

Module 18

Risk Assessment of Small-Scale Water Supply Systems

Summary – Using sanitary inspection forms

The following represents a range of sanitary inspection forms for assessing risks of a range of supply systems: mainly community managed point sources such as boreholes, springs, dug wells and piped water supplies fed with surface water or mechanised boreholes connected to distribution systems.

Objectives

Pupils can eventually, with the support of an adult and/or the water supplier, carry out a basic inspection of the water supply system. Pupils can process the risk assessment forms for specified water systems.

Preparation /material

Materials	Preparation
Risk assessment forms available from this module	Making copies, eventual revising and adding more relevant questions

Risk assessment of small scale-water supply systems

Introduction

Having described and understood the water supply system technically, the next step is to conduct a risk assessment – hazard analysis of the system. Hazards may occur throughout the whole system, from the water catchment to the point of consumption.

One of the most critical hazards within a water supply system is caused by infiltration and contamination of the drinking water with microorganisms (pathogens). Pathogens generally originate from human or animal faecal material, contaminating raw water and finding their way into the water delivery system. Common sources of faeces include: wildlife such as birds, grazing animals and vermin in and around reservoirs, backflow from unprotected connections and sewer cross connections.

One way to identify hazards is through water analyses (see module 16). However, water analyses illustrate the presence or absence of a contaminant in a certain moment. Therefore, possible factors that could cause contamination at all possible times must be considered.. For example, the application of human or animal manure, or an accident with a sewage line in a catchment area, can be a temporary hazard of the supply system and not necessarily affect it infinitely. Besides the required water analyses, visual surveys and interviews are extremely important for the overall assessment of a drinking water system.

1. Sanitary inspection forms

The World Health Organisation (WHO) developed sanitary inspection forms for conducting a sanitary inspection (risk assessment) of small-scale water systems. For different distribution systems, the situation and risks can be different, and therefore, other aspects have to be considered. For the most relevant small-scale water delivery systems, forms were developed including a checklist for the basic and most general hazards.

The risk assessment forms presented in this module were partly adjusted to the local requirements or extended to relevant possible hazards. The forms enable citizens to conduct a basic and simple sanitary survey of the water sources, contributing to the identification and understanding of the hazards in a small-scale water system. The sanitary inspection is an important part of a WSP, although it is not a stand-alone activity for the implementation of a WSP. The risk assessment is like a piece of the whole “WSP puzzle”, and the challenge will be to gather and interpret the correct information.

In this module, sanitary inspection (risk assessment forms) are provided for the following water systems:

- a) Dug well or borehole
- b) Public tap of piped water
- c) Piped water with service reservoir
- d) Gravity-fed piped water
- e) River-water-fed piped water
- f) Deep borehole with mechanised pumping
- g) Protected spring

The WSP team should discuss and decide which form should be used, and which questions of the sanitary inspection are lacking and should be added. Depending on the water system, several systems, such as centralised piped water supply, can only be assessed in cooperation with the responsible person or team of the water supply system. In case of an individual or public dug well or borehole, the assessment can be carried out mainly by observation.

2. The results

After the “yes” and “no” answers of the related form are identified, the yes answers are counted. The total score of “yes” answers and the related level of risks for the water system are presented at the bottom of the form.

Positive results of a sanitary inspection are no guarantee for safe drinking water. Groundwater and spring sources can be influenced by contaminants, which infiltrated the source many kilometres away from the point of abstraction (see also module 10). This happens in mountainous areas with karst formations in particular. A challenge in identifying the risks of water sources is the amount of knowledge there is regarding the hydrological and geological conditions of the sources. Unfortunately, this knowledge is not always available.

From case to case, it may be concluded that not all the questions of the form have the same level of risks. For example, in Form A. “risk assessment of dug well or borehole”, questions 1 and 2 (Is there a latrine, animal breeding etc. within 30m of the well or borehole?) could be more important than question 6. (Is the fence missing or faulty?).

Furthermore, possible risks of water contamination related to, for example, the mining of minerals or oil are not considered in the sanitary inspection forms of this module. Industry and geogenic conditions are also not included. For more information on WSP risk assessments with typical hazards on several stages of a piped water distribution system, refer to the information presented in module 2.

Nevertheless, carrying out a risk assessment by using the sanitary inspection forms is an excellent tool for learning more about the possible risks of the water system and raising awareness on possible sources of pollution.

3. Text Sources and further reading

WHO, (2001). Water quality: Guidelines, standards and health, Assessment of risk and risk management for water related infectious disease. Available from http://www.who.int/water_sanitation_health/dwq/whoiwa/en/

18a. Risk assessment of dug well or borehole

Location:

Depth of well/borehole: meter

Nitrate (quick test) concentration of the water: mg/litre

Date of visit:

Inspection was carried out by:

	Specific Diagnostic Information for Assessment Risk	Yes	No	Remarks
1	Is there a latrine within 30m of the well or borehole?			
2	Is there animal breeding of pigs, cows, goats or others within 30m of the well or borehole?			
3	Is there any cultivation (use of manure or fertiliser) within 30m of the well or borehole?			
4	Is the drainage faulty, allowing ponding within 2m of the well or borehole?			
5	Is the drainage channel cracked, broken or needs cleaning?			
6	Is the fence missing or faulty?			
7	Is the apron less than 1m in radius?			
8	Does spilt water collect in the apron area?			
9	Is the apron cracked or damaged?			
10	Is the hand pump loose at the point of attachment?			
11	Is the well-cover unsanitary?			

(Source WHO, modified by WECF)

Total Score of Risks: 10 for dug well, 11 for borehole;

Risk score: 9-11 = Very high; 6-8 = High; 3-5 = Medium; 0-3 = Low

Results and Recommendations:

The following important points of risk were noted (list 1-11):

Comments:

18b. Risk assessment of public tap of piped water

Location:

Nitrate (quick test) concentration of the water: mg/litre

Date of visit:

Inspection was carried out by:

	Specific Diagnostic Information for Assessment Risk	Yes	No	Remarks
1	Does any tap stand leak?			
2	Does surface water collect around any tap stand?			
3	Is the area uphill of any tap stand eroded?			
4	Are pipes exposed close to any tap stand?			
5	Is human excreta on the ground or latrine within 30m of any tap stand?			
6	Is animal manure on the ground within 30m of any tap stand?			
7	Is there any fertilising with manure or chemicals within 30m of any tap stand?			
8	Is there a sewer within 30m of any tap stand?			
9	Is there a sewer or any fertilising with manure or chemicals within 30m of any extraction point?			
10	Has there been discontinuity in the last weeks at any tap stand?			
11	Are there signs of leaks in the mains pipes in the parish?			
12	Did the community report any pipe breaks in the last weeks?			
13	Are the mains pipes exposed anywhere in the parish?			

(Source WHO, modified by WECF)

Total Score of Risks 13;

Risk score: 10-13 = Very high; 10-7 = High; 4-7 = Medium; 0-4 = Low

Results and Recommendations:

The following important points of risk were noted (list 1-13):

Comments:

18c. Risk assessment of piped water with service reservoir

Location:

Nitrate (quick test) concentration of the water: mg/litre

Date of visit:

Inspection was carried out by:

	Specific Diagnostic Information for Assessment Risk	Yes	No	Remarks
1	Does any standpipe leak at sample sites?			
2	Does water collect around any sample site?			
3	Is the area uphill of any tap stand eroded?			
4	Are pipes exposed close to any sample site?			
5	Is human excreta on the ground within 30m of any tap stand?			
6	Is a sewer or latrine within 30m of any sample site?			
7	Is animal manure on the ground within 30m of any tap stand?			
8	Is there any fertilising with manure or chemicals within 20m of any sample site?			
9	Has there been discontinuity in the last weeks at any sample site?			
10	Are there signs of leaks in the sampling area?			
11	Did the community report any pipe breaks in the last weeks?			
12	Is the main supply exposed in sampling area?			
13	Is the service reservoir cracked or leaking?			
14	Is the inside of the service reservoir clean?			
15	Are the air vents or inspection cover unsanitary?			

(Source WHO; modified by WECF)

Total Score of Risks 15

Risk score: 15-12 = Very high; 11-8 = High; 5-7 = Medium; 2-4 = Low; 0-1 Very low

Results and Recommendations:

The following important points of risk were noted (list 1-15):

Comments:

18d. Risk assessment of gravity-fed piped water

Location:

Nitrate (quick test) concentration of the water: mg/litre

Date of visit:

Inspection was carried out by:

	Specific Diagnostic Information for Assessment Risk	Yes	No	Remarks
1	Does the pipe leak between the source and storage tank?			
2	Is the storage tank cracked, damaged or leaking?			
3	Are the vents and covers on the tank damaged or open?			
4	Is the storage tank clean?			
5	Does any tap stands leak?			
6	Does surface water collect around any tap stand?			
7	Is the area uphill of any tap stand eroded?			
8	Is human excreta on the ground or a latrine within 30m of any tap stand?			
9	Is there any fertilizing with manure or chemicals within 20m of any tap stand?			
10	Is there a sewer within 30m of any tap stand?			
11	Is there a sewer or any fertilising with manure or chemicals within 30m of any extraction point?			
12	Has there been discontinuity in the last weeks at any tap stand?			
13	Are there signs of leaks in the mains pipes in the system?			
14	Did the community report any pipe breaks in the last weeks?			
15	Are the main pipes exposed anywhere in the system?			

(Source WHO, modified by WECF)

Total Score of Risks 15

Risk score: 11-15 = Very high; 11-7 = High; 4-7 = Medium; 0-4 = Low

Results and Recommendations:

The following important points of risk were noted (list nos. 1-15):

Comments:

18e. Risk assessment of river water-fed piped water

Location:

Name of river

Depth, width and length of the river: meter

Date of visit:

Inspection was carried out by:

	Specific Diagnostic Information for Assessment Risk	Yes	No	Remarks
1	Is the area up stream eroded?			
2	Is there ground cover (meadow or forest) within 100m from the riverbank to the extraction point?			
3	Have grazing animals access to the river within 100m from the river banks to the extraction point?			
4	Is there any fertilising with manure 100m from the river banks to the extraction point			
5	Is there any solid waste dumping place within 100m from the river banks to the extraction point			
6	Is there any communal or industrial wastewater discharge into the river upstream?			
7	Are particles in the water removed by sedimentation/filtration?			
8	Is the river water intensively treated?			
9	Is the water disinfected?			
10	Is the storage tank cracked, damaged or leaky?			
11	Are the vents and covers on the tank damaged or open?			
12	Is the storage tank clean?			
13	Does any tap stands leak?			
14	Has there been discontinuity in the last weeks at any tap?			
15	Are there signs of leaks in the main pipes of the system?			
16	Did the community report any pipe breaks in the last weeks?			
17	Are the main pipes exposed anywhere in the system?			

(Source WHO and DVGW Arbeitsblatt W102, modified by WECF)

Total Score of Risks 16; Risk score: 12-17= Very high; 12-8 = High; 4-7 = Medium; 0-4 = Low

Results and Recommendations:

The following important points of risk were noted (list 1-17):

Comments:

18f. Risk assessment of deep borehole with mechanised pumping

Location:

Depth of borehole: meter

Nitrate (quick test) concentration of the water: mg/litre

Date of visit:

Inspection was carried out by:

	Specific Diagnostic Information for Assessment Risk	Yes	No	Remarks
1	Is there a latrine or sewer or animal manure 100m from the pump house?			
2	Is there any source of other pollution within 100m?			
3	Is there an uncapped well within 100m?			
4	Is the drainage around the pump house faulty?			
5	Does damaged fencing allow animal entry?			
6	Is the floor of the pump house permeable to water?			
7	Does water form pools in the pump house?			
8	Is the well seal unsanitary?			
9	Is the well-cover unsanitary?			

(Source WHO, modified by WECF)

Total Score of Risks: 9

Risk score: 8-9 = Very high; 6-7 = High; 4-5 = Medium; 0-3 = Low

Results and Recommendations:

The following important points of risk were noted (list 1-9):

Comments:

18g. Risk assessment of protected spring

Location:

Depth of borehole: meter

Nitrate (quick test) concentration of the water: mg/litre

Date of visit:

Inspection was carried out by:

	Specific Diagnostic Information for Assessment Risk	Yes	No	Remarks
1	Is the spring unprotected?			
2	Is there a latrine or sewer uphill and/or within 30m of the spring?			
3	Is there any fertilising with manure or chemicals uphill or within 30m of the spring?			
4	Is there any other source of pollution uphill and/or within 30 m of spring? (solid waste, manure, pesticides)			
5	Can animals have access within 30m of the spring?			
6	Is the masonry protecting the spring faulty?			
7	Is the backfill area behind the retaining wall eroded?			
8	Is the fence absent or faulty?			
9	Does surface water collect uphill of the spring?			
10	Is the diversion ditch above the spring absent or non-functional?			

(Source WHO, modified by WECF)

Total Score of Risks: 10

Risk score: 9-10 = Very high; 6-8 = High; 3-5 = Medium; 0-3 = Low

Results and Recommendations:

The following important points of risk were noted (list 1-10):

Comments: