
Introducing Water Safety Plans

*For small-scale water supply systems- boreholes,
dug-wells, springs*

Introduction

In many rural areas citizens depend for their drinking water on unprotected water sources and hence depend on unsafe drinking water. The World Health Organisation (WHO) initiated the Water Safety Plans (WSP), which is to be considered as a part of the WHO or other guidelines or directives on drinking water quality. The WSP asks for an identification of risks, which could affect water safety and human health in every stage of the water supply. It is also necessary, however, to identify measures, which minimise and manage the risks have to be identified.

A WSP should be discussed, developed and implemented with involvement of all stakeholders. The WSP focuses on the safety of all the different aspects of a water supply, which can vary from a large-scale supply providing water to several million consumers to a small-scale system, e.g. a bucket-well. The WSP is a concept to develop a process-orientated observation of the water supply and its goal is to identify and eliminate all the possible risks in the entire water supply system: from the potential risks of water pollution in the catchment area all the way along the line to the consumers. Therefore an understanding of the mechanisms of the system is needed. As well as the possible risks pertaining to the individual processes involved in the water supply and standard of water quality, the reasons for the potential and real risks have to be identified. Moreover, all stakeholders of the system and the „is and the should-be“ situation has to be defined. In addition, the means and tools on how to monitor the different stations, how to report and share the information and activities for improvement of the supply have to be defined.

The main goals of this WSP programme are:

- Minimising the health risks caused by unsafe drinking water in every stage of the water supply system
- Monitoring the drinking water quality and sources of pollution in the communities
- Raising awareness and motivating citizens to take local action for improving their environment, their access to information and to safe drinking water

1. Why involvement of schools?

Experiences show that children and young people are open to accepting new knowledge and participating in new activities. Children will involve their parents and transfer their knowledge. But for the development of the WSP, the support of the parents, teachers and authorities is also a condition. Cooperation with all stakeholders, sharing information will be learned and will give the children a wider view on their environment and community. A major advantage of the WSP is that children and the other stakeholders are discovering and gathering together information about the environmental situation in their community. This ‘learning by doing’ has proven a very effective way to internalise knowledge.

Depending on the age of the children, the available time, the level of involvement of teachers and other stakeholders, the final outcome of the WSP will be more or less detailed, whilst fulfilling certain criteria. Parts of the proposed programme can be selected and even changed and adopted to the local circumstances and implemented by the pupils.

This action plan proposes a programme for children's involvement in the monitoring of the quality of drinking water and the environment in their village. This programme will have several outcomes, such as:

- Understanding of the water supply system, the risks and danger of pollution
- Awareness raising about possible water borne diseases
- Regular monitoring of drinking water quality
- Registration of the seasonal fluctuations of nitrate concentrations in the water
- Assessment and mapping the risks of drinking water pollution
- Environmental awareness raising among children and citizens through active participation
- Cooperation and capacity building of all stakeholders
- Strengthening the demand for active water protection measures on local, regional and national level

The results of the programme can be used for lobbying for the right to information and access to safe drinking water. The programme will contribute to a better gender balance; besides men, women will be involved in planning and decision making processes



*Children learning to appreciate water as a valuable resource
(Photo by Margarita Torres)*

2. Development of Water Safety Plans

Identification of the weaknesses, strengths of the water supply, the possible sources and risk of drinking water contamination is the base for a WSP, meaning also a better groundwater and well protection and improvement of water quality.

The steps to be undertaken for the development of a WSP can be:

- Setting up a team, discussing and deciding about the methodology to develop a WSP
- Description of the water supply system: Making a detailed description of the whole system from the water catchment area to the extraction, the water treatment and transport until water storage at home and consumption by the consumer
- Identifying stakeholders; drawing and mapping are good tools to support this activity
- Discussion and taking decisions on e.g. what and when will be done, who will do it, and how hazards will be monitored and reported
- Hazard assessment: Identification of the main hazards that can affect the safety of the water quality: e.g. water pollution by pit latrines, cracked wells or by dirty hands or buckets
- Carrying out water analyses and interviews
- Identification of local and regional water born diseases
- Reporting and sharing information on the findings: organising exhibitions, meetings/discussions with citizens, authorities and mass media
- Developing actions for improvement and maintenance of the system
- Developing plans for operation, monitoring and maintenance, improvements and follow-ups of the WSP
- Reporting and sharing information on the developed WSP on local, regional and national level
- Reviewing the WSP, the hazards, risks and control mechanisms regularly

2.1. Organising the programme

For covering the different aspects of the water supply system a team of persons with different background and expertise will benefit the development of WSP. A basis of knowledge about the water system from the point where the water is extracted until it is used in the households should be gained by discussions, interviews, observations, and eventually via input from experts. Some existing data about the water supply and quality can be gathered from local and regional authorities. Water analyses can be done partly in the frame of the WSP programme.



Box 1. Framework for Safe Drinking Water.

Source WHO 2004, http://www.who.int/water_sanitation_health/dwq/wsp170805.pdf

Nitrate concentration in water can serve as an indicator of anthropogenic water pollution by mismanagement of wastewater, animal manure or fertiliser. Children can carry out the nitrate analyses of water sources in the village and monitor the seasonal fluctuation of nitrate concentration in water. It gives an impression of the filter capacity of the soil layer and the possible relation to human activities. Further assessment of the occurrence of water born diseases, of the environment and the risks of water pollution will give insight into the level of water safety and the measures to be taken for improving water quality and minimising water related diseases.

2.2. System and stakeholder analyses

The procedure for carrying out the programme should be discussed in the community, in the school with children and teachers and it is desirable that parents and local authorities are informed about and involved in the project.

Responsibilities and management

Investigation of the current situation concerning the responsibilities and management of the water supply system is useful for identification of who is doing what. The involved NGO plays a crucial role in this process by facilitating the gathering of information from the different stakeholders. Questions like, who have officially the task of monitoring, cleaning and maintaining the water system should be posed. Is there any system or institution analysing the water quality and, if yes, with whom are the results shared? Is there any budget available for operation and maintenance; is there any contribution from the local citizens for water consumption? Who takes the decision about the budget etc.? Particular attention has to be paid to the role of women, as they are often responsible for the household budget as well as for health and sanitation issues. Local and national joint action can be developed by creating an atmosphere of understanding and cooperation, by knowing the different tasks and responsibilities, and bringing the consumers, water suppliers and all other stakeholders closer together. Structures of the responsibilities of the whole system can be summarised in an overview of responsibilities or in e.g. a 'network diagram'. Other graphics of listing, ranking and connecting institutions, groups or individuals and communication systems and information sources that influence the community's decision making on water supply can be used.

Mapping of the village and the water supply

With the help of a map of the village an overview of a specified issue can be given. It helps to make the situation more visible and understandable. As far as possible, schools and citizens can make an inventory of the local water supply. What kind of supply is there? Are there dug wells, boreholes or public taps? Which water source is used and how deep is the tapped water layer? Where are the water points? Which distance do they have to the houses of the consumers? Which households have access to the water point or supply? Where are sources of contamination? What is the distance of the pollution (e.g. manure or latrine) from the water point? Many of this information can be transferred to a map. Using an existing map for identification and mapping is very useful. If no map is available an overview of the village and the water points or supply should be drawn up.

Experiences/problems/perception analyses of supply owner and consumer

The users of the water system often focus on problems or have different perceptions about e.g. water quality or about access to water compared to the water supplier. By using questionnaires or by participatory approaches like ranking, an insight about the problems and experiences of the supplier and user could be obtained. The interviewer should keep in mind that closed questions could easily get unreliable answers. For example the question: 'Do you get ill from the water' might give another answer than 'How do you perceive the drinking water quality? And why? And what are the consequences of drinking this water? What is the daily /monthly water consumption and for which purposes is the water used?' Information can also be gathered by interviews from citizens, doctors or other key-informants. Note that if you gather information from people, they often want to know the results and the subsequent concrete actions. You can therefore organise a village meeting and inform the people about the findings.



Without involving the people Water Safety Plans will not work. Participation and access to information is a key to the success of Water Safety Plans

2.3. Inventory of the water quality

Water can basically be contaminated either chemically (e.g. by heavy metals or pesticides), or biologically by micro organisms/pathogens (bacteria or viruses which cause diseases). Unfortunately, it is not easy to measure this kind of pollution. A certified and preferably independent laboratory could be contacted to carry out analyses of bacteria. Also pesticides could be a significant source of water pollution and should be measured in a laboratory. There are many kinds of pesticides and it should be known in advance which pesticides could be found in the drinking water because each pesticide requires a different analysis. However these analyses are quite costly. For some analyses such as acidity or nitrate in water easy to do quick tests are available.

Observations and secondary data

Nevertheless, it is quite possible to gather some indication about the quality of drinking water without laboratory analyses.

- First of all doctors, teachers and other key-informants in the village can be asked about the occurrence of water-related diseases and a survey can be done among villagers about their perceptions of drinking

water quality. The authorities should be asked for the data of water analyses and how the public water supply systems are maintained.

- Secondly, the facilitating NGO can search for secondary data such as which research on water quality has been done in the past. Experts can be contacted and interviewed. Probably there is some information available about the geo-hydrological situation (groundwater depth, soil, and direction of the flow). This could be very useful for the planning phase.
- Thirdly, observations can be made concerning the colour, taste, smell, turbidity, sediments etc. Observations can also include potential pollution risks. It always has to be kept in mind that these methods give only an indication. Even if all the results are within the norm, the water can still be highly polluted.

Quick tests

Quick tests can be a good and accurate way of obtaining a better indication of the water quality. They are cheap and easy to carry out. However they are not available for all the different kinds of pollution. Until now WECF has had good experiences with nitrate strips. Nitrate can be dangerous for new-born babies, but for older children and adults nitrate is not the most dangerous substance in drinking water.

According to the EU directive for drinking water the limit for nitrate in drinking water is 50 mg/l. The EU considers ground water with nitrate values more than 25 mg/l as influenced by human activities. It therefore indicates if there is some contamination by human sources. Water protection measures should be initiated. Water samples are quick to analyse on nitrate pollution by using nitrate test stripes. It is preferable to test the water samples in the same season, e.g. during spring or summer time. Pupils can take the sample to school or the tests can be carried out directly on the spot. The depth of the water source should be noted.

Other observations on water quality, like colour, turbidity or others should be reported. Physical parameters such as soluble sediments (turbidity) indicate possible microbiological pollution. Another easy to analyse parameter is the acidity or pH of water. The pH is a so-called indicator parameter, which means a too high or too low pH as such will not be harmful for health. Indicator parameters are often fixed for technical or esthetical reasons. The advised pH value in drinking water is 6.5 to 9.5. However water with a low pH can have corrosive properties for metal tools such as copper or lead water pipes. Too high concentrations of copper or lead in drinking water cause health risks.



Nitrate test strips are cheap and water samples are quick to analyse

Nitrate monitoring of water sources

Monitoring of the water sources can be done in two different ways. First, a good overview of the existing nitrate concentration of the well water should be obtained. The water sources should be chosen in such a way that they are representative for all water sources. That means sources in different parts of the village, which are potential sources of drinking water for the public must be analysed. It is preferable to test the water

samples in the same season, e.g. during spring or summer time. Pupils can take the sample to school or the tests can be carried out directly on the spot. The depth of the water source should be noted. Other observations on water quality, like colour, turbidity or others should be reported. Physical parameters such as soluble sediments (turbidity) indicate possible microbiological pollution. The locations of the investigated wells and the test results must be noted, and can be transferred to the map (for reporting and mapping).

Secondly, it can be very informative to monitor nitrate levels in some wells throughout the year. For example a high, low and medium nitrate-polluted well is chosen for the seasonal monitoring.

The tests results of a whole year give an overview of the seasonal fluctuation, which might be useful for the WSP. Depending on the soil layers e.g. the leakage of nutrients in the groundwater by precipitation, fertilisation by manure or nitrogen can be assessed clearly using such a monitoring programme. Therefore it is good to measure the precipitation and temperature as well, since these parameters could be related to the nitrate concentration. It must be ensured that everything is registered well to avoid any potential mistakes.

When this is done on a 14-day basis throughout the whole year, you get an interesting and significant picture of the fluctuations of nitrate, temperature and precipitation). In order to raise awareness among the villagers, a very good approach, which gets everyone really involved, is to carry out these analyses with the involvement of the children under the teacher's supervision.

Other water quality parameter

As most water borne diseases are caused by microorganisms, this is the most important parameter to identify the safety of drinking water. Water of unprotected and badly maintained sources is easily affected with microorganisms due to the contamination with human and/or animal excreta. One gram of faecal material can contain millions of bacteria and viruses! Water of public wells or central water supplies should be analysed on a regular basis and the results should be made accessible of water supplied to the community.

The appearance of microorganisms, such as *Escherichia coli* (E-coli) or *Enterococci* should be known; otherwise an authorised laboratory should be requested for analysing the drinking water on microorganisms. Both are indicator bacteria for microbiological pollution: No E-coli or *Enterococci* at all should be found in 100 ml drinking water.

2.4. Risk and hazard assessment

For the risk assessment of the danger of well/ground water pollution by e.g. animal manure or wastewater questionnaires and checklists can be used. Also the state of the well or the tap and its surroundings should be investigated. E.g. is there a cover? Is there rain or wastewater infiltration? Is there an apron around the pump or well, etc.?

After instructions and awareness raising by the teacher, children can make their own observations such as estimating the distances from manure heaps or pit latrines to the well, population density or the location of the source of pollution e.g. uphill or downhill, in the north or in the south of the water source.

Citizens living near the wells should be interviewed about their practices of fertilising their fields. Other sources of microbiological pollution such as tools used for extracting the water or for the storage of water in the houses have to be observed and identified. A checklist adapted to the area and circumstances has to be prepared. Citizens, medical and water administration, doctors are important sources for information and should be interviewed on drinking water quality and related health diseases.

2.5. What to do with the results?

A part of the WSP is the documentation of the collected information and making the results and plans visible to all stakeholders. All the collected information should be objective and available in reports, and depending on the issue the results can be made visible in graphics or in maps. The facilitating NGO could be responsible for this.

Systems and structures

Water supply systems can be made visible using drawings with the input of all stakeholders. What types of sources are used, e.g. wind wheels or pumps, dug wells or bore holes. Are there different water layers or sources in use? If yes, where and what are the given properties, such as depth? Location of the public wells or taps, location of sources and pipes etc. should be identified and which citizens are dependent on which source? All the collected data and information should be summarised in a report and made accessible to the citizens.

Reporting, mapping wells and risks

The results of the analyses and findings of the drinking water and seasonal fluctuations should be carefully documented in the register book. This can include:

- The depth of the well
- The state of the well (is it well maintained, does it have a cover and what kind of cover, does it have a concrete enforcement around it or not)
- The location and presence of possible sources of pollution in 50 m proximity around the well. Is the source of pollution e.g. in the north or in the south of the water source, uphill or downhill
- Nitrate concentrations of the water sources should be mapped

If maps of the village exist, then those should be used. Wells or taps and the density of citizens can be indicated on the map, using different colours for the wells according to their nitrate pollution. In the absence of maps, simple maps can be drawn. The sources and dangers of pollution can be plotted manually on tracing paper, and overlaid on top of the map of the village.

It is further recommended to prepare poster and to hang it in a classroom or a school corridor, where the results of the analyses are open to the pupils and visitors of the school.



The results of the analyses of the drinking water should be carefully documented

2.6. Developing plans for improvement of the water system

Finally the main goal of the WSP is the identification of weaknesses and strengths of the system; reaching an improvement and minimising risks and hazards, which can deteriorate the water quality. After a shared identification of risks and hazards and possible improvements of the water system, joint actions on a local level could perform a better risk management, e.g. cleaning and restoring the source or pipes, installation of closed pump systems, safe human and animal excreta management, or even lobbying for the installation of a central water supply system.

A community based WSP developed with the involvement of all stakeholders will forward:

- An improvement of water protection
- A minimising the health risks of water related diseases

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- An adequate management of the water system
 - Improvement of access to information and to safe and affordable water
 - An improved ownership of the water supply system

Remarks

The given examples and suggestions are not fixed and should be adjusted and developed according to the local situation and possibilities of implementation. For example, the age and the engagement of the pupils, the possibilities of the teachers, the input and cooperation of the citizens, the local and/or regional authorities and other stakeholders will all influence the results of the WSP.

3. Text sources and further reading

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