Federal Democratic Republic of Ethiopia
Ministry of Health

NATIONAL DRINKING WATER QUALITY MONITORING AND SURVEILLANCE AND RESPONSE GUIDELINE

June 2017

Forward

The health of the community highly depends on the availability of adequate and safe water. Water is primarily essential for life, health and human dignity. In addition to public health benefits, all people have the right to access safe and adequate water in equitable manner for drinking, cooking, personal and domestic hygiene.

Adequacy and safety of drinking water are important to reduce the occurrence of water-related health problems especially diarrheal diseases. However, the access to safe water provision and utilization in the country is still low, though the country managed to met the MDG target. There is a growing demand from a increased population, economic expansion and increasing mean water required per capita.

The use of unprotected water sources in rural part of the country is common by travelling long distances which determine the amount of water to be also scarce. Such water sources are constantly exposed to contamination from human and animal excretes in the process of economic activities and naturally occurring events. Drinking water is also liable for contamination during collection, transportation, storage and unsafe handling at household level. As a result, the concerted efforts made to reduce diarrheal diseases is countered by frequent occurrence of acute watery diarrheal particularly during the recent few years which was transmitted through fecal contamination of drinking water and food. In addition, diarrheal diseases are the major contributors of high under five morbidity and mortality rates in the country. The under-five mortality rate is 67 per 1,000 live births (EDHS, 2016).

Therefore, to bring major changes in improving drinking water quality for control of diarrheal diseases and other public health benefits, implementation of water safety plan for addressing safe water chain from source to consumption is essential. This involves water quality surveillance and response including household water treatment and safe storage in order to verify and enable continuous avoidance of risk.

This guideline is therefore developed in order to guide the implementation in this regard. It requires concerted effort of all stakeholders. In particular FMoH, regional health bureaus and woreda health offices are primarily responsible to initiate and lead relevant sector collaborations and coordination at their respective levels. Ministry of Health as responsible body to verify water quality will lead the implementation through strengthening existing institutional arrangement, inter-sectoral collaboration and coordination. Finally with such established capacities at all tires and existing well-structured health service delivery system to the grass route level, implementation of the this guideline will be enhanced to ensure the safety of water for public health protection.

In general,
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Acronyms

AWD	Acute Watery Diarrhea
CBOs	Community-Based Organizations
CSA	Central Statistics Authority
EHNRI	Ethiopian Health and Nutrition Institute
ES	Ethiopian Standards

FMHACA	Food, Medicine and Health Care Administration and Control Authority
FMoH	Federal Ministry of Health
FMoWE	Federal Ministry of Water and Energy
FMoE	Federal Ministry of Educaion
GDP	Gross Domestic Products
GTP	Growth and Transformation Plan
HACCP	Hazard Analysis and Critical Control Points
HEW	Health Extension Workers
HMIS	Health Management Information System
HSDP	Health Sector Development Program
JMP	Joint Monitoring Program
MIS	Management Information System
MoU	Memorandum of Understanding
NGOs	Non-Governmental Organizations
NHSTF	National Hygiene and Sanitation Task Force
NWQMS	National Water Quality Monitoring and Surveillance Strategy
OWNP	One WASH National Plan
PASDEP	Poverty Alleviation and Sustainable Development Programme
PoU	Point of Use
PPP	Private Public Partners
QSA	Quality Standards Authority
RADWQ	Rapid Assessment of Drinking Water Quality
SWOT	Strength, Weakness and Threats
UAP	Universal Access Plan
UNICEF	United Nations International Children's Emergency Fund
WASH	Water, Sanitation and Hygiene
WASHCOs	WASH committees
WB	World Bank
WHO	World Health Organization
WIF	WASH Implementation Framework
WQMS	Water Quality Monitoring and Surveillance

WSP AF	Water and Sanitation Program for Africa
WSP	Water Safety Plan
CLTSH	Community-Led Total Sanitation and Hygiene

I. BACKGROUND

Despite major progresses that have been made to improve the health status of the population in Ethiopia, communicable diseases account for about 60-80% of the health problems. More than 90% of child deaths are due to diarrhea, pneumonia, malaria, neonatal problems, malnutrition and HIV/AIDS, and often a combination of these conditions.

The existing burden of disease is preventable and high proportion is related to unsafe water. Chidden in the country experiences frequent episodes of diarrhea in a year and outbreak of acute watery diarrhea (AWD) is recurring proble. Based on the morbidity records, there are prevalent communicable diseases related to water supply conditions in the country among which about 60% of the top ten diseases are related to poor quality and scarcity of household water consumption. According to the current (JMP SDG baseline report), access to safely managed water supply in Ethiopia is 11%.

To address the problem, the country has universal access plan for water Supply, hygiene and sanitation Strategic Action Plan and GTP II until 2020. Memorandum of Understanding among Ministries of Water and Energy, Health, Education and Finance and Economic Development was signed in 2012 for one WASH national program.

The ministry of health also developed comprehensive environmental health strategy (2016-2020) which included water safety as one of the strategic objective. This guideline is therefore developed for effective implementation of this strategy on water safety.

II. GOAL, SCOPE AND OBJECTIVES

The overall goal of this guideline is to ensure microbial safe water provision to households and address related health problems through risk based assessment and prevention of water contaminants, water quality monitoring, surveillance and intervention ah point of use.

2.1 Scope and purpose

This Guideline describes basic concepts and elements in water supply with focus to water safety applicable to community water supply universally including cities and towns from source (improved and unimproved) to household level. It outlines the guiding principles necessary to ensure water quality surveillance is effective. It is also concerned with the linkage between surveillance and remedial actions to ensure water safety at point of use.

The guideline covers planning, and subsequent chapters deal with the procedures used in the collection of information—sanitary inspection and community surveys, and the analysis of water quality. The analysis and interpretation of the information gathered and its use in improving water-supply services are also covered. The final chapters cover strategies for improvement—technical interventions, hygiene education and legislation and regulation.

This document is to be used by public health experts of Ministry of Health, Regional Health Bureaus, Zonal and woreda Health experts in the quality assurance and surveillance of drinking water supplies and application of appropriate measures for treating and giving assurance for the use of water for drinking and other domestic purposes both in urban and rural settings

2.2 General Objective

The main objective of this guideline is to help experts in indicating guiding water quality monitoring values and provide tools for the surveillance of water supply systems so that remedial actions could be taken and also ensure that both microbiological and physicochemical quality of drinking water supply from source to point of use

2.3 Specific objectives

Specific objectives of this guideline include:

- Describe the concepts and elements of water supply including quality
- Indicate overall drink water safety framework as per WHO Guideline
- Describe water quality monitoring and surveillance system
- Describe remedial action including household water treatment and safe storage
- Indicate implementation plan: activities, roles and responsibilities, coordination, monitoring and evaluation

III. WATER SUPPLY: INTRODUCTION AND CONCEPTS

3.1 Water and health

The quality of drinking-water is a major environmental determinant of health. The most predominant waterborne disease, diarrhea, has an estimated annual incidence of 4,600 million episodes and causes 2.2 million deaths every year. In terms of global burden of disease, diarrhea ranks second after respiratory infections. Children under five years of age are most affected: some 1.33 million die each year of diarrhea, representing 15% of overall mortality in that age group. It is estimated that 50% of cases of malnutrition are associated with repeated episodes of diarrhea or intestinal helminthiases.

There are several variants of the feco-oral pathway of waterborne disease transmission. These include contamination of catchment areas (by human and animal feces) and sources (through inadequate disposal of human or animal excreta, or domestic or industrial waste) of drinking-water. Transmission can also result from contamination in the distribution system (through "leaking" pipes, obsolete infrastructure, and inadequate treatment and storage) and unhygienic handling of stored household water.

Moreover, millions of people are exposed to unsafe concentrations of chemical contaminants in their drinking-water. This contamination may be linked to naturally-occurring inorganic chemicals such as arsenic and fluoride, which cause cancer and tooth and/or skeletal damage, respectively. Alternatively, it may be linked to a lack of proper management of urban and industrial wastewater or agricultural run-off water, with potentially long-term exposure to pollutants, resulting in a range of serious health implications.[1]

The health of community basically depends on the availability of safe and adequate water for drinking, domestic use and personal hygiene. If public health is to be improved and maintained through provision of safe and adequate water supply the five vital key elements of water supply are: ***accessibility /coverage, quantity/service level, quality, affordability/cost and continuity***.

These are line with the new global plan of SDG for safely managed drinking water. The JMP has developed a new service ladder which builds on the established source type classification and introduces additional criteria on the accessibility, availability and quality of drinking.

Accessibility/ Coverage

From the public health standpoint, the proportion of the population with reliable access to safe drinking-water is the most important single indicator of the overall success of a drinking-water supply program.

Access to water is of paramount concern and other factors, such as the population served, the reliability of the supply and the cost to the consumer, must therefore be taken into account. Access to water may be restricted in several ways, inability to pay, seasonal fluctuations in availability or lack of supplies to remote areas. In some parts of the country has to be transported over long distances by road or on foot, the cost of drinking-water may absorb a significant proportion of the average daily income. Elsewhere, seasonal, geographical and hydrological factors may conspire to deny individual households or entire communities a continuous, reliable supply of drinking-water.

There are a number of definitions of access (or coverage), many with qualifications regarding safety or adequacy. Access to safe drinking-water for the SDG is currently measured by the WHO/UNICEF Joint Monitoring Program for Water Supply and Sanitation through a proxy that assesses the use of improved drinking-water sources by households. An improved drinking-water source is one that by the nature of its construction and design adequately protects the source from outside contamination, in particular faecal matter. The underlying assumption is that improved sources are more likely to supply safe drinking-water than unimproved sources.

Determining the proportion of a population with reliable access to drinking water is an important function of a drinking-water surveillance agency. This task can be facilitated by establishing a common definition for reasonable access, appropriate to a local context, which may describe a minimum quantity of water supplies per person per day together with a maximum tolerable distance/time to a source (e.g. 20 liters, and within 1 km/30 minutes, respectively, for basic access).

Quantity

The quantity of water collected and used by households has an important influence on health. There is a basic human physiological requirement for water to maintain adequate hydration and an additional requirement for food preparation. There is a further requirement for water to support hygiene, which is necessary for health.

Estimates of the volume of water needed for health purposes vary widely. In deriving World Health Organization (WHO) guideline values, it is assumed that the daily per capita consumption of drinking-water is approximately 2 liters for adults, although actual consumption varies according to climate, activity level and diet. Based on currently available data, a minimum volume of 7.5 liters per capita per day will provide sufficient water for hydration and incorporation into food for most people under most conditions. In addition, adequate domestic water is needed for food preparation, laundry and personal and domestic hygiene, which are also important for health. Water may also be important in income generation and amenity uses.

Measurements of the volume of water collected or supplied for domestic purposes may be used as a basic hygiene indicator. Some authorities' use a guideline value of 50 liters per capita per day, but this is based on the assumption that personal washing and laundry are carried out in the home; where this is not the case, lower figures may be acceptable.

Service level is a useful and easily measured indicator that provides a valid surrogate for the quantity of water collected by households and is the preferred indicator for surveillance. Available evidence indicates that health gains accrue from improving service level in two key stages: the delivery of water within 1 km or 30 minutes of total collection time; and when supplied to a yard level of service. Further health gains are likely to occur once water is supplied through multiple taps, as this will increase water availability for diverse hygiene practices. The volume of water collected may also depend on the reliability and cost of the water. Therefore, collection of data on these indicators is important.

The evaluation of community water supplies requires the consideration of a number of quantitative factors. The quantitative nature of the evaluation makes possible the meaningful comparison of systems, and assists in the assignment of relative priorities to those requiring improvement. The indicators most commonly used to evaluate community water supplies are quality, quantity, coverage, cost, and continuity.

Quality

Safety of water supply is another important element for pubic health and included in the current SDG goal as part of focus area and progress monitoring. The detail is described below.

Affordability / Cost

The affordability of water has a significant influence on the use of water and selection of water sources. Households with the lowest levels of access to safe water supply frequently pay more for their water than do households connected to a piped water system. The high cost of water may force households to use alternative sources of water of poorer quality that represent a greater risk to health. Furthermore, high costs of water may reduce the volumes of water used by households, which in turn may influence hygiene practices and increase risks of disease transmission.

When assessing affordability, it is important to collect data on the price at the point of purchase. Where households are connected to the drinking-water supplier, this will be the tariff applied. Where water is purchased from public standpipes or from neighbors, the price at the point of purchase may be very different from the drinking-water supplier tariff. Many alternative water sources (notably vendors) also involve costs, and these costs should be included in evaluations of affordability. In addition to recurrent costs, the costs for initial acquisition of a connection should also be considered when evaluating affordability.

Continuity

Analysis of data on continuity of supply requires the consideration of two components daily and seasonal continuity. Continuity can be classified as follows:

- Year-round services from a reliable source with no interruption of flow at the tap;
- Year-round service with daily variation, of which the most common causes are:
  - ✓ Restricted pumping regimes in pumped systems, whether planned or due to power failure;
  - ✓ Peak demand exceeding the flow capacity of the conduction line or the capacity of the reservoir;
- Seasonal service variation resulting from source fluctuation, which typically has three causes:
  - ✓ Natural variation in source volume during the year
  - ✓ Volume limitation because of competition with other uses such as irrigation
  - ✓ Periods of high turbidity when the source water may be untreatable;
- Compounded daily and annual discontinuity.

These classifications reflect broad categories of continuity, which are likely to affect hygiene in different ways. Any interruption of service is likely to result in degradation of water quality, increased risk of exposure to contaminated water and therefore increased risk of waterborne disease. Daily or weekly discontinuity results in low supply pressure and a consequent risk of in-pipe recontamination. Other consequences include reduced availability and lower volume use, which adversely affect hygiene. Household water storage may be necessary, and this may lead to an increase in the risk of contamination during such storage and associated handling. Seasonal discontinuity often forces users to obtain water from inferior and distant sources. As a consequence, in addition to the obvious reduction in quality and quantity, time is lost in water collection.

Infectious diseases transmission by through water supply is categorized as:

- Water borne diseases: those transmit through drinking water (such as typhoid, cholera, gastro-enteritis etc)
- Water washed diseases: those diseases caused by the shortage of adequate water for personal hygiene (scabies, and trachoma)
- Water based diseases: those transmitted through aquatic vectors (, such as schistosomiasis)
- Water related diseases: those spread by insects that depend on water (malaria and yellow fever)

Federal Ministry of Health has taken a step to address the gaps seen in water quality monitoring and surveillance, and how to achieve safe water chain up to the consumption points including the improvements and scaling up of household water treatment methods. Hence, the development of water quality monitoring and surveillance strategy was envisioned as an important step which will be followed by detailed guidelines and manuals to effectively implement the strategy.

3.2 Water safety and quality

A drinking-water quality guideline value represents the concentration of a constituent that does not result in any significant health risk to the consumer over a lifetime of consumption. Drinking-water should be suitable for human consumption and for all usual domestic purposes. When a guideline value is exceeded, the cause should be investigated and corrective action taken. The amount by which, and for how long, any guideline value can be exceeded without endangering human health depends on the specific substance involved.

In drawing up national standards for drinking-water quality, it is necessary to consider various local, geographical, socioeconomic and cultural factors. As such national standards could differ from the guideline values. The use of categories of bacteriological contamination of small-community supplies is useful in this context.
Ministry of Health has adopted interim standards for intractable natural contaminants such as fluoride, pending the development of appropriate treatments for their removal from community supplies.
There are three parameters of drinking water quality: physical, bacteriological and chemical parameters.

3.3 Types of Water sources

Different sources of water include: ground, surface and rain water based system. Important differences exist in the quality of surface water, ground water and rainwater. Rainwater is usually clean but may pick up impurities from the surface from which it is collected. Groundwater may comprise excess chemicals, but is usually free from harmful bacteria and viruses unless the water is polluted for example by nearby pit latrines or during abstraction and transport. Most surface water is contaminated with harmful bacteria and viruses and may also contain other contaminants such as herbicides, pesticides and excess chemicals. (Smet and van Wijk , 2002).

The increased involvement of community members in the administration and operation of water-supply systems is characteristic of small communities; this provides a ready distinction between community water supplies and the supply systems of major towns and cities. However, water supplies in periurban areas—the communities surrounding major towns and cities—are often organizationally similar to those of rural communities; these may also be classified as "community water supplies".

During dry seasons, spring sources may dwindle, reservoirs may become exhausted and excessive demands by one group of people may limit supplies to their neighbors. If the performance of a community water-supply system is to be properly evaluated, a number of factors must be considered. Some countries that have developed national strategies for the surveillance and quality control of water supply systems have adopted quantitative service indicators for application at community, regional and national levels.

The water supply from these sources is classified as:

- Improved water sources: includes piped water into dwelling, yard or plot, public tap or standpipe, tube well or borehole, protected dug well, protected spring, and rainwater collection.
- Unimproved water sources: includes unprotected dug well, unprotected spring, cart with small tank or drum provided by water vendor, tanker truck provision of water, and bottled water
- Surface water sources (river, dam, lake, pond, stream, canal, irrigation channel)

SDG water supply ladders

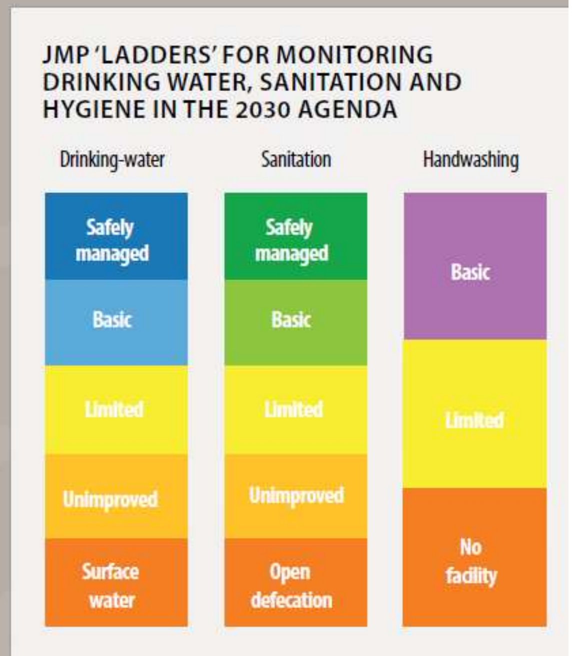
New global indicators for drinking water, sanitation and hygiene

Sustainable Development Goal (SDG) 6 aims to 'Ensure availability and sustainable management of water and sanitation for all' and comprises six technical targets relating to drinking water, sanitation and hygiene, wastewater management, water efficiency, integrated water resource management and protection of aquatic ecosystems.

The WHO/UNICEF Joint Monitoring Programme for Water Supply and Sanitation (JMP)[1] has been monitoring progress on drinking water and sanitation since 1990 and is collaborating with UN-Water partners to develop a framework for integrated monitoring of water and sanitation related SDG targets under the recently established Global Expanded Monitoring Initiative (GEMI)[2].

This briefing note summarises the new global indicators for monitoring the drinking water, sanitation and hygiene (WASH) elements of the SDG targets and reflects extensive technical consultation with over 100 experts from over 60 organisations worldwide[3].

The SDG targets apply to all countries so the JMP proposes to use a 'service ladder' approach to benchmark and track progress across countries at different stages of development. Emerging JMP ladders build on existing datasets and introduce new indicators which reflect the ambition of the new SDG targets. Forthcoming thematic reports on safely managed drinking water and safely managed sanitation and hygiene services will describe the indicators, definitions, and proposed methodologies in more detail[4].

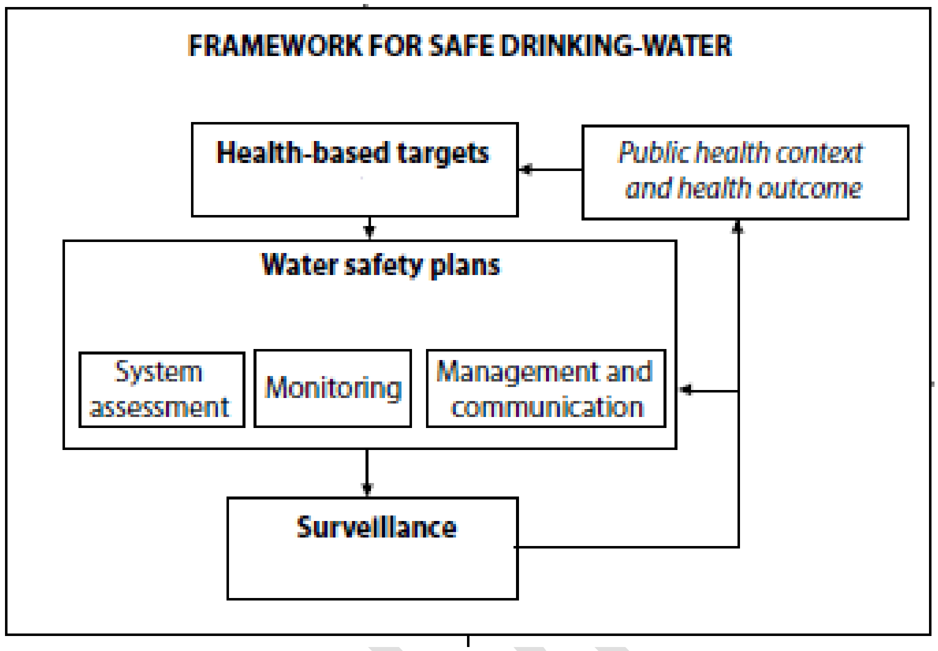


1 http://www.wssinfo.org/
2 http://www.unwater.org/gemi/en/
3 http://www.wssinfo.org/post-2015-monitoring/
4 http://www.wssinfo.org/sdg-baselines/

IV. SAFE DRINKING WATER FRAMEWORK

Safe drinking water is water which does not represent any significant risk to health over a lifetime of consumption, including different sensitivities that may occur between life stages.

Microbial compliance alone does not guarantee safety. To ensure safe drinking water, WHO and UNICEF promote a Framework for Safe Drinking Water, as described in the WHO Guidelines for Drinking Water Quality and related tools. This framework comprises three key components: target setting, water safety plans and independent surveillance.



Adapted from WHO Drinking Water quality guideline, revised 2017

Target setting: National standards should be established for contaminants that occur frequently at significant concentrations and that have the greatest health impact. WHO guideline values for a range of contaminants can be used as a point of departure for developing national standards and regulations, but countries should consider all exposure pathways. National standards may be higher or lower than the WHO guideline values.

Water safety plans: are systematic risk assessments and risk prevention approach encompassing all steps in the water supply system, from the catchment through to the consumer. It is effective means of consistently ensuring the safety of a drinking-water supply. By identifying the greatest risks and putting in place barriers, WSPs offer water suppliers a tool for managing the risks related to water and a framework to achieve water quality targets included in national standards and regulations. The principles of WSPs can be implemented for both large- and small-scale supplies.

For example, simplified risk assessments with a stronger focus on risks related to transport and storage are more appropriate for community-managed systems.

WSPs represent an evolution of the concept of sanitary surveys and vulnerability assessments that include and encompass the whole of the water supply system and its operation. The WSP approach draws in particular the multiple-barrier approach and hazard assessment and critical control points (as used in the food industry). Programming for water quality tends to be reactive – responding to problems as they occur rather than focusing on safety and prevention.

The primary objectives of a WSP in ensuring good drinking-water supply practice are the prevention or minimization of contamination of sources water, the reduction or removal of contamination through treatment processes and the prevention of contamination during storage, distribution and handling of drinking-water. These objectives are equally applicable to large piped drinking-water supplies, small community supplies and household systems and will be achieved through:

- Development of an understanding of the specific system and its capability to supply water that meets water quality targets;
- Identification of potential sources of contamination and how they can be controlled;
- Validation of control measures employed to control hazards;
- Implementation of a system for operational monitoring of the control measures within the water system;
- timely corrective actions to ensure that safe water is consistently supplied;
- Undertaking verification of drinking-water quality to ensure that the WSP is being implemented correctly

Independent surveillance: In a WSP approach, surveillance of water quality at critical points in the system is important, as it provides independent assurance that the WSP is appropriate, and that the chosen barriers are correctly implemented and

effective in ensuring that water quality is meeting national standards. Findings from surveillance inform water safety policies and programmes and can provide inputs to revisions to national standards and regulations. For instance, the presence of validated WSPs could be a better indicator of water safety than microbiological compliance alone. Simpler risk
assessment tools, such as sanitary inspections, can also yield valuable information about risks to water supplies by indicating proportion of water sources with low, moderate and high risk.

V. WATER QUALITY MONITORING AND SURVEILLANCE SYSTEM

Drinking-water supply surveillance refers to "continuous and vigilant public health assessment and review of the safety and acceptability of drinking-water supplies" (WHO, 1976). It is a careful watching and protecting of drinking water from possible contamination risks. It contributes to the protection of public health by promoting improvement of the *quality, quantity, accessibility, coverage, affordability and continuity* of water supplies and is complementary to the quality control function of the drinking-water supplier.

Surveillance of drinking water is conducted with the objective of ensuring acceptability of established standards from public health point of view. This requires legislation supported by regulatory standards and code of practices with institutional arrangements. It includes institutional inspection, sanitary survey, continuous monitoring of physico-chemical and microbiological parameters (laboratory or spot testing of water samples collected at different locations, i.e. at source, pipe line, reservoirs and delivery points) and time, data processing, evaluation followed by remedial action and preventive measures.

Surveillance extends beyond drinking-water supplies operated by a discrete drinking-water supplier to include drinking-water supplies that are managed by communities and includes assurance of good hygiene in the collection and storage of household water. Drinking-water supply surveillance is also used to ensure that any transgressions that may occur are appropriately investigated and resolved. It is appropriate to use surveillance as a mechanism for collaboration between public health agencies and drinking-water suppliers to improve drinking-water supply than to resort to enforcement, particularly where the problem lies mainly with community-managed drinking-water supplies.

Four components of Water Quality Surveillance

- Water supply system assessment - sanitary Inspection /Survey
- Water quality monitoring/testing
- Data Analysis and Interpretation
- Remedial and preventive measures

5.1 Assessment - Sanitary Inspection

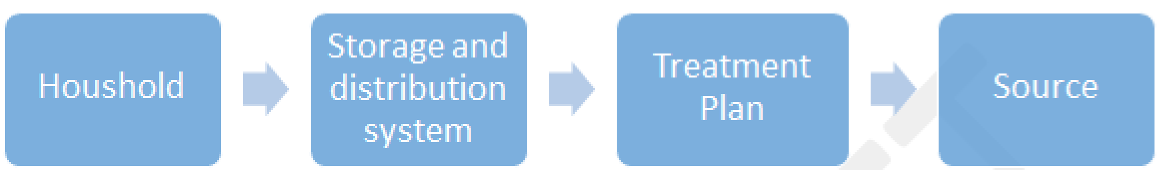
A sanitary inspection is an on-site inspection and evaluation of all conditions, devices, and practices in the water-supply system that poses an actual or potential danger to the health and well-being of the consumer. It is a fact-finding activity that should identify system deficiencies—not only sources of actual contamination but also inadequacies and lack of integrity in the system that could lead to contamination. It applies to all water supply system including improved and unimproved/surface water sources.

It is an inspection and assessment of potential contamination risks including water supply facility condition, health hazard application and practices around all schemes. However, it is not an alternative to water quality analysis but is an important component and may be a prerequisite to conduct water quality analysis. Public utilities and citizens can then use the results to take remedial actions to reduce potential sources of contamination and protect drinking water.

The two principal activities are sanitary inspection and water-quality analysis. It has been suggested that sanitary inspection should take priority over analysis, but the two should be done together wherever possible. They are complementary activities; inspection identifies potential hazards, while analysis indicates both contamination and its intensity.

Carrying out sanitary inspections

Four elements in water supply system



Steps in conducting Inspection and risk identification

Establish team: identify with relevant members, provide orientation and set objectives including water committee members. The team will be chaired by district health water surveillance officer or kebele health extension worker.

Staff responsible for field sanitary inspection work should always try to notify the local community representatives in advance of the visit, especially where the presence of the latter is required in order to obtain access to certain points in the supply system and where the assistance of community members in conducting the inspection is needed. On arrival in the community, the surveillance officer must verify basic data with community representatives.

Knowledge of system description: Before visiting the community, the surveillance officer should have prior knowledge of the type and number of supplies, sources, and taps. This should be checked against local records and maps held by the local health post or health center. If no map is available, an attempt should be made to prepare sketch map of the supply or sources. Much of the information required for the investigation of drinking-water supply services will be obtained by interviewing community members; this is especially important when visiting households to assess the continuity of service. Any records that the community keeps, for example of tariffs, should be examined and the information noted, including the amount charged and the number of households paying.

Identify Hazards: Inspection or audit tool will be used to identify possible hazards (Annexed). While it may appear logical for inspection and sampling to begin at the source of piped supply and to progress through the system with the flow of water, the converse is actually the case. Working against the flow beginning with household's water safety awareness and practices assessment to the distribution network and progressing up through the system.

Based on the audit tool indicators identify the indicators by categorizing as ***fulfill, medium fulfilled and un-fulfilled***. Complete the sanitary inspection report on site together with the community representatives. Opportunities to point out problems or defects in the field to community members, their representatives, or the system caretaker or operator should be taken whenever possible. It may also be appropriate to undertake simple repairs, e.g. replacement of washers in public taps, at the same time.

Table Example of a simple scoring matrix for ranking risks

Likelihood	Severity of consequences				
	Insignificant	Minor	Moderate	Major	Catastrophic
Almost certain	5	10	15	20	25
Likely	4	8	12	16	20
Moderately likely	3	6	9	12	15
Unlikely	2	4	6	8	10
Rare	1	2	3	4	5

Risk score	< 6	6–9	10–15	> 15
Risk rating	Low	Medium	High	Very high

Risk identification - Determine and validate existing control measures, asses and prioritize risk. The team conduct risk analysis to the hazards identified based on the possible impact on water quality and categorize the hazards as: ***high risk, medium and low risk***.

Communication and follow up/ Action: make feedback to the community regarding the assessment and make action plan with the community.

The survey officer carrying out the sanitary survey should record whether or not sampling or analysis will be undertaken. Labor and hence time can sometimes be saved by carrying out the analysis in the field at the same time as the inspection; elsewhere, water analysis may be part of follow-up, with samples transported to a laboratory for testing. Special postcards the community can use to report serious operational or remedial requirements can also be produced that are posted to the agency responsible for operation and maintenance, which then makes an appropriate response and provides the necessary technical support.

The results of sanitary inspections and the actions that need to be taken to protect and improve the water quality should be discussed with the household and community. For example, in the following illustration of an open well, possible actions to protect the water source may include:

- Relocate a latrine if it is too close to the water source

- Ensure that animals do not have access to the water source
- Fix the cracks around the well platform
- Improve the drainage around the well platform
- Promotion of household water treatment and use of clean water collection container that is stored in a safe location

Barriers to effective sanitary inspections are:

- No standardized method for conducting the inspection
- Interpretation of on-site observations can vary between inspectors
- Data are difficult to quantify or compare due to subjectivity in interpretation and 'observational' style
- No effort made to analyze data in order to investigate general trends or common problems

These problems highlight the need for good planning, management, and training to make sure that sanitary inspections are an effective tool for helping to ensure safe drinking water.

Timing and frequency of sanitary inspections

Sanitary inspections should be undertaken on a regular basis for each water sources including water supply system. Below table is suggested frequency.

Suggested minimum annual frequency of sanitary inspections

Source and mode of supply	Community[a]	Water-supply agency[b]	Surveillance agency[a,b,c]
Dug well (without windlass)	6	—	1[d]
Dug well (with windlass)	6	—	1[d]
Dug well with hand-pump	4	—	1[d]
Shallow and deep tubewell with hand-pump	4	—	1[d]
Rainwater catchment	4	—	1[d]
Gravity spring	4	—	1[d]
Piped supply: groundwater sources (springs and wells), with and without chlorination	—	1	1
Treated surface source of piped supply, with chlorination:			
<5000 population	12	1	1
5000–20 000 population	—	2	1
Distribution system of piped supply[e]	—	12	1

[a] For family-owned facilities (e.g. dug wells with or without hand-pumps), the family is responsible for inspections, with support from the surveillance agency.
[b] All new sources should be inspected before commissioning.
[c] Under emergency conditions, such as onset of epidemic diseases, inspection should take place immediately.
[d] Where it is impractical to inspect all such facilities, a statistically significant sample should be inspected.
[e] Public standposts are cleaned by the community if the population is less than 5000. The water-supply agency maintains the distribution system and tapstands if the population is between 5000 and 20 000.

5.2 Water Quality Monitoring

Samples represent conditions at a single point in time and—even when there is frequent sampling and analysis—the results are reported after contamination has occurred, especially in systems without long-term storage. Microbiological contamination is often sporadic and may not be revealed by occasional sampling.

Sampling: collect samples from 5-10 % of the households and respective taps, from distribution points, reservoir and source.,

Field testing kits

Analyses for many important physical, chemical and microbiological variables can be carried out in the field using apparatus made specifically for field use. A significant advantage of field analysis is that tests are carried out on fresh samples whose characteristics have not been contaminated or otherwise changed as a result of storage in a container. This is of special importance for samples that are to undergo microbiological analysis but cannot be transported to a laboratory within the time limits or under some conditions. These test kits provide simple, effective visual comparison tests for a variety of water quality parameters. There are quick and easy test strips, color tube colorimetric tests with a graduated color comparison disc and drop count titration kits. These kits can be used to measure acidity, alkalinity, ammonia, arsenic, bromine, carbon dioxide, chlorine, chloride, chromium, copper, cyanide, detergents, dissolved oxygen, hardness, hydrogen peroxide, hydrogen sulfide, iodine, iron, manganese, microbiological contaminants (bacteria, yeast, and mold), nitrogen, nitrate/nitrite, ozone, pH, phenols, phosphate, phosphorus, salinity and temperature. In using any field kit it is essential to follow exactly the procedures specified in the manufacturer's instruction manual. Carefully measured quantities of reagents may be supplied in pre-packaged form, and use of a different concentration of a chemical from that recommended would distort the result of an analysis.

Laboratory based testing

The standardization of methods and laboratory procedures is important. International standard methods should be evaluated under local conditions before they are formally adopted by national surveillance programmes. A list of ISO standard methods is given in the Bibliography. The methods described in the annexes to this publication are based on these ISO standard methods, modified where appropriate in the light of experience in the surveillance of community water supplies. The principal methods used in the isolation of indicator organisms from water are the membrane-filtration (MF) method, the multiple-tube (MT) or most probable number (MPN) method and presence–absence tests.

Membrane-filtration method

In the membrane-filtration (MF) method, a minimum volume of 10ml of the sample (or dilution of the sample) is introduced aseptically into a sterile or properly disinfected filtration assembly containing a sterile membrane filter (nominal pore size 0.2 or 0.45 μm). A vacuum is applied and the sample is drawn through the membrane filter. All indicator organisms are retained on or within the filter, which is then transferred to a suitable selective culture medium in a Petri dish. National Water Quality Monitoring and Surveillance (WQMS) Guideline, Ethiopia

Following a period of resuscitation, during which the bacteria become acclimatized to the new conditions, the Petri dish is transferred to an incubator at the appropriate selective temperature where it is incubated for a suitable time to allow the replication of the indicator organisms. Visually identifiable colonies are formed and counted, and the results are expressed in numbers of "colonyforming units" (CFU) per 100ml of original sample. This technique is inappropriate for waters with a level of turbidity that would cause the filter to become blocked before an adequate volume of water had passed through. When it is necessary to process low sample volumes (less than 10ml), an adequate volume of sterile diluent must be used to disperse the sample before filtration and ensure that it passes evenly across the entire surface of the membrane filter. Membrane filters may be expensive in some countries. Typical sample volumes for different water types are shown in Table 4.3. Where the quality of the water is totally unknown, it may be advisable to test two or more volumes in order to ensure that the number of colonies on the membrane is in the optimal range for counting (20–80 colonies per membrane).

Table. Typical sample volumes for membrane-filtration analysis

Sample type	Sample volume (ml)
Treated drinking-water	100
Partially treated drinking-water	10–100
Protected source water or groundwater	10–100
Surface water and water from open wells	0.1–100[a]

[a] Volumes less than 10ml should be added to the filtration apparatus after addition of at least 10ml of sterile diluent to ensure adequate dispersal across the surface of the membrane filter.

Multiple-tube method

The multiple-tube method is also referred to as the most probable number (MPN) method because—unlike the MF method—it is based on an indirect assessment of microbial density in the water sample by reference to statistical tables to determine the most probable number of microorganisms present in the original sample. It is essential for highly turbid samples that cannot be analyzed by membrane filtration. The technique is used extensively for drinking-water analysis, but it is time-consuming to perform and requires more equipment, glassware, and consumables than membrane filtration. However, the multiple tube method may be more sensitive than membrane filtration.

The multiple-tube method depends on the separate analysis of a number of volumes of the same sample. Each volume is mixed with culture medium and incubated. The concentration of microorganisms in the original sample can then be estimated from the pattern of positive results (the number of tubes showing growth in each volume series) by means of statistical tables that give the "most probable number" per 100ml of the original sample. The combination of sample volumes for processing is selected according to the type of water sample or known degree of contamination. Various configurations and tables may be used; typical volumes and dilutions are summarized in Table below.

Appropriate volumes of water are added aseptically to tubes or other vessels containing sterile nutrient medium of a concentration that will ensure the mixture corresponds to single-strength medium. For example, 10ml of sample would typically be added to 10ml of double-strength medium or 1ml of sample to 10ml of single-strength medium and so on. The tube must also contain a small inverted glass tube (Durham tube) to facilitate the detection of gas production. Growth in the medium is confirmed by visible turbidity and/or a colour change. Tubes are incubated without resuscitation, and the number of positive reactions is recorded after 24 and/or 48 hours, depending on the type of analysis.

Typical sample volumes and numbers of tubes for the multiple-tube method

Sample type	Number of tubes for sample volume:				
	50 ml	10 ml	1 ml	0.1 ml	0.01 ml[a]
Treated drinking-water	1	5	—	—	—
Partially treated drinking-water	—	5	5	5	—
Protected source water or groundwater	—	5	5	5	—
Surface water or water from open wells	—	—	5	5	5

[a] Volumes of 0.1 and 0.01 ml are tested by the addition of 1 ml of a 1/10 and 1/100 dilution sample, respectively, to 10 ml of single-strength culture medium.

Presence–absence tests

Presence–absence tests may be appropriate for monitoring good-quality drinking-water where positive results are known to be rare. They are not quantitative and, as their name suggests, they indicate only the presence or absence of the indicator sought. Such results are of very little use in countries or situations where contamination is common; the purpose of analysis is then to determine the degree of contamination rather than indicate whether or not contamination is present. Thus, presence–absence tests are not recommended for use in the analysis of surface waters, untreated small-community supplies, or larger water supplies that may experience occasional operational and maintenance difficulties.

Choice of methods

Very often the choice between the multiple-tube and the membrane-filtration methods will depend on national or local factors, e.g. the equipment already available or the cost of certain consumables. The advantages and disadvantages of each method should be considered when a choice has to be made; these are summarized in Table 4.5. The schematic decision-making network shown in Fig. 4.3 will aid the selection of procedure and method. The purpose of this diagram is merely to provide suggestions for the approach to be used; local or other circumstances will also affect the final decision.

Water quality standards, Ethiopia

No	Substance	Guideline Value (GN)
A	Treated Water Entering the Distribution System	
1	E.Coli or thermo tolerant Coliform bacteria	0/100 ml
2	Total Coliform Bacteria	0/100 ml
B	Treated Water In the Distribution system	
1	E.Coli or thermo tolerant Coli form bacteria	0/100 ml
2	Total Coliform Bacteria	0/100 ml

5.3 Data Analysis and Interpretation

The objective of surveillance is not simply to collect and collate information, but also to contribute to the protection of public health by promoting the improvement of water supply with respect to quality, quantity, coverage, cost and continuity. The aim of a surveillance program is to generate data that lead to optimization of activities and investment and thence to improved drinking-water supplies. Data analysis and interpretation are therefore fundamental components of the surveillance process.

So conduct analysis to link the assessment/inspection and water testing results.
For each type of water source the proportion or percentage of points recorded as positive for risk during the sanitary inspection gives a sanitary risk score. The scores associated with various levels of risk should be selected in the light of local circumstances. Because the objective is to produce a classification that facilitates remedial action, it is important to ensure that the proportion of supplies or point sources falling into each category is reasonably balanced. In the early stages of implementation a narrow range of scores in the "high-risk" category may be advisable in order to avoid overloading the workforce.

Table. Sanitary inspection risk scores

Risk score	Risk
0	No observed risk
1-3	Low risk
4-6	Intermediate risk
7-10	High risk

The term "risk" as used here indicates potential danger to human health from a water source or supply.

As with sanitary inspection, data on microbiological water quality may usefully be divided into a number of categories; the levels of contamination associated with each category should be selected in the light of local circumstances. Where community water supplies are unchlorinated, they will inevitably contain large numbers of total coliform bacteria, which may be of limited sanitary significance. It is therefore recommended that the bacteriological classification scheme should be based on thermotolerant (faecal) coliform bacteria or E. coli.

Table. Classification and colour-code scheme for thermos tolerant (faecal) coliforms or E. coli in water supplies

Count per 100 ml	Category and color code	Remark
0	A	In conformity with WHO
1-10	B	Low Risk
10-100	C	Intermediate risk
100-1000	D	High risk
>1000	E	Very high risk

The most effective means of consistently ensuring the safety of a drinking-water supply is through the use of a comprehensive risk assessment and risk management approach that encompasses all steps in water supply from catchment to consumer. Exposure to a pathogen or chemical can result in a number of outcomes, typically ranging from no effect (either no infection or asymptomatic infection) through mild self-limiting disease to mortality. For pathogens there may also be a range of sequelae (health effects that occur as a consequence to infection) that can result which should, where possible, be taken into account within the overall estimate of the burden of disease. For the purposes of risk analysis, the results of E. coli counts and sanitary inspection are combined. It is clear that there is a general tendency for the results to be distributed in a band running from the top right to the bottom left of the table. This is to be expected since a greater risk of contamination is likely to be associated with the occurrence of a greater degree of contamination. Nevertheless, a high sanitary risk score associated with low level faecal contamination still requires urgent action, as does a low sanitary risk score associated with high-level faecal contamination. It can be seen that the priority rating of such systems is high.

Fig. assessment of priority of remedial actions by risk analysis

Fig. Example of a completed risk analysis

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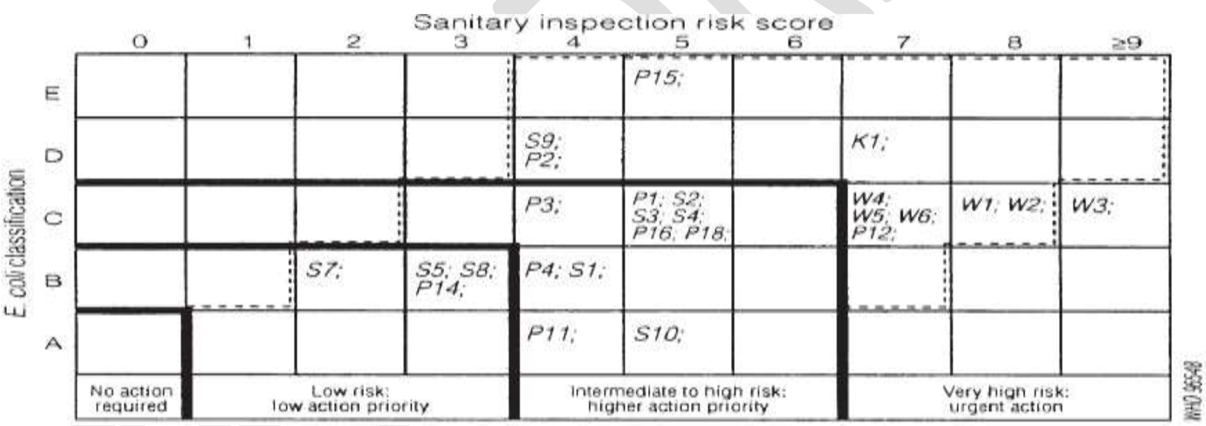

Note: Each number represents a water-supply facility

Table . Example of categorization of drinking-water systems on the basis of population size and quality rating in order to prioritize actions

Quality of drinking-water system[a]	Proportion (%) of samples negative for *E. coli*		
	< 5000 population	5000–100 000 population	> 100 000 population
A	90	95	99
B	80	90	95
C	70	85	90
D	60	80	85

[a] Quality decreases from A to D.

Table . Example of assessment of priority of remedial actions of community drinking-water supplies based on a grading system of microbial quality and sanitary inspection rating or score[a]

		Sanitary inspection risk score (susceptibility of supply to contamination from human and animal faeces)			
		0–2	3–5	6–8	9–10
E.coli classification[b]	A				
	B				
	C				
	D				

Low risk: no action required	Intermediate risk: low action priority	High risk: higher action priority	Very high risk: urgent action required

[a] Where there is a potential discrepancy between the results of the microbial water quality assessment and the sanitary inspection, further follow-up or investigation is required.

[b] Classifications based on those shown in Table 5.2. Quality decreases from A to D.

Source: Adapted from Lloyd & Bartram (1991). See also the supporting document *Rapid assessment of drinking-water quality*

Table Example of assessment of priority of remedial action for household drinking-water systems based on a grading system of microbial quality and sanitary inspection rating or scores[a]

		Sanitary inspection risk score (susceptibility of supply to contamination from human and animal faeces)			
		0–2	3–5	6–8	9–10
E. coli classification (as decimal concentration/100)	< 1				
	1–10				
	11–100				
	> 100				

Low risk: no action required	Intermediate risk: low action priority	High risk: higher action priority	Very high risk: urgent action required

[a] Where there is a potential discrepancy between the results of the microbial water quality assessment and the sanitary inspection, further follow-up or investigation is required.

5.4 Remedial and preventive measures

Intervention plan need to be developed in order to address the risk conditions to water quality (*Format annexed*).

VI. HOUSHOLD WATER TREATEMTN AND SAFE STORGAE

6.1 Introduction

Household water treatment and safe storage (HWTS) is an important public health intervention to improve the quality of drinking-water and prevent waterborne disease. HWTS interventions can lead to dramatic improvements in drinking water quality and reductions in diarrheal disease—making an immediate difference to the lives of those who rely on water from polluted rivers, lakes and, in some cases, unsafe wells or piped water supplies. Can significantly reduce diarrheal disease, as much as 45 % WHO (2014a) when used correctly and consistently by vulnerable population

HWTS intervention has the potential to fill the service gap where piped water systems are not possible, resulting in enormous positive health impacts in developing countries as a barrier to waterborne infectious disease due to source water contamination (e.g., home wells, cisterns or surface waters). Many piped water supplies are also microbiologically unsafe due to post-collection and post-treatment contamination during distribution, and HWT technologies can also be used to overcome this widespread problem. Similar small technologies can also be used by travelers in areas where the drinking-water quality is uncertain. If unprotected sources are the only option as sources of drinking water, the focus is to improve water quality at point of use (PoU).

Health outcome of HWTS can be optimized when ***effective*** technologies are used ***correctly*** and ***adopted*** through consistently and continued use over time.

6.2 Technology Options

HWTS technologies are any of a range of devices or methods employed for the purposes of treating water in the home or at point of use in other settings. These are also known as point-of-use (POU) water treatment technologies (Cotruvo & Sobsey). These technologies include: filtration, chemicals, disinfection by heat, solar and /or ultraviolet (UV), or combination of technologies, such as flocculant-disinfectants which applies multi-barrier approach. These categories of the technologies are being used by different segment of the population in Ethiopia, being promoted by Health Extension Workers and partners in the Country.

Categories of HWT Technologies

Technologies by treatment process	Description
1. Chemical Disinfection *Free chlorine disinfection*	Turbidity and chlorine demanding solutes inhibit this process; free chlorine x time product predicts efficiency Not effective against Cryptosporidium oocysts
2. Membrane, porous ceramic or composite filtration *Porous ceramic and carbon block filtration*	Varies with pore size, flow rate, filter medium and inclusion of augmentation with silver or other chemical agents
Membrane filtration (microfiltration, ultrafiltration, Nano-filtration, reverse osmosis)	Varies with membrane pore size, integrity of filter medium and filter seals, and resistance to chemical and biological ("grow-through") degradation
Fiber and fabric filtration (e.g. sari cloth filtration)	Particle or plankton association increases removal of microbes
3. Granular media filtration	
Household-level intermittently operated slow sand filtration	Varies with filter maturity, operating conditions, flow rate, grain size and filter bed contact time
Rapid granular, diatomaceous earth, biomass and fossil fuel–based filters	Varies considerably with media size and properties, flow rate and operating conditions

4. Combined technologies	
Flocculation plus disinfection systems (e.g. commercial powder sachets or tablets)	Applies multi-barrier approach
5. Solar disinfection *Solar disinfection (solar UV radiation + thermal effects)*	Varies depending on oxygenation, sunlight intensity, exposure time, temperature, turbidity and size of water vessel (depth of water)
6. Thermal (heat) technologies *Boiling*	Treatment to reduce spores (vegetative cells) by boiling must ensure sufficient temperature and time
7. UV light technologies using lamps *UV irradiation*	Excessive turbidity and certain dissolved species inhibit process; effectiveness depends on dose, which varies with intensity, exposure time, UV wavelength
8. Sedimentation *Simple sedimentation*	Effective due to settling of particle associated and large (sediment able) microbes ; varies with storage time and particulates in the water

(*Adapted from WHO 2011, evaluating household water treatment options*)(3)

6.3 Technology Choice

Many people simply want to be told the best technology for household water treatment. Unfortunately, there is no easy formula that will answer this question since there are many factors to consider. First of all, it is important to remember that household water treatment is a process (i.e. sedimentation, filtration and disinfection), not just a single technology. It is not easy to know which combination of technologies is the most appropriate. Many measures have the potential to seriously reduce diarrheal disease, each with its advantages and limitations depending on the local circumstances. Different technologies have varying suitability in each local situation.

The best process ought to be driven by a number of factors, including treatment effectiveness based on the source water quality and local contaminants, appropriateness, affordability, and acceptability for sustainable use by poor households.

Since the household water treatment process is dependent on so many different factors, there can be no standard solution. However, decision making tools are available to help identify the HWTS process that is best suited for the local context. The tools are participatory activities which encourage the involvement of different stakeholders in a group process. Participants can actively contribute to decision making, rather than passively receiving information from outside experts, who may not have an understanding of the local context and issues.

Participatory activities are designed to build self-esteem and a sense of responsibility for one's decisions. Experience shows that when everyone contributes to the decision making process, people feel more ownership of the problem and develop more appropriate solutions for their situation. Participatory decision making can empower communities to implement their own HWTS improvements.

The parameters needs to be considered in technology selection include: effectiveness in removing the pathogens, simplicity for operation and maintenance, robust and reliable, affordable for households, and accepted by the local community. Microbial performance and technologies certified by national regulatory authority should be the focus in technologies selection decision making.

WHO recommended performance classification of technologies is indicated below:

Microbiological performance targets for HWT technologies

Performance classification	Bacteria (log10 reduction required)	Viruses (log10 reduction required)	Protozoa (log10 reduction required)	Interpretation (assuming correct and consistent use)
★★★	≥ 4	≥ 5	≥ 4	Comprehensive protection (very high pathogen removal)
★★	≥ 2	≥ 3	≥ 2	Comprehensive protection (high pathogen removal)
★	Meets at least 2-star (★★) criteria for two classes of pathogens			Targeted protection
–	Fails to meet WHO performance criteria			Little or no protection

log 2=99.0%, log 3=99.9%, log 2=99.99%, log 5=99.999%

6.3 Elements in HWTS Implementation

There are three basic functions in HWTS implementation:

- Demand creation / promotion
- Access creation
- Monitoring and evaluation

6.3.1 Promotion

Promotional activities will be multi-level at national, regional and Woreda levels to mobilize resources towards the allocation of budget for water quality monitoring and surveillance. Decision-makers and social leaders at all levels must be informed on the role they play in achieving the National Goals of safe and adequate water. The promotion need to be carried out through selected and applicable communication channels. This will be mainly done through awareness building among stakeholders that preventive health interventions must be prioritized.

On the other hand, for safe handling and storage behavioral change communication as part of existing community conversation should focus on the following practices: always handling water with clean containers, use clean drinking cup/glass, water containers should always be properly covered and kept off the floor in clean place, no hand contact made during drawing water from containers and drinking, no Deeping and no use of common cup for the family and store drinking water in separate container.

Main activities to be undertaken:

a) Conduct public awareness creation on drinking water quality through multi-media approach
b) Promote household water treatment and safe storage and practices through demonstration and experience sharing
c) Promote social marketing on point of use water treatment technologies through Private Public Partners (PPP)
d) Introduce safe water management approach

Promotional methods

Community-Based Approaches

Community approaches engage community members, including formal and informal leaders, to engage in collective problem diagnosis, problem-solving, and action for change. Communities should be engaged in a range of collective analysis using a range of techniques such as community conversation tools as described in the National Community Led Total Sanitation and Hygiene implementation guide line.

Furthermore, there are a number of approaches designed to scale-up household water treatment and safe storage such as family dialogue method to involve households in protecting water at point of use. The following approach will be used for community involvement in water quality monitoring and surveillance especially in community managed water supply systems. Community will manage most of the remedial and preventive action based on the risk factors identified.

Media Communication

With the heavy reliance on promotion of HWTS methods or using safe water at point of use, as well as the need to engage political and social leaders in the efforts of protecting water quality throughout its destiny, communication and media are key partners in this attainment.

Communication and media can promote focusing the following main components:

- Marketing and scale up of proven household water treatment methods and safe storage as a lifestyle and social norm for whole communities.
- Linkages to existing high profile communication platforms like the world water and health days, Global Handwashing Days, World Toilet Days, etc.
- Reaching out pro-actively with communication to broader group of change agents like: Health Extension Workers, health development army, religious leaders, influential groups, agricultural extension workers, school children, school WASH clubs, women, and youths, CBOs, NGOs and WASHCOs.
- Continuous mass mobilization and media engagement in case of emergencies (flooding and AWD situation, etc)

Strengthening Household Outreach

Household visits are essential for household level change and must be achieved by coordinated and independent activities of government and development partners implementing capacity building activities at woreda level. The Health Extension Workers trained model households and health development army are to be the primary promoters of the small do-able actions, supported by Environmental Health Professionals, WASHCOs, agricultural agents and Health Development Team. The combined efforts of these all will expand reaching to households and communities. Effective household outreach needs to use participatory approaches which encourage negotiation, and allowing households to access analyze and take action within their existing means. Support to improving facilitation skills of all community-level workers is critical to the success of this approach.

Sanitation Marketing on Household Water Treatment Methods

Extensive promotion on safe and adequate water and the use of household water treatment methods may create demand for the use of treatment devices at household-level. This must be matched with sufficient supply to meet the growing demand for proven household water treatment devices. Therefore, social marketing is an approach aimed at both generating demand for improved devices and meeting that demand with improved supply of goods and services. The approach stimulates and facilitates improvements in the supply side of the service by utilizing small to medium scale private sector providers in the provision of the goods and service

6.3.2 Creating Access

To achieve national targets for HWTS possible pathways are indicated below:

1. Health Centers
- Large network of different health centers, near the target group
- Health Extension Workers to be engaged in promotion
2. Sanitation Business Centers:
- Large network of different Sanitation Business Centers & Farmer Centers with a range of products and services
3. Water Utilities (Drinking Water Companies)
- Utilities have a nation-wide presence
- Utilities are known as experts on drinking water
- Utilities are committed to provide 100% Safe Water at point of use
- They are service deliverers who operate financial management and can easily engage in additional business activities
- Utilities can play a role in promotion and sales of HWTS to most vulnerable target groups (unserved population)
- They can eventually also sell HWTS to existing client
4. Pharmacies
- It is an existing pathway in urban settings
- Engages the private sector

6.3.3 Monitoring and Evaluation

In order to develop effective mechanisms to encourage and sustain correct use of HWT, need to monitor and evaluate the uptake

- WHO/UNICEF tool kit including indicators helps

1. Process monitoring to assess programme implémentation and;
2. Quantitative analysis through surveys, direct observation and water quality monitoring.

- A set of 20 indicators are recommended which are grouped into:

Parameters

- Reported (self) and observed use
- Correct and consistent use (adherence) and storage
- Knowledge and behavior
- Other environmental health interventions
- Water quality

Refer to the WHO/UNICEF HWTS monitoring and evaluation toolkit for detail indicators and reference as well as to the WHO round 1 and 2 technologies evaluation results.

There is a household water treatment technologies regulation guideline for Ethiopia which describes the regulation process and requirements including certification.

VII. IMPLIMENATION PLAN

7.1 Institutional arrangement

The authority responsible for drinking-water supply surveillance is the Ministry of Health through its structure at regional, zone and district levels. Water quality surveillance unit at all levels in the health sector needs to be established. Ensure integration with water sector at different level in particular in using existing resources.

FMHACA is a responsible organization of regularly functions on drinking water quality including bottled drinking water and regulation of water treatment technologies.

Water supply and sanitation utilities are the direct service providers that are involved in the delivery of safe drinking water. Since these institutions are responsible to deliver 'safe' drinking water to the public, some of them conduct quality controls before they dispatch the water supply into the distribution system. However, such quality control practices are only conducted by those well-organized water supply services found in large towns and it is not universally conducted by all of them.

7.2 Roles and responsibility

MoH and Regional Health Bureau

- Guideline and tool development on water quality, surveillance and household water safety interventions
- Capacity building through trainings on different topic including water safety, testing and surveillance system as well as regulation
- Monitoring of high level indicators on water safety
- Quality surveillance through field evaluation, inspection at retail, and user feedback and complaints management
- Control unregistered products not to be promoted
- Awareness raising to stakeholders
- Water quality surveillance and response to reduce risks

District Health Office

- Conduct district water safety plan and support implementation in all kebeles
- Establish water quality testing laboratory
- Develop IEC materials on water safety

- Recognize water supply systems which performed best
- Conduct monitoring of water safety indicators and reporting in the district

Health Extension workers

- Conduct water quality monitoring at household level
- Work on awareness raising and behavior change on water quality and water safety including household water treatment to the community and households
- Monitor the status of hazards in the water supply system

Partners and private sectors

- Provide support at different level for effective intervention of water safety program

Manufacturer/applicants

- Oversee product quality, proper storage and distribution
- Address customer complaints
- Ensuring proper information of use and performance of HWT products
- Recording of product manufacture, distribution and dispatching list
- Cover cost for service and post market surveillance
- Apply the authority rules, procedures and principles
- Apply to the authority if any variation or known deterioration in performance of the technology
- Ensure sustainability of the supply chain like spare parts including information where to find, repairs, manuals

Implementers

Implementers are agencies who procuring and suppling to the public, for instance in case of emergency response and reaching vulnerable population to unsafe drinking water:

- Ensure HWT products pre distribution training to ensure proper use

- Ensure proper targeting of households based on vulnerability basis
- Conduct post distribution monitoring (PDM)
- Ensure sustainability of the water quality intervention

7.3 Capacity building

Training

The quality of the information and intervention produced by a monitoring and surveillance programme including HWTS depend largely on that of the work undertaken by the staff responsible for liaison with communities, filling in the sanitary survey report form, and undertaking water-quality analysis. The personnel responsible for data collection in the field therefore need to be trained in a number of skills, including interviewing, working with communities, observation, sampling, and water-quality analysis.

Adequate training in these areas will help ensure that monitoring and surveillance findings are standardized throughout the program and not subject to regional or local variations. The training strategies adopted will depend on:

- The previous training and experience of the staff allocated to surveillance;
- The range of activities to be undertaken by the surveillance agency and its staff (e.g. hygiene education may or may not be the responsibility of field staff);
- Local water supply practice;
- The practical organization of surveillance (e.g. whether water-quality testing is to be undertaken on site by field staff or in laboratories).

To ensure that the surveillance agency functions effectively, adequate training should be provided for staff at all levels. Separate training courses are required for field staff, laboratory staff, regional and national managers, and so on. Although not strictly training activities, workshops and seminars for the dissemination of surveillance findings are also important for promotional and motivational reasons. For field staff responsible for liaison with communities, on-site water-quality testing, sanitary inspection, and data reporting, the minimum training period should be 2 weeks. This assumes that staff have a general background in environmental health; considerably longer may be required if they have not already received relevant training.

Community capacity building

Awareness-raising in communities is the first step in a process of change. Informed and motivated individuals will begin to make the changes necessary to improve the water quality status of their homes and community, but additional knowledge and tools are necessary to improve the community's capacity to act as their own water quality custodians. While improved government surveillance systems and better practices among water service providers are significant steps, empowered communities are the key to significant and sustainable change. Training is only part of community capacity building – the strengthening of local management bodies and processes is also an important step.

Communities, knowing their own capacity, will be best able to choose – with the assistance of support agencies – what new skills are required to supplement existing resources. Training programmes can be designed accordingly. The use of participatory approaches will ensure that the community has ownership of the process and will be motivated to participate in training programmes and apply new skills. Community capacity building for water quality may be an independent initiative, or it may be part of a larger water and sanitation development programme.

7.4 Collaboration and coordination

Provision and ensuring safe drinking water is the responsibility of all individuals, households, communities and the relevant government and non-government sectors. It can be achieved through collective responsibility with mutually reinforcing roles played by the various sectors and partners at each level. This will ensures relevant sectors to work together based on the understanding that good performance in each sector makes a significant contribution to the achievement of policies and targets.

Empirical collaboration and integration of health and water sectors is needed to ensure effective surveillance and application of remedial actions through use of available expertise and other resources. It is also important to ensure partnership with partners including NGOs and private sectors to building the capacity of the health sector and community members for the implementation of surveillance and household water treatment interventions.

Ensue effective coordination system through strengthening and use existing coordination mechanism at all levels. Reviving and placement of proper coordination mechanism that could involve all stakeholders as per the signed Memorandum of Understanding (MoU 2012) is the first step. The existing WASH structure which is already stretched up to the kebele level is able to play the role of coordinating the relevant actors. The hygiene and environmental health task force under the health sector cascaded its structure at all levels, will be involved as contextual situation of each coordination level should plays a leading role in water quality surveillance and implementation of HWTS.

7.5 Monitoring and Evaluation

This refers to monitoring and evaluation of the water quality and surveillance program at different level including tracking the key indicators. There should be schedules visit to households and water supply chain, doing inspection and water sample collection and testing.

The progress should be reviewed, assess the impacts and the planning target revised overtime. Conduct periodic survey, document lessons and challenges of the program.

Key monitoring and evaluation Indicators

1. # of public health laboratories equipped with water quality equipment's and proper logistic arrangements
2. % of water supply schemes annually inspected
3. % of water supply systems with Water Safety Plan in their program,
4. % of water supply systems implementing remedial actions proposed by the surveillance agency.
5. Number of Woredas equipped with rapid water quality test kits
6. % of water supply facilities inspected
7. % of water supply facilities tested for water quality
8. % of water samples with positive results for E. coli in drinking water at the point of sampling,
9. % of water supply facilities meeting bacteriological water quality standards
10. % of water supply facilities meeting physicochemical water quality standards
11. % of households with positive results for E. coli in drinking water at the point of use
12. % of households with chlorine residual as per the national standards in drinking water treated with a chlorine product
13. Number of health workers including HEWs trained on water quality monitoring and surveillance
14. Number of WASHCOs trained on water quality monitoring and surveillance
15. Number of school WASH clubs trained on water quality monitoring and surveillance
16. % of trained health workers including HEWs practicing water quality monitoring as per training
17. % of households that use an improved drinking water source
18. % of households practicing correct use of recommended household water treatment technologies
19. % of households storing treated water in safe storage containers
20. % of households with access to improved drinking water sources
21. % of respondents who agree that their drinking water needs to be treated at home
22. % of respondents who believe others treat drinking water at home

23. % of respondents that feel confident they can improve the quality of their drinking water
24. % of respondents who know at least one location where they can obtain recommended household water treatment product(s)

Annexes:

Annex 1: Sanitary Inspection – Audit tool Indicators

District: ____________________

Kebele: ___________________________

Water source type: ________________________

Total beneficiary households ______________ population ______________________

Date of Assessment: ____

Water system	**Household**	**Distribution and Tap**	**Reservoir and Treatment**	**Source**
Piped water				
Boreholes with motorized				
Dug well with hand pump and manual				
Surface water (River/pond)				
Rain water harvesting				

Annex 2: Summary of hazards identification

Total # of Indicators: _________

Indicators fulfilled: _______, medium __________ totally not fulfilled_____________

Indicator	**Medium fulfilled**	**Unfulfilled**

Annex 3: Intervention planning format

Intervention	Timetable	Responsibility	Budget