Water Safety Plan

[Name of water supply system]

*Last Updated:*

*DD/MM/YYYY*

***Note to Supplier:***

***The text and tables included in this WSP template are intended to be used as examples only. In all cases, the supplier should review and revise the material provided to reflect system-specific conditions. Areas flagged in blue text indicate areas where special attention is needed by suppliers to customize the example material provided.***

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# Introduction

A Water Safety Plan (WSP) is widely considered to be the most effective means of consistently ensuring the safety of a drinking water supply. A WSP follows a comprehensive [risk assessment](http://en.wikipedia.org/wiki/Risk_assessment) and [risk management](http://en.wikipedia.org/wiki/Risk_management) approach that encompasses all steps in [water supply](http://en.wikipedia.org/wiki/Water_supply), from [catchment](http://en.wikipedia.org/wiki/Drainage_basin) to consumer, and it is a valuable tool to help suppliers effectively operate and manage the water supply system.

# Water Safety Plan Team

## Roles and responsibilities of the core WSP team

* Walk the complete system (from catchment to consumer)
* Develop a detailed system description (including diagrams)
* Identify relevant hazardous events/hazards and control measures and assess risk
* Develop and implement an improvement plan
* Develop and implement monitoring plans
* Develop standard operating procedures and an emergency response plan
* Develop and implement supporting programs (e.g. operator training)
* Meet at least quarterly to review WSP-related records
* Review and update the WSP at least annually
* Maintain records of all WSP-related activities (e.g. monitoring results, meeting minutes)

## WSP team membership

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Name** | **Organization** | **Job Title** | **Role on the WSP Team** | **Contact Information** |
|  |   |   |   |   |
|   |   |   |   |   |
|   |   |   |   |   |
|   |   |   |   |   |
|   |   |   |   |   |
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|   |   |   |   |   |

# System Description

## Intended users and uses

The water supplied is intended for consumption, food preparation, bathing and laundry. Intended consumers do not include individuals or industries with special water quality needs. These groups are advised to apply additional treatment as appropriate.

## Drinking water quality standards

Drinking water quality shall be in accordance with the World Health Organization’s (WHO) Guidelines for Drinking Water Quality (4th Edition).

## System diagrams

*The following diagrams are examples only and need to be replaced with system-specific diagrams. (Where system schematics, distribution system maps, etc., exist elsewhere and it is not feasible to cut/paste them into the WSP document, they should be referenced in this section.)*





## Additional system information

|  |  |
| --- | --- |
| **Type of source** *(surface water or groundwater)* |   |
| **Number of staff dedicated to water supply system operation and maintenance**  |  |
| **Capacity of source/abstraction infrastructure**  |  |
| **General description of catchment**  *(forested, protected, industrial, residential, mixed use)* |  |
| **Specific catchment activities or developments that may impact water safety** *(upstream of intake)* |  |
| **Population served by the water supply system** |   |
| **Number of service connections** |   |
| **Hours of supply** *(daily)* |   |
| **Total consumer demand** |  |
| **Description of treatment works**  |  |
| **Year of construction of the water supply system** |  |
| **Capacity of treatment plant** |  |
| **Any known treatment plant issues**  |  |
| **Distribution pipeline information**  |  |
| **% non-revenue water** *(% volume produced lost through leaks, illegal connections, etc.)* |  |
| **Any known treated water quality problems** *(e.g. issues with low chlorine or high microbial counts at certain locations, etc.)* |  |
| **Consumer practices**  |   |

# Hazard Identification and Risk Assessment

## Key terminology

* A **hazard** is a biological, chemical or physical agent that has the potential to cause harm.
* A **hazardous event** is an event or situation that can introduce a hazard to the water supply system.
* **Risk** is the likelihood that a hazardous event/hazard will occur combined with the severity of the consequences.
* **Control measures** are activities or processes to prevent or reduce a hazardous event/hazard.
* **Validation** refers to reviewing evidence to determine whether or not the control measures can effectively control the hazardous event/hazard.

## Risk assessment approach



|  |  |
| --- | --- |
| **Likelihood level** | **Definition** |
| **1** | **Unlikely** | Could occur at some time but has not been observed |
| **2** | **Possible** | Might occur at some time; has been observed occasionally |
| **3** | **Most likely** | Will probably occur in most circumstances; has been observed regularly |
|  |  |  |
| **Consequence level** | **Definition** |
| **1** | **No/minor impact** | Minor or negligible impact on water quantity or quality (e.g. aesthetic impact, not health related) for a small percentage of customers; some manageable disruptions to operation; rise in complaints not significant |
| **2** | **Moderate impact** | Minor impact on water quantity or quality (e.g. aesthetic impact, not health related) for a large percentage of customers; clear rise in complaints; community annoyance; minor breach of regulatory requirement |
| **3** | **Major impact** | Major water quantity or quality impact; illness in community associated with the water supply; large number of complaints; significant level of customer concern; significant breach of regulatory requirement |

## Hazard identification and risk assessment

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  | **Are controls effective?** | **Risk assessment** | **Additional control needed?** |
| **Process Step** *(catchment, source, treatment plant, etc.)* | **Hazardous Event** *(how a hazard could potentially be introduced)* | **Hazard** *(microbial, chemical, physical, etc.)* | **Existing control measures** *(measure in place to address hazard)* | **Yes** | **No** | **Somewhat** | **Validation notes** *(basis of control measure effectiveness decision)* | **Likelihood** | **Consequence** | **Risk score** | **Risk level** | **Yes** | **No** | **If yes, proposed controls and Improvement Plan reference number (IP#)** *(further detailed in the improvement plan below)* |
|   |  |   |   |  |   |  |   |   |   |   |   |   |  |   |
|   |   |   |   |   |  |   |   |   |   |   |   |  |   |   |
|   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |

# Improvement Plan

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **IP#[[1]](#footnote-1)** | **Specific improvement action** | **Relevant hazardous event/hazard** | **Responsible party** | **Estimated Budget** | **Due date** | **Status update[[2]](#footnote-2)** |
| *(summarize from the risk assessment table above)* | *(individual accountable)* |
| 1 |   |   |   |   |   |   |
| *2* |  |   |   |   |   |   |
| 3 |   |   |   |   |   |   |
| 4 |   |   |   |   |   |   |

# Operational Monitoring Plan

Operational monitoring is carried out by the supplier by visual inspection and water quality testing in accordance with the tables below to confirm that key water supply system components and control measures are working effectively.

## Water quality testing

The table below describes the preferred monitoring plan, but monitoring is presently not performed as described due to a lack of testing equipment. As indicated in the improvement plan, equipment and training for test turbidity, chlorine residual and pH are needed before the monitoring plan can be implemented.

*The supplier should customize the table below to reflect its own water quality monitoring programme.*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  |  |  | ***(If applicable)*** |
| **Where** | **What** | **When** | **Who** | **Critical limits** *(or target range)[[3]](#footnote-3)* | **Corrective actions if critical limits exceeded** |
| Source (intake chamber) | Turbidity | Seasonally | Technician | Turbidity: <1000 NTU | Technician to divert flood water immediately & suspend raw water harvesting until turbidity level drops below critical limit. |
| Clearwater tank (outlet) | pH | Weekly | Technician | pH: 6.5-8.5 | Technician to investigate change in pH. |
| Turbidity | Turbidity: <5 NTU | Technician to confirm WTP performance and check for leaks/breaks in pipeline. |
| Cl2 | Cl2: 0.6-0.8mg/L | Technician to check and adjust chlorine dosing as needed. |
| Customer taps (5 taps each time) | pH | Weekly | Technician | pH: 6.5-8.5 | Technician to investigate change in pH. |
| Turbidity | Turbidity: <5 NTU | Technician to confirm WTP performance and check for leaks/breaks in pipeline. |
| Cl2 | Cl2: 0.2-0.6 mg/L | Technician to check and adjust chlorine dosing as needed. |

## Visual inspections

*The supplier should customize the table below to reflect its own system components and visual inspection programme.*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **What to inspect** | **Inspection frequency** | **Who to inspect** | **Critical limit** *(or target condition)* | **Corrective action if critical limit is exceeded** |
| **Intake** |
| Blockages at the strainer of the inlet pipe | Weekly | WTPO | Strainer free of debris and inflow unaffected | WTPO to immediately remove the debris suspended at the strainer |
| **Slow Sand Filter (SSF)** |
| Water level (head) | Daily | WTPO | X feet below the top of the SSF basin | Technician to investigate and, if needed, remove the sediment layer as per the SOP |
| **ETC** |
| ETC | ETC | ETC | ETC | ETC |

# Verification Monitoring Plan

Verification monitoring is carried out as described below to confirm that drinking water quality standards are being met, consumers are satisfied and the WSP continues to be implemented and updated appropriately.



## Compliance monitoring

Health workers perform water quality testing to confirm compliance with drinking water quality standards in accordance with the table below. It is the responsibility of the supplier to obtain a copy of the compliance monitoring results from the health workers and respond to adverse results as appropriate. (This compliance monitoring programme by health workers complements the operational monitoring programme carried out by the supplier, which is detailed above.)

*The supplier should customize the table below.*

|  |  |
| --- | --- |
| **Sampling frequency:**  | Quarterly |
| **Parameter tested:** | Faecal coliforms |
| **Target value:** | 0 cfu/100mL |
| **Sampler:** | District health technician |
| **Sampling locations:** | Source[[4]](#footnote-4), all storage reservoirs, taps/HH storage containers (5 pairs) |
| **Samples tested at:** | District health laboratory |

## Consumer satisfaction

*The supplier should describe how consumer satisfaction will be monitored (e.g. consumer comments register as shown in Appendix C, annual household surveys, etc.).*

## WSP auditing

The WSP should be audited once in two years by an external audit team composed of representatives from Ministry of Works and Human Settlement, Department of Public Health, and National Environment Commission. Internal auditing should be lead by the WSP team leader annually. An example audit checklist is provided in Appendix D.

# Management Procedures

## Standard operating procedures (SOPs)

*The supplier should document SOPs for all key operational tasks, such as:*

* *Filter operation and maintenance*
* *Chlorination*
* *Jar testing*
* *Water sampling*
* *Water testing (for various parameters)*
* *Storage tank cleaning*
* *Pipeline repair practices*
* *Pump operation and Maintenance*
* *Etc.*

*If preferred, the supplier could document SOPs in a table format as shown below. (Note that the table is an example only. The content would need to be revised by the water supplier.)*

|  |  |  |
| --- | --- | --- |
| **Key operational task** | **Standard operations and maintenance** | **Responsible party** |
| Slow sand filter operation and maintenance | Limits filter loading (or WTP production) to XX L/s. When the filtration rate begins to slow and the head level rises, remove the top layer (~X cm) of sand.Every X years, remove, wash, and replace all sand with sand conforming to XX specifications from XX supplier.XX volume of water should be filtered to waste following any filter maintenance to prevent dirty water from entering the system when the filter is returned to service after maintanence. | In-charge and caretaker |
| Chlorine batching | Wearing all recommended personal protective equipment, (including mask, gloves and eyewear), mix X kg of chlorine powder (X%) into X liters of water. Mix thoroughly. Allow to settle for X minutes such that all sediments settle to the bottom. Decant the liquid solution into the chlorine dosing tank, taking care not to disturb the sediments at the bottom. | Operator |
| Gravity chlorine dosing | Do not allow the chlorine solution to drop below level X in dosing tank. Check gravity injection lines daily to ensure there are no blockages.*(Need to add guidance on how to determine appropriate valve setting at the outlet of the chlorine dosing tank as a function of the rate through the water treatment plant to apply the dose required to achieve the target chlorine residuals at the outlet of the contact tank and throughout the distribution network. This will require careful consideration, calculation and possibly additional training. Chlorine residual testing equipment is critical to confirming that the appropriate dose has been applied.)*  | Operator |
| Storage tank cleaning | Annually, close the inlet, drain out the water, dry the tank for one day, clean the walls and remove the silt manually. The consumers will be notified through the local TV channel or BBS two days ahead of the tank cleaning date. | Caretaker and municipal technician |

## Emergency response plan

*The supplier may wish to add more details to the example emergency response plan provided below. The information in the table below should be considered a minimum.*

|  |  |
| --- | --- |
| **Potential water quality incidents or emergencies (e.g. treatment chemical overdose, microbiological contamination, etc.)** |   |
| **Persons to be notified (from within the supplier as well as external agencies), including contact details** |   |
| **Person responsible for notifying external agencies, including contact details** |   |
| **Plan for disseminating alert to consumers (when necessary), including responsible parties and method of communication** |   |

# Supporting Programmes

## Operator training

*The supplier should describe its operator training programme and record-keeping practices. An Education and Training Log Sheet is provided in Appendix E as an example.*

## Consumer education

*The supplier should document its awareness and educational programmes and record-keeping practices. An Education and Training Log Sheet is provided in Appendix E as an example.*

# Review & Revision

## Quarterly review

The WSP team will meet at least quarterly to ensure that the WSP is being carried out as planned and is effective, and the WSP team will keep records/minutes for all meetings. Major items for review and discussion during quarterly meetings are:

* Improvement plan implementation
* Operational monitoring records
* Verification monitoring records

## Annual review

The WSP team will meet annually to thoroughly review and revise the WSP to keep it up-to-date, and the WSP team will keep records/minutes for all meetings. Possible reasons for WSP revision include:

* Changes to the WSP team
* Changes to land use in the catchment
* Any system changes (source, treatment, storage, distribution, population served, etc.)
* New hazardous events or control measures
* Updates or changes to the improvement plan
* Changes to the operational or verification monitoring plans
* Changes to management procedures or supporting programmes

## Post-incident review

In addition to scheduled WSP reviews, relevant components of the WSP will be reviewed following incidents or emergencies and revised as appropriate to avoid recurrence and to improve response.

Appendix A – WSP team meeting minutes form

**Date of WSP team meeting:**

**Meeting participants:**

**Topics discussed and outcomes of meeting:**

**Date, time and location of the next WSP team meeting:**

Appendix B – Record of completed improvement works

|  |  |  |  |
| --- | --- | --- | --- |
| **Improvement undertaken** | **Relevant hazardous event/hazard** *(from the risk assessment table)* | **Date completed** | **Actual cost**  |
|   |  |   |   |
|   |  |   |   |
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|   |  |   |   |

Appendix C – Consumer comments register

|  |  |
| --- | --- |
| **COMMENT** | **ACTION** |
| **Date received** | **Comment received by** | **Specific comment** *(including consumer name if applicable)* | **Relevant location** | **Date action taken** | **Action taken by** | **Specific action taken** | **Recommendations for further action** |
|   |   |   |   |   |   |   |   |
|   |   |   |   |   |   |   |   |
|   |   |   |   |   |   |   |   |
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|   |   |   |   |   |   |   |   |

Appendix D – Audit checklist

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| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |
|  |  = satisfactory |  |  = needs improvement |  |  |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |

* WSP Team member list current
* System description current/accurate
* Hazard ID and risk assessment table current and thorough
* Improvement plan current and improvement works being carried out
* Operational monitoring carried out as planned
* Verification monitoring carried out as planned

# of faecal coliform tests conducted on treated water in past 12 months: \_\_\_\_\_\_\_\_\_

# of non-zero faecal coliform results from treated water in past 12 months: \_\_\_\_\_\_\_\_\_

# of any other tests carried out from treated water in past 12 months: \_\_\_\_\_\_\_\_\_\_

* SOPs current and being followed
* Emergency response plan current

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |   |   |   |  |   |   |  |
| ***Signature of auditor*** |  | ***Date*** |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  |  |  |  |

Appendix E – Education & training log sheet

|  |  |  |  |
| --- | --- | --- | --- |
|  |  |  |  |
| **Training date(s)** | **Person(s) trained**  | **Course/programme** | **Trainer/training body** |
|   |   |   |   |
|   |   |   |   |
|   |   |   |   |
|   |   |   |   |
|   |   |   |   |
|   |   |   |   |

1. Improvement Plan reference number from the hazard identification and risk assessment table [↑](#footnote-ref-1)
2. As planned improvements are implemented, they are removed from this Improvement Plan and documented in the “record of completed improvement works” (see Appendix B) [↑](#footnote-ref-2)
3. Test results for all treated water must comply with drinking water quality standards (i.e. WHO guidelines) [↑](#footnote-ref-3)
4. Source water samples are not required to comply with drinking water quality standards [↑](#footnote-ref-4)