.25 a day. ADB is committed to reducing poverty through inclusive economic growth, environmentally sustainable growth, and regional integration.

Based in Manila, ADB is owned by 67 members, including 48 from the region. Its main instruments for helping its developing member countries are policy dialogue, loans, equity investments, guarantees, grants, and technical assistance.

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