Federal Democratic Republic of Ethiopia
Ministry of Health

National Drinking Water Quality Monitoring and Surveillance Strategy

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I. Executive Summary

The Federal Ministry of Health, as a surveillance agency of assuring water quality has taken a serious concern to address the gaps seen in water quality monitoring and surveillance. Beside the improvements of safe water coverage in the country, there could be some mechanism to ensure drinking water quality safety from source to consumption. As a result, development of water quality monitoring and surveillance strategy was envisioned as an important step as a requirement for subsequent development of detail guidelines and implementation manuals to be used at all levels. On the other hand, the strategy emanates from the health sector development program initiative which is identified through the review of existing sector policy and strategies.

Therefore, it is intended to contribute to the goals and visions of the health sector by strategically addressing safe water chain and water quality standard problems and challenges. The strategic intervention areas identified are further assessment and strengthening of the system, achieving inter-sectoral collaboration with defined roles and responsibilities at all levels, establish coordination mechanism and emphasize the importance of conducting multi-level advocacy, promotion and communication to revitalize water quality monitoring and surveillance activities to prevent contamination of drinking water from source to consumption in a sustainable way.

To effectively conduct water quality monitoring and surveillance activities, existing institutional arrangements particularly public health laboratories at national and regional levels. It also requires organizational capacity need assessment in relation to expected water quality monitoring and surveillance performance abilities. Accordingly, they will be strengthened for the gaps identified which should include: establishing water quality monitoring and surveillance database, capacity building in terms of human resource training and deployment, proper budget allocation and logistic arrangements.

In parallel, Ministry of Water and Energy could perform internal drinking water quality assurance as stipulated in the sector mandate. It is also expected to build performance capacities of water supply service providers to implement proposed remedial action by the surveillance agency which might include periodic preventive maintenance of drinking water delivery systems as well as there should be Water Safety Plan to prevent contamination of drinking water using multiple barrier system from source to the point of use. In addition, other stakeholders were involved in the process of the development of the strategy that the participants represented have been equally sharing the responsibilities to improve existing situations concerning water quality monitoring and surveillance.

This five years (2011-2015) strategic document has the methods and approaches of monitoring-evaluation with proposed indicators which are addressed in it. The National Drinking Water Quality Monitoring and Surveillance strategy implementation requires **21,830,622USD**. The Strategy is intended to be used by policy makers, programme implementers, planners, partners, research institutions and those who are concerned with the water and public health.

II. Acknowledgment

The Federal Ministry of Health greatly acknowledges WHO Ethiopia Country Office for organizing financial and technical support in development of the National Drinking Water Quality Monitoring and Surveillance (NWQMS) Strategy. The National Hygiene and Sanitation Taskforce (NHSTF) is highly appreciated in taking the lead of the whole process especially Mr. Waltaji Terfa, NPO,WHO and Mr. Getachew Belaineh, WASH Specialist, UNICEF/FMOH and Mr.Dagnew Tadesse, Officer, FMOH for developing the concept note, draft preparation and finalization including editorial work. The Ministry would also like to thank partners and stakeholders who actively involved in the development of the strategy from its draft to final stages. In general, FMOH would like to express its sincere gratitude for all the individuals and groups listed below who made remarkable and immense contributions towards the successful development of this strategy.

Name	Organization
Abiy Girma	Federal Ministry of Water and Energy
Shemsedin Bamboro	FMOH, Public Relation and Communication Directorate
Behailu Shimelis	Addis Ababa Water and Sewerage Authority
Chanyallew Tadesse	Federal Ministry of Health
Ejegayehu Yeshitela	Ethiopian Food, Medicine and Health Care Control and Administration Authority
Mulugeta Mekonnen	Quality Standard Authority of Ethiopia
Tamene Gossa	UNICEF
Abyot Bekele	EHNRI, Public Health Emergency Management
Yared Legesse	WHO WASH Consultant
Zereu Girmay	Environment Consultant
Zinash Tsegaye	Netherlands Developmental Organization-SNV Ethiopia

Furthermore the Ministry of Health extends its special thanks to participants of the National Drinking Water Quality Monitoring and Surveillance (NWQMS) Strategy validation workshop from Federal Sector Ministries (Water and Energy, Agriculture, Investment Agency, Government Communication Affairs Office), Developmental partners (UNICEF, WHO, International and local NGOs, religious

organizations) and all Regional Health, Water and Energy Bureaus. The participant list is annexed to this strategic document.

III. Forward

The health of the community entirely depends on the availability of adequate and safe water. Hence, water is primarily essential for life, health and for human dignity. Therefore, in addition to public health benefits, all people have the right to safe and adequate water accessed in equitable manner for drinking, cooking, personal and domestic hygiene. In this case, both adequacy and safety of drinking water are equally important to reduce the occurrence of water-related health problems especially diarrheal diseases.

However, the access coverage of safe water provision and utilization in the country is not yet ensured to address the increasing water demands from a growing population, economic expansion and increasing mean water required per capita. The worst condition is that many communities in the rural part of the country are still using unprotected water sources 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 faecal 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. Both infant and under five mortality rates are categorized still highest (77/1000, and 123/1000 respectively).

Therefore, to bring major changes in improving drinking water quality for significant reduction of diarrheal diseases and other public health benefits, there should be strategic action for addressing safe water chain from source to consumption. On the other hand, implementation of the strategy and achieving its overall goal requires the combined effort of all stakeholders including donors and partners. 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.

In general, Ministry of Health as responsible body to verify water quality standards will lead the implementation of the National Water Quality Monitoring and Surveillance Strategy. To do this, existing institutional arrangement will be strengthened, inter-sectoral collaboration and coordination mechanism that will involve all relevant stakeholders will be in place and multi-level advocacies, promotion and communication will be

conducted. Finally with such established capacities at all the tires and existing well structured health service delivery system to the grass route level, implementation of the strategy will be enhanced to meet water quality standards of the country for public health protection.

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V. Acronyms

ADB	African Development Bank
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
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 Programme
MDGs	Millennium Development Goals
MIS	Management Information System
MoE	Ministry of Health
MoU	Memorandum of Understanding
NGOs	Non Governmental Organizations
NHSTF	National Hygiene and Sanitation Task Force
NWQMS	National Water Quality Monitoring and Surveillance Strategy
PASDEP	Poverty Alleviation and Sustainable Development Programme
PoU	Point of Use
QSA	Quality Standards Authority
RADWQ	Rapid Assessment of Drinking Water Quality
SNV	Netherlands Development Organization (interpretation)
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
WQMS	Water Quality Monitoring and Surveillance
WSP	Water and Sanitation Program
WSS	Water Supply and Sanitation

1. Country Background

Ethiopia is located in the East of Africa. The neighbouring countries are: Somalia and Djibouti in the East, Eritrea in the North, Sudan in the West, and Kenya in the South. It stretches with geographic coordinates of 3^0-15^0 N and 33^0-48^0 E with estimated area of 1,104,300 sq km. Ethiopia is a country with great geographical diversity. The topography varies ranging from high peaks of 4,550m above sea level to a low depression of 110m below sea level. The predominant climate type is tropical monsoon, with temperate climate on the plateau and hot in low lands. Usually highlands receive more rain fall than the lowlands.

The current projected population of the country, (i.e. projected from the Census conducted in 2007) is about 80 million with nearly equal male to female ratio. The average size of each household is 4.7. The life expectancy has been estimated as 53.4 for males and 55.4 for females.

Ethiopia has a Federal government structure. The country has nine Regional States and two city Administrations for Addis Ababa and Dire Dawa. The regional states and city administrations are sub divided into Woredas (districts). The Woreda is the basic decentralized administrative unit and has an administrative council composed of elected members. Regions and districts have also regional sector bureaus and line district sector offices respectively for the management of sector services including health, water and education at their levels. There are about 801 Woredas which are further divided into about 16,253 Kebeles

Ethiopian economy largely depends on agriculture. About 54% of the gross domestic products (GDP) are coming from agriculture. As per the PASDEP document, any development focuses to end Poverty, which the attention in the health sector program, (HSDP) includes to address poverty-related health problems. The government is also committed to meeting targets set by global initiatives, notably the Millennium Development Goals (MDGs). Currently Ethiopia has endorsed a new five year Growth and Transformation Plan which is going to be implemented as of the present year. The GTP is an ambitious plan that seeks to fundamentally transform the Country’s economy and thereby improve the standard of living of its population.

2. Introduction

The quality of drinking-water is a powerful environmental determinant of health. Assurance of drinking-water quality has been a pillar of primary prevention for more than 150 years and continues to be the foundation for the prevention and control of waterborne diseases. Water can and does serve as a medium for disease transmission in countries on all continents; all are affected, from the poorest to the wealthiest. The most predominant waterborne disease, diarrhoea, 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 diarrhoea, representing 15% of overall mortality in that age group. More than 50 Member States continue to report cases of AWD every year. It is estimated that 50% of cases of malnutrition are associated with repeated episodes of diarrhoea or intestinal helminthiases. Childhood malnutrition is at the root of 35% of all child mortality.

There are several variants of the feco-oral pathway of waterborne disease transmission. These include contamination of drinking-water catchment areas (by human and animal feces) and sources (through inadequate disposal of human or animal excreta, or domestic or industrial waste).Transmission can also result from contamination in the distribution system (through “leaky” 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]

Despite major progresses have been made to improve the health status of the population in the last one and half decades, in Ethiopia the 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 a considerable proportion is directly related to unsafe water. The average Ethiopian child usually suffers five to twelve diarrhea episodes a year basically resulting from poor

environmental sanitation; and between 50, 000 to 112,000 under five children die annually due to the same cause.

[1]S*IXTY-FOURTH WORLD HEALTH ASSEMBLY A64/24Provisional agenda item 13.15, April 2011*

To alleviate the above mentioned challenges, Ethiopia has prepared Universal Access plan for Water Supply, Hygiene and Sanitation Strategic Action Plan (2011-2015) and signed Memorandum of Understanding between Ministry of Water and Energy and Education sectors. More specifically, National Water Quality Monitoring and Surveillance Strategy is the live gap in implementing the Drinking Water Quality Standards in coordinated efforts. Therefore the Ethiopian government showed dedication and commitment in developing National Drinking Water Quality Monitoring and Surveillance Strategy with the involvement of multitudes of partners in the arena.

2. General Considerations

There is high level of political commitment and fertile ground to improve existing health, drinking water, sanitation, and hygiene situations. The country's health policy focuses on providing quality promotive and preventive health services in an equitable manner. To implement the health policy a series of Health Sector Development Programs were prepared in which the recent one is HSDP IV. HSDP IV indicates that safe water provision is one of the program initiatives. The government has also endorsed water resource management policy followed by the Universal Access Plan which features ambitious targets to be achieved by mid 2012. In addition, donors and international organizations including WHO, UNICEF, WSP/WB, ADB, SNV, Water Aid, Plan International and local organizations that operate with substantial donor funding are contributing a combined effort under the coordination of FMoH through establishing the National Hygiene and Sanitation Task Force (NHSTF).

Potential pollution sources that pose threats to drinking water are open field defecation, animal wastes, plants, economic activities (agricultural, industrial and businesses) and even wastes from residential areas as well as transportation systems. Any water sources, especially older water supply systems, hand dug wells; spring-fed systems (including treatment plants, reservoirs, pressure breaks, pipe net works, and delivery points) are vulnerable to such contamination. Particularly systems with casings or caps that are not water-tight are most vulnerable. This is particularly true if the water sources are located close to surface runoff that might be able to enter the source. Another way by which pollution reaches and enters a water supply is through inundation or infiltration by flood waters. Flood waters commonly contain high levels of contaminants.

The health of community highly 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 major five key elements are vital which includes quantity, quality, cost, coverage and continuity. Most of the time the occurrence of communicable diseases in the country is related with water supply conditions in the locality. Basically, infectious diseases affected by changes in the water supply situation are categorized as follows:

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

Based on the morbidity records, there is still a high occurrence of communicable diseases which most of the time is related with 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.

Therefore, the Federal Ministry of Health has taken a step to address the gaps seen in water quality monitoring 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.

2.1 Components of Water Quality Monitoring and Surveillance Activities

Monitoring and surveillance in relation to water quality is careful watching and protecting drinking water from possible contamination risks. This requires a continuous and systematic sanitary inspection and water quality testing of samples taken at different time and points of the whole water supply system from catchment to end users. Monitoring and 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. The components of water quality monitoring and surveillance 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.

2.1.1 Institutional Inspection and Analysis

Institutional inspection of water supply system will help to identify poor operation and maintenance situation of relevant functions like defective design, ineffective supervision, inadequate training, lack of inter-sectoral coordination resulting in capacity gaps and absence of clarity of roles, which as a consequence the water supply components fail to operate at optimum efficiency.

2.1.2 Sanitary Survey and Analysis

Sanitary survey as component of water quality monitoring is the on-site inspection and assessment of potential contamination risks including water supply facility condition, health hazard application and practices around all schemes. However, sanitary survey is not an alternative to water quality analysis but is an important component and may be a prerequisite to conduct laboratory based analysis. Public utilities and citizens can then use the publicly available study results to take remedial actions to reduce potential sources of contamination and protect drinking water.

2.1.3 Microbiological Water Quality

The total coliform group has been selected as the primary indicator bacteria for the presence of disease causing organisms in drinking water. It is a primary indicator of suitability of water for consumption. If large numbers of coli forms are found in water, there is a high probability that other pathogenic bacteria or organisms exist. The WHO and Ethiopian drinking water guidelines require the absence of total coliform in public drinking water supplies. The frequency of testing for public water supplies depends on the size of the population served.

2.1.4 Physicochemical Quality of Drinking Water

A number of chemical contaminants have been shown to cause adverse health effects in humans as a consequence of prolonged exposure through drinking-water. These include, both organic and inorganic chemicals including some pesticides. Some of them are toxic to humans or affect the aesthetic quality of water. In this regard the WHO has put forward guideline values that set limits for many of the contaminants in drinking water.

Ethiopia has also prepared its own drinking water quality specification in line with the international norms and values. The Quality and Standards Authority of Ethiopia have stipulated legally binding drinking water quality specifications (i.e. ES 261:2001) in 2001. The Ethiopian standard ES 261:2001 set limits not only for the physico-chemical parameters but also for Microbiological and radiological

parameters (see Annex II). Even though it is still found in its draft form and not adopted by the appropriate organs of the government, the Ministry of Water and Energy have also prepared draft guidelines for specification of drinking water quality. The later drinking water specification prepared by the FMoWE appears to be more or less similar to the one prepared by the QSA except on few physicochemical parameters in which it is more relaxed and lenient.

The above findings of the components of Water Quality Monitoring and Surveillance Activities indicated from 2.1.1-2.1.4 will be processed, analysed and evaluated. Based on these results, appropriate remedial actions could be intervening as per the existing guidelines of the Water Quality Monitoring and Surveillance.

3. Situation Analysis

3.1 Water Supply Coverage

Coverage of water supply is a development area which has been showing an increasingly progressive growth in Ethiopia. This is particularly the case with respect to rural water supply coverage. The Water sector development plan which was prepared in 2001 showed that the rural water coverage was standing at 23.1% during that year. Later the Universal Access Programme which was published in 2005 reported that the proportion of the rural people that benefited from clean water had reached to 35%. The recently published Water Supply and Sanitation PASDEP II (WSS PASDEP II) which was released in January 2010, indicated that the rural water supply coverage to have increased to 60.8%. This coverage assumes accessing 15 litres per person per day within 1.5 km distance in rural areas where as getting 20 litres per person per day within 0.5km in urban areas. In a similar manner, WSS PASDEP II has indicated that the current water supply coverage in the urban areas to have reached 88.2%. Clearly it can be seen that though the coverage have shown considerable improvement over the last decade, it remains far from adequate to fully satisfy the demand of the population for safe drinking water. As a result the UAP and WSS PASDEP II are designed with the aim of raising the rural and urban water supply coverage to about 98% and to 100% respectively by the end of 2012.

Many communities in the country use unprotected water sources. Rural communities mostly use unprotected springs and hand-dug wells. Other groundwater sources for some communities include shallow-drilled wells, deep-drilled wells, ponds, lakes, streams, and rivers. Roof water-harvesting techniques are used to capture rainwater when there is rain. These sources are exposed for contamination from human activities and naturally occurring events. The biological contamination usually originates from human and animal wastes. There is also a potential health risk of re-

contamination during collection, transportation, storage and unsafe drawing cups at household level. The potential contamination also includes physical and chemical hazards. The physical impurities affect the palatability of the drinking water due to bad smell, odour and unsightliness of the water.

The Ministry of Water and Energy is planning to conduct a national inventory on the existing Water Supply, Sanitation and Hygiene (WASH) schemes found in the entire Country starting this year. The inventory is expected to generate complete Water Supply, Sanitation and Hygiene baseline reports which will create an opportunity to understand the existing water supply sources and quality

3.2 Status of Water Quality Monitoring

Water quality monitoring in the health sector has not been well addressed. The focus on WQMS appears to diffuse further with the absence of clearly defined roles between the health promotion and disease prevention directorate and the newly established regulatory agency of the ministry. Existing institutional arrangements in relation to water quality assurance entirely lack focus and are with a lot of constraints which includes lack of proper budget allocation and logistic arrangements. Therefore, the demand for assuring water quality is not responded to and the status of drinking water quality vis-a-vis the national standard was not checked. Hence, there was lack of updated information for decision making and to plan for interventions as deemed necessary.

Water quality testing was being largely conducted on demand bases except for the national rapid assessment of drinking water quality (RADWQ) which was conducted from December 2004 to April 2005. According to the RADWQ assessment report only 72% of the facilities met water quality standards[3]. For example the recommendation of the National Water Quality Rapid Assessment Report is not yet implemented and water quality monitoring and surveillance has not been done since 2005[2]. There are no regular water quality monitoring and surveillance activities conducted on a scheduled and continuous basis Though there are laboratories at national, regional and sub regional levels, these facilities are not uniformly organized and equipped with standard instrumentation and supplies particularly for water quality analysis and no follow up is made to strengthen the facilities. There is also shortage of trained human power at all levels.

Drinking water quality monitoring as a regular and continuous activity is an area which is less practiced by the main actors in the water supply sector. The Federal Ministry of Health owns a laboratory and portable field kits which are dedicated to undertake physico-chemical and Microbiological analysis of drinking water samples. These facilities are mostly used to conduct analysis of water samples collected from new water supply schemes to verify its suitability for drinking purposes. Usually such samples are

tested only once before the schemes are made to enter into operation. In addition, the ministry conducts extensive water sampling and laboratory analysis as a response for an emergency situation caused by waterborne epidemics. Sampling of such water quality monitoring lasts as long as the outbreak is put under control Quiet often the ministry also undertakes drinking water quality analysis of certain water supply schemes in response to requests made by different public organizations, NGOs, and others that are necessitated by public health or other relevant concerns. Apart from these, the ministry appears not to have regular and continuous programmes of drinking water quality monitoring. For example, an exception to this is the ongoing effort of the ministry to develop drinking water quality map of the Country. In an interview conducted with the staff of the Drinking Water Supply and Sanitation Directorate of the Ministry it was indicated that the water quality team was implementing a drinking water sampling and analysis programme for the last two to three years with the objective to develop drinking water quality map for the whole of Ethiopia. It was reported that sample collection and analysis from few regions is completed and the remaining regions will be covered in the future.

Drinking water quality monitoring in the regions also follows more or less the same pattern as discussed in the above paragraph. However, the frequency of monitoring is often better in the regions than it is at the Federal level. Most of the regions do have their own water quality laboratories. The existing drinking water quality monitoring practices at the Federal and regional level tends to be more reactive than preventive.

It was stated elsewhere that the urban water supply and sanitation services are the once that are responsible for the production and distribution of safe drinking water to the urban population. As a consequence most of the water utilities of the bigger cities run water treatment operations and perform quality control checks on their treatment processes. The objective of this kind of monitoring is clearly to verify whether the water is fit for the intended use, which is for drinking and domestic supply purposes. There are also towns that continuously conduct the water treatment activities (i.e. chlorination) but do not have the resources and the capacity to perform the quality control checks. In totality, however, it is in these water supply and sanitation authorities that a continuous and preventive type of water quality control checks are done.

With regard to community involvement in water quality monitoring and surveillance there is no significant involvement of community in the water quality management. As there is scarcity of potable water in the country, communities give priority to quantity than quality. There is also little awareness creation work done regarding water quality issues in the country.

3.3 Level of Integration and Coordination With Respect to WQMS

Until recently the roles of the two main sectors that are involved in drinking water quality assurance, i.e. FMoH and FMoWE with their regional counterpart bureaus were mainly working based on their restricted mandates. After the signing of the Memorandum of Understanding between the FMoH, FMoWE and MoE for the implementation of the WASH programmes the role confusions were fundamentally cleared and the importance of concerted actions to ensure safe drinking water to the community emphasised. Implementation of the WASH MoU has now created an opportunity for coordination between the water suppliers and public health regulators at all levels.

3.4 Existing Institutional Arrangements with Respect to Water Quality Monitoring.

The recent business process reengineering conducted in the federal FMoH has come up with Health Care Delivery Core Process. The stated core process consists of Health Promotion and Disease Prevention (HPDP) General Directorate and three other directorates (i.e. Agrarian, Pastoralist and Urban) as the main functional sub-processes. These directorates have no separate units for water quality monitoring and surveillance activities.

There are a number of government organs within the water sector that could be considered to have a certain role in the exercise of drinking water quality monitoring. The main ones include the Federal Ministry of Mines, the Regional Water Bureaux and the urban water supply and sanitation utilities. These organizations work at different levels and their role in the process varies. The Ministry of Water and Energy consists of a water supply and sanitation directorate under which exists a small unit for Drinking Water quality Monitoring.

In a similar way regional Governments have established their own regulatory bureaus of water, mines and energy or bureaus of water resources development. Most of the regional bureaus have branch offices in the zones and woreda's. The Woreda offices are organized and staffed to deal more with rural water supply than urban. Functions as monitoring water quality are among the regulatory activities of the regional bureaus and it is believed to have been undertaken more frequently than is by the Federal body.

Water supply and sanitation utilities are the direct service providers that are involved in the delivery of safe drinking water in urban areas. Since these institutions are the once 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.

3.5 SWOT Analysis of the Water Sector in Relation to WQMS

a) Strengths

There are several factors in the water sector that lay the ground for the implementation of the WQMS strategy. One among them is the commitment of the government to provide acceptable quality of drinking water. The initiative taken by the FMoWE to prepare the Drinking Water Quality guidelines, which is still found in its draft form, is a measure taken towards ensuring the provision of acceptable water quality to the people. The government have accepted the MDG goals and is working to implement it by implementing the universal access programme. On the other hand the existence of regional water bureaus with a structure down to the woreda level and the presence of water quality laboratories in most of the regions is another strong side of the sector that creates favourable condition for WQMS. The practice of water quality testing for newly constructed large scale water supply schemes both by the federal and regional laboratories is a strong side that can contribute to WQMS. In this regard the decentralization of the management of urban water supply utilities and water supply schemes also encourages the undertaking of water quality control and WQMS activities.

b) Weaknesses

There are noticeable downsides in the water sector with regard to WQMS. Perhaps the root cause for these is the comparatively less focus given to water quality monitoring as compared to provision of access and coverage. The primary focus of the UAP, WSS master plan, WSS PASDEP II is on expanding access and coverage of water supply and do not contain detailed plans for water quality. These have led to the absence of comprehensive and regular internal drinking water quality monitoring practices in the sector. The fact that most of the water sampling campaigns are conducted in response to emerging public health concerns or emerging epidemics makes the whole exercise to be reactive; which is weaker in providing sustained safe drinking water than preventive approaches. The absence of an organised and well equipped central laboratory for water quality monitoring at FMoWE level is another downside for the practice of WQMS. In addition most of the urban water supply utilities lack sufficient capacity to monitor the quality of water they produce. Awareness raising activities in the area of drinking water quality that target the community are also weak. The absence of fully functional data management system that enables to store data generated by the regional bureaus, urban water supply utilities, and other community managed water schemes is also another downside of the sector.

c) Opportunities

The joint implementation of the WASH program by the water, health and education sectors creates a unique opportunity for both the water and health sectors. The WQMS strategy can benefit from the structures of the WASH programs during its implementation.There are a number of organizations, both governmental and non-governmental, that works in the area of Water supply and Sanitation in collaboration with either the Ministry of health or the ministry of Water and Energy. These different stakeholders can be broadly grouped into the following four categories.

- Community
- Partners (Donors)
- Private sector
- Regulators (QSA)

d) Threats

Pollution of water sources due to extensive economic activities on water shades, agricultural or industrial wastes discharged into water bodies including underground aquifers will be threats for water quality. Such pollutants may require high technology for removal of the contaminants which makes the cost of water treatment unaffordable. This threat may affect the sustained provision of safe drinking water.

3.6 SWOT Analysis of the Health Sector in Relation to WQMS

a) Strengths

One of the overarching principles of the health policy is to promote preventive approaches in the health care system. The health policy is implemented by a series of health sector development plans (HSDPs) that were prepared every five year. This underlies the fundamental basis for the implementation of strategies such as the WQMS. Furthermore, out of the sixteen health extension packages included in HSDP IV seven of them are environmental health packages and one from among them mainly focuses on safe water management. This again demonstrates the enabling and favorable environment for the implementation of WQMS by the health sector. The presence of regional health bureaus whose structures goes down to woreda level, the presence of health extension workers in each woreda and kebelle throughout the country, and the presence of environmental health professionals at woreda and health center levels all contribute to the strong sides of the sector for WQMS strategy implementation.

The newly established regulatory arm of the FMoH which is FM HACA with its structures expanded to the regional level also adds to the strengths of the sector in relation to WQMS. The sector also has

regional and sub-regional public health laboratories staffed with microbiologists that create additional favorable conditions for WQMS. The EHNRI is another public health laboratory present at the federal level.

b) Weaknesses

Clearly one of the down sides in the health sector in relation to WQMS is the lack of clear strategy and guidelines that can direct all stakeholders and partners to collaboratively work towards the same goal of ensuring the delivery of safe water to the community. Lack of capacity building through in service training and the unavailability of water quality testing equipments and other related logistics at woreda level due to shortage of resources are among the weaknesses attributable to the health sector. In similarity with the water sector awareness raising activities in the area of drinking water quality and safe water chain practices that target the community are also weak. There is also inadequate safe water management at household level that can be related to weaknesses in promoting the practices by the sector.

c) Opportunities

The increased emphasis given to the WASH programme and the signing of the Memorandum of understanding (MoU) among the three sector ministries (health, education and water) followed by establishing the WASH structure at all levels is again a good opportunity to build upon in order to implement the WQMS strategy. Moreover the presence and implementation of the National Hygiene and Sanitation Strategy with the protocol which encourages household water treatment and safe storage and proper hand washing at critical times, also creates additional opportunities to build upon while implementing the WQMS.

4. Vision, Goals, Scope and Objectives of the Strategy

Vision: To ensure all Ethiopians have potable and safe water in order to realize a healthy, productive and prosperous society.

Goal: The overall goal of the WQMS strategy is to reduce morbidity and mortality attributable to use of unsafe drinking water and to maximize public health gain.

Scope: The scope of the strategy covers conventional and community managed drinking water supply systems and household water treatment and safe storage practices.

4.1 Objectives

4.1.1 Strategic Objective

To ensure the quality of drinking water supply both Microbiological and physicochemical from source to the point of use through WQMS to fulfil the nationally set standards.

4.1.2 Strategic Objectives

The strategic objectives are:

- To strengthen the system to regularly monitor physicochemical and microbiological critical parameters and sanitary inspection (Surveillance).
- To ensure that physicochemical and microbiological standards of drinking water are met.
- To promote safe management and storage of water at community and household level in order to maximize the public health importance.
- To improve the provision of water quality monitoring and surveillance information for decision makers and users to support preventive and remedial actions.
- To strengthen multi-sectoral stakeholder's coordination and collaboration at all levels.
- To improve the capacity of WQMS laboratories at national and regional levels(public health laboratories)

5. Water Quality Monitoring and Surveillance (WQMS) Approaches and Strategic Directions

Monitoring and surveillance in relation to water quality is the ceaseless watching and protecting of drinking water from possible contamination risks. This requires the combined efforts of all relevant actors at all levels. To achieve the intended targets in water quality, the following approaches and strategic direction options are recommended.

5.1 The Multiple Barrier Approach

The detection of microbial and chemical constituents in both raw water and water delivered to consumers is often slow, complex and costly, which limits early warning capability and affordability. Water supply systems can be considered as a number of steps aimed at assuring the safety of drinking-water, including:

- Preventing pollution of source waters;
- Selective water harvesting;
- Controlled storage;
- Treatment prior to distribution;
- Protection during distribution; and
- Safe storage within the home and, in some circumstances, treatment at the point of use.

The most effective means of assuring drinking water quality and the protection of public health is through adoption of a preventive management approach that encompasses all steps in water production

from catchment to consumer. The risk management approach is based largely upon HACCP (Hazard Analysis and Critical Control Point). The principles of HACCP are based on developing an understanding of the system, prioritising risks and ensuring that appropriate control measures are in place to reduce risks to an acceptable level. The national standard for critical water quality parameter for physicochemical and Microbiological analysis, which will be used in this strategic document, is attached for reference (Annex II).

5. 2 House hold Water Treatment and Safe Storage Approach

Household water treatment practice is a solution primarily for point of use interventions. If unprotected sources are the only option as sources of drinking water, the focus is to improve water quality at point of use (PoU) which are practiced at household level. These techniques should meet the criteria set by WHO. The parameters for such techniques include simplicity for operation and maintenance, robust and reliable, affordable for households, and accepted by the local community.

Currently the following household treatment methods are being promoted by health extension workers in the Country. These are boiling, filtration Chemical disinfection and use of direct sunlight radiation.

5.3 Strategic Directions

The strategic directions addressed in this document are summarized as four inter-dependent pillars. Three of the four core issues facilitate the realization of water quality monitoring and surveillance interventions at all levels. Under each pillar various action points are encompassed. The pillars are,

1. System strengthening and mainstreaming
2. Intersectional collaboration, coordination and partnership
3. Water quality monitoring and surveillance
4. Promotion, advocacy and communication

The articulation of the strategic directions, in relation to the goal and objective of the strategy are shown in the following diagram.

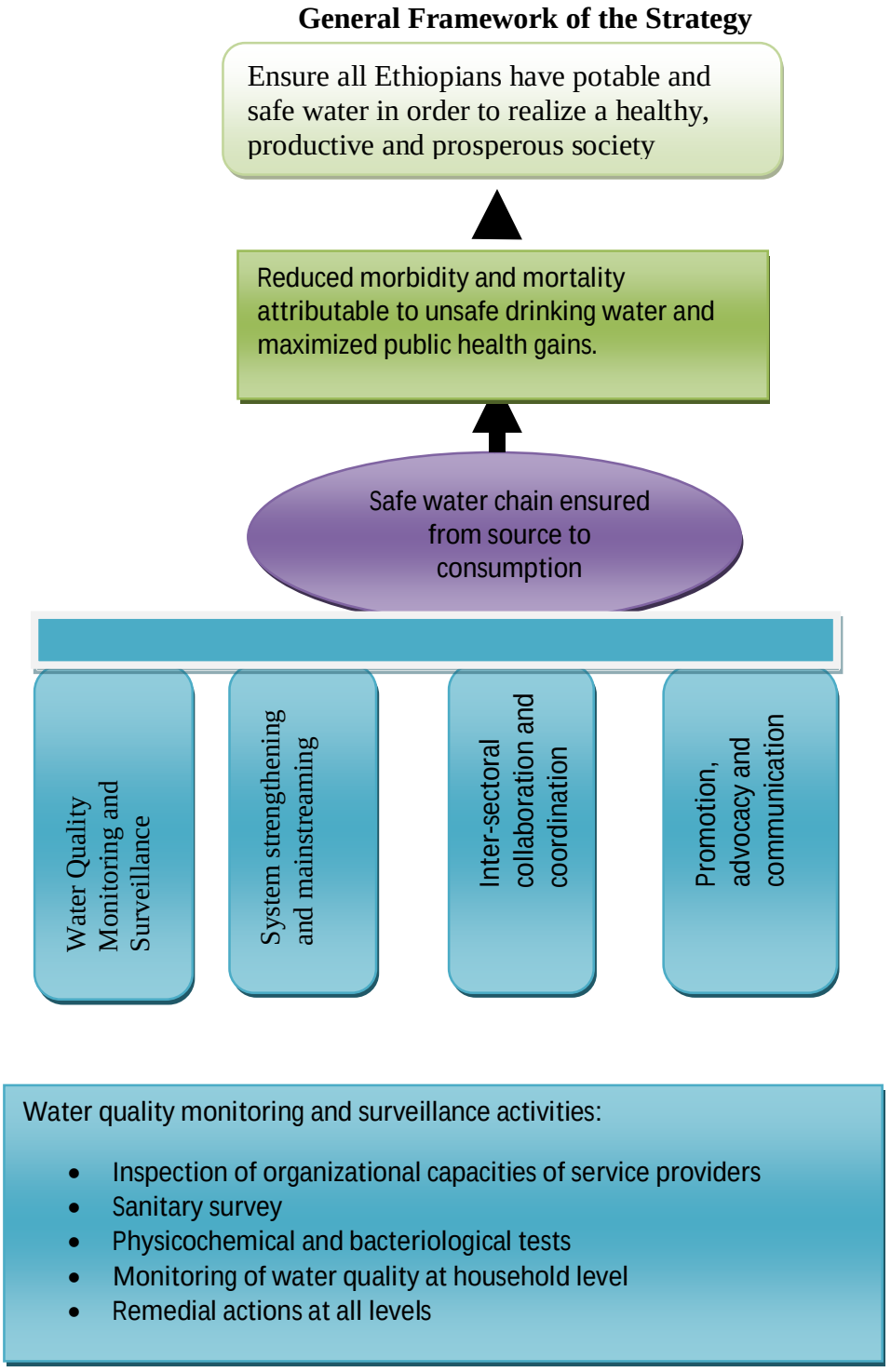


Diagram1: Schematic Diagram of the Strategy Framework

5.3.1 System Strengthening and Main Streaming

The existing drinking water quality monitoring and surveillance system is characterized by inadequate capacity, irregularity, poor management and integration. It has also been discussed elsewhere that the practice of water quality control and safe water delivery by the water suppliers is far from adequate and it is non-uniform. Therefore, one issue that urges for strategic action is the need for uniform and standard system of monitoring safe water delivery by the suppliers. This strategy is designed to be

implemented using the already established system. Thus, the following activities are identified to strengthen the drinking water quality monitoring system through integrating activities in to sectoral strategic and annual operational plans.

a) Conduct needs assessment in relation to laboratory equipment, material, human resource, training, necessary guidelines and procedures.

b) Provide step wise water quality monitoring equipments, field kits and supplies.

c) Provide training to improve technical skills on water quality monitoring and surveillance.

d) Develop guidelines, manuals and procedures to support standardized, uniform and comparable practices of water quality monitoring and surveillance.

e) Integrate WQMS plan into sector strategic and annual operational plans.

f) Link and integrate WQMS information to WASH MIS and existing HMIS for preventive and remedial actions.

5.3.2 Water Quality Monitoring and Surveillance

There are different water supply systems ranging from large scale conventional water supply system to small scale community managed water supply schemes in the Country. Most of the conventional water supply systems which involve water treatments and distribution systems are normally run by water supply and sanitation utilities found in urban settlements. On the other hand nearly about 40% of the Ethiopian population depend on different types of unimproved water sources.

According to the WHO drinking water guidelines a preventive management “framework for safe drinking water” comprise five key components. These are:

- Health-based targets based on an evaluation of health concerns
- System assessment to determine whether the drinking-water supply (from source through treatment to the point of consumption) as a whole can deliver water that meets the health-based targets
- Operational monitoring of the control measures in the drinking-water supply that is of particular importance in securing drinking-water safety
- Management plans documenting the system assessment and monitoring plans and describing actions to be taken in normal operation and incident conditions, including upgrade and improvement, documentation and communication
- A system of independent surveillance that verifies that the above are operating properly.

Three of the five components which are outlined above in the preventive management framework for safe drinking-water combine to form the Water Safety Plan (WSP). A WSP comprises system assessment and design, operational monitoring and management plans, including documentation and communication. The elements of a WSP build on the multiple-barrier principle, the principles of hazard analysis and critical control points (HACCP) and other systematic management approaches. The plans would address all aspects of the drinking water supply and focus on the control of abstraction, treatment and delivery of drinking-water.

There is a need for a shift from the existing reactive drinking water quality monitoring approach which is being widely practised by the relevant stakeholders and utilities to a more preventive risk management approach that would provide a comprehensive coverage from catchment to consumer. This is an area where a strategic intervention will be demanded to ensure the consistent delivery of safe drinking water. The level or frequency of water quality monitoring and surveillance to be conducted on each of the different water supply systems which will depend also on the size of the population served are indicated in the Ethiopian Standard for Drinking Water (ES 261: 2001) and the WHO drinking water guidelines (Refer Annex II for ES 261:2001). The details will be covered in water quality monitoring and surveillance guidelines, but the core activities that need to be addressed are described as short and medium term strategic directions as follows.

A) Short Term Interventions

a) Monitor the presence of internal WQM system in the suppliers, identify gaps and recommend remedial actions.

b) Conduct sanitary survey to water supply systems

c) Conduct microbiological WQM

d) Conduct monitoring of the critical physicochemical parameters

In addition to the above for conventional water supply systems**:**

a) monitor whether appropriate catchment management actions are implemented

b) monitor the water treatment processes or operations

c) monitor the internal quality monitoring system starting from the source to the point of consumption

d) monitor the distribution system management

B) Medium Term Interventions

a) In collaboration with the appropriate stakeholders and partners develop a national framework for safe drinking water that promotes a preventive management approach in water quality monitoring and Surveillance.

b) In collaboration with the appropriate stakeholders and partners pilot test and demonstrate the implementation of the framework for safe drinking water and its guidelines on a selected Water Safety Plan Approach guided utilities by WHO and improved community based water schemes.

c) Scale up the application of the framework for safe drinking water in all the urban water supply utilities and improved water schemes in Ethiopia. The following diagram depicts the summary of the WQMS

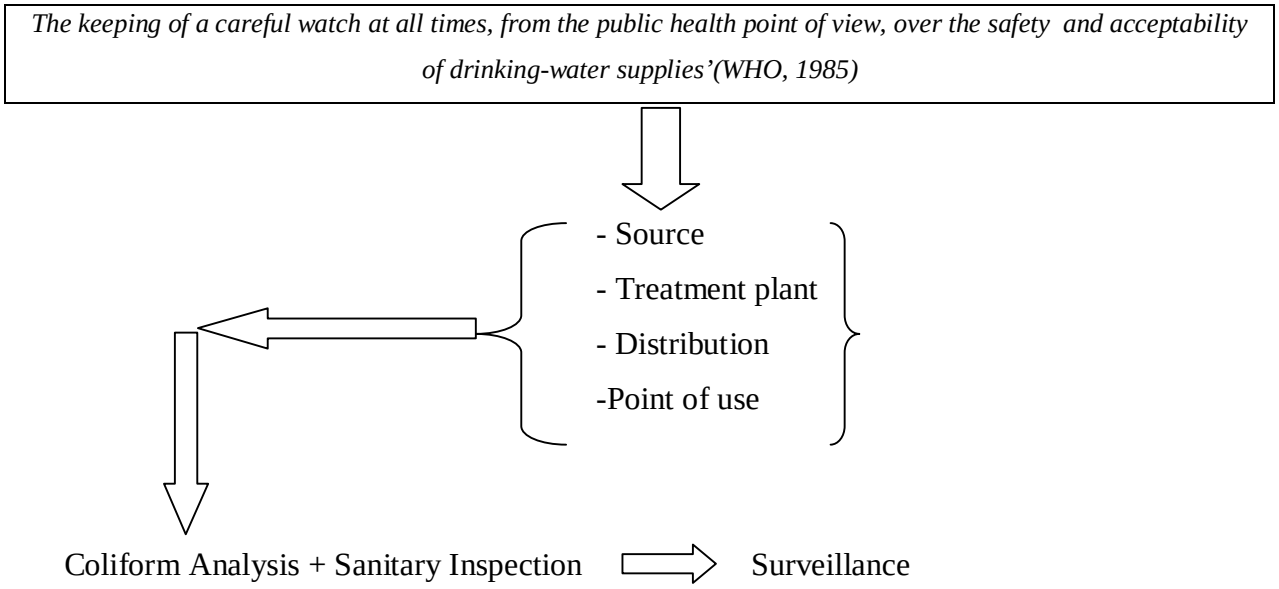


Diagram 2: Summary of WQMS

5.3.3 Inter-sectoral Collaboration, Coordination and Partnership

It has been observed that there exists a wider gap between the various stakeholders and sector institutions in playing their expected roles and responsibilities as drinking water suppliers and as custodian of public health. This gap is another area which has to be filled by devising proper strategic actions that favour coordinated and mutually supportive mechanisms towards ensuring safe water delivery. Different stakeholders should work in partnership at all levels (household, village, Kebele) to ensure water safety. This will be strengthened through the following actions:

a) Initiate the Revitalization of WQMS as indicated in the WASH MoU signed by the sectoral institutions to implement WASH programs.

b) Collaborate in resource mobilization for the implementation of WQMS

c) Conduct monitoring and evaluation of the implementation of the strategy

5.3.4 Promotion, Advocacy and Communication

Advocacy 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 behavioural 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.

The main activities to be done under this pillar constitute the following core actions;

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

5.3.4.1 Elements for Advocacy and Promotion

A) Media Communication

With the heavy reliance on promotion of household water treatment and safe storage 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 etc.

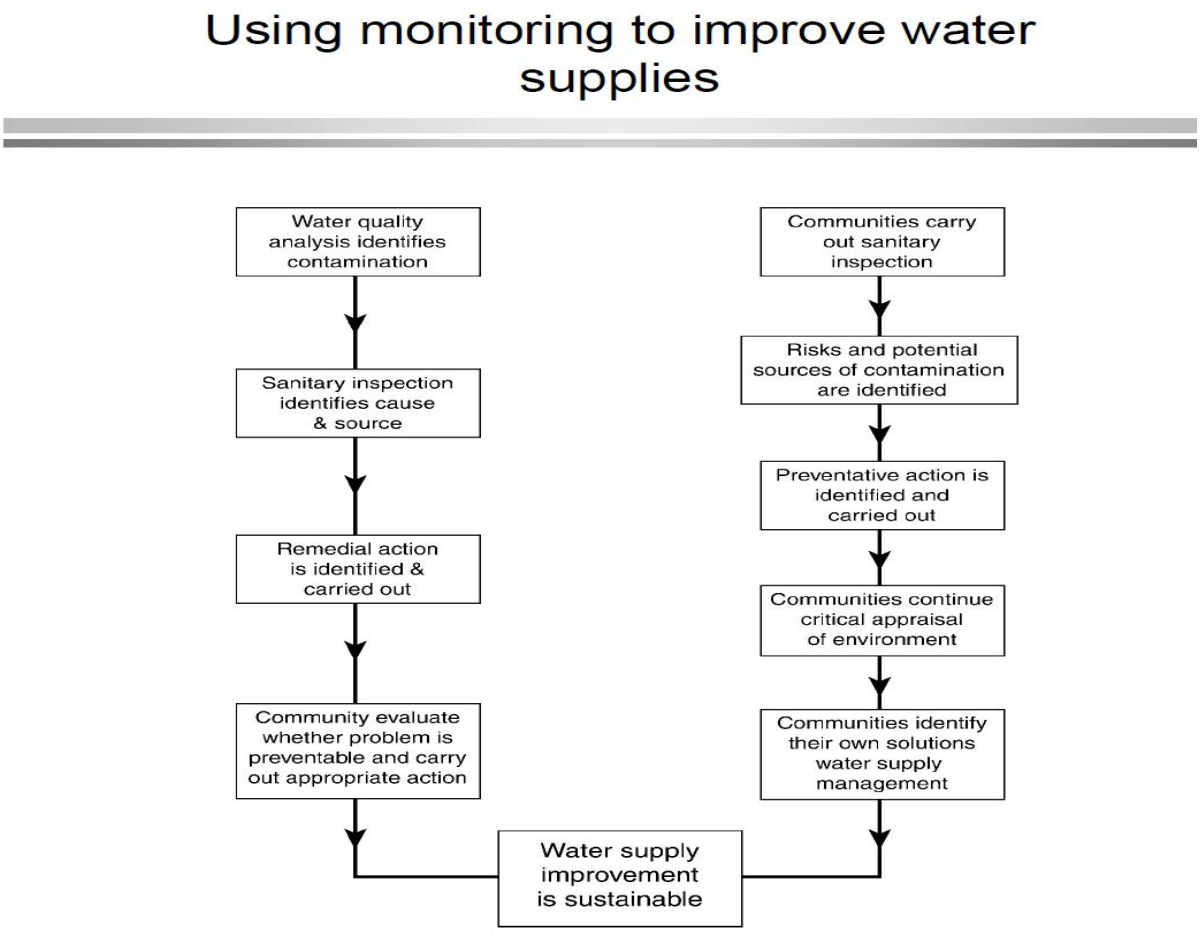
- Reaching out pro-actively with communication to broader group of change agents like: religious leader, agricultural extension workers, schools (cluster system), women, youth, CBOs, NGOs outside the classical WASH groups.
- Continuous mass mobilization and media engagement in case of emergencies (flooding and AWD situation etc)
- Integrate WQMS issues in existing community conversations (dialogues)

B) 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[1].

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 system. Community will manage most of the remedial and preventive action based on the risk factors identified (diagram.3).

[1]National Community Led Total Sanitation and Hygiene Implementation Guideline; Ministry of Health (Draft level)



Adopted from WHO Guide line of community involvement in water quality monitoring and surveillance

Diagram 3: Community involvement in WQM

C) Strengthening Household Outreach

Household visits are essential for household level change and must be achieved by coordinated and independent activities of government and NGO partners. The Health Extension Worker, trained model households and Community Health Volunteers are to be the primary promoters of the small do-able actions, supported by Environmental Health Professionals, WASH volunteers, agricultural agents, NGO community-level workers and home-visitors. The combined efforts will expand household and community reach. 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.

D) 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

E) Assessment of best practices

Assessment of best practices is required to improve household water treatment practice and to identify proven water treatment methods at point of use. Assessment and analysis of best practices on household water treatment and Safe Storage will be conducted for documentation, dissemination and scaling up of the lesson derived from the ongoing promotion activities.

6. Coordination Mechanism and Institutional arrangements for Strategy Implementation

Relevant sectors (health and water) at all levels will establish coordination mechanism to achieve maximum combined efforts of available leadership capacity and expertise in different sectors. This coordination mechanism will be initiated and led by the health sector at all levels.

6.1 Suggested Coordination Mechanism

The proposed coordination mechanism to implement water quality monitoring and surveillance strategy is to build upon and use existing institutional arrangements at all levels by strengthening it. As it is indicated in the sectors analysis, water quality monitoring and surveillance activity suffers because of the absence of defined roles. Therefore, the reviving and placement of proper coordination mechanism that could involve all stakeholders is the first step. Hence, the strategy focuses on re-institutionalization of water quality monitoring and surveillance activities to existing coordination mechanism of WASH program implementation. 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 sanitation task force under the health sector cascaded its structure at all levels, will be involved as contextual situation of each coordination level plays a leading role in water quality monitoring and surveillance activities. The education sector will be a member at all levels.

However, the promotion and the remedial action needs the participation and involvement of the individual user at the community at large which is indicated under the section ‘roles and responsibilities’.

6.2 Institutional and Human Power Arrangements

The essential part of water quality monitoring and surveillance are: ensuring legal frameworks, strengthening the relevant units, properly equipping laboratory facilities and the deployment of trained human power at all levels. This process of institutional arrangement is hence to say that the revitalization of water quality monitoring units at all levels in the health sector.

The other alternative for conducting water quality monitoring and surveillance by the health sector is the integration of the activities with the service provider (i.e. using water quality control facilities organized by the water sector). The advantage of integration approach is to effectively utilize the available expertise and other resources. Particularly, integration can be applied during implementing proposed remedial actions. However, water quality analysis for monitoring and verification purposes should be conducted independently by the health sector at all levels. The results can be analyzed by team of mixed professionals in terms of public health requirements or established standards of drinking water quality. But at woreda and health facility levels where there are no laboratory facilities, water quality monitoring can be conducted using properly trained environmental health workers who should be equipped with mobile water test kits in collaboration with water utilities or woreda water desks. At household level, water quality monitoring can be conducted by health extension workers for promotion of point of use treatment methods.

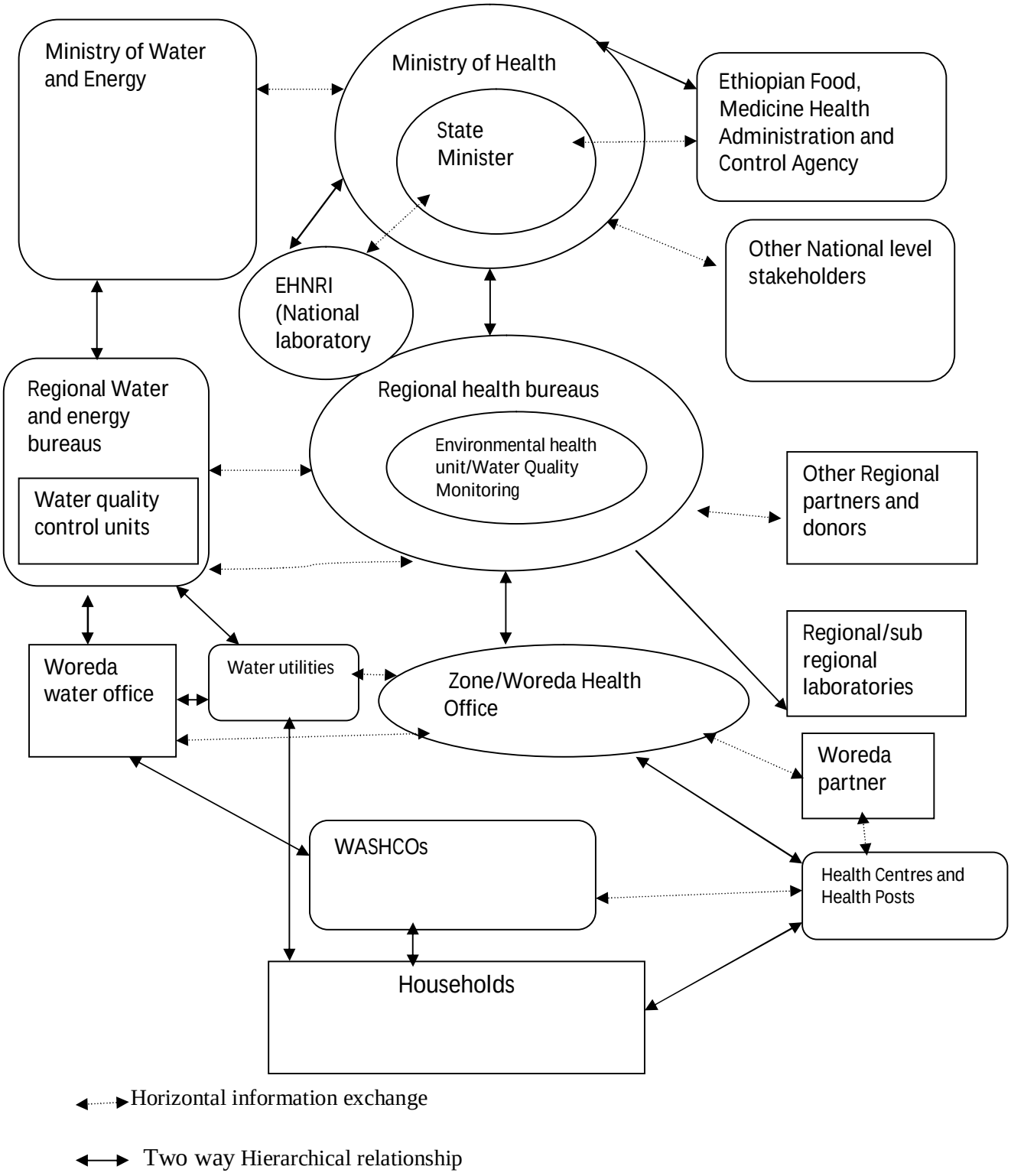


Diagram 3: Summary of Proposed Institutional Arrangements

6.3 Roles and Responsibilities of Key Stakeholders

Adequate and safe water provision and ensuring its quality is the responsibility of all individuals, households, communities and the relevant government and non government sectors. It will be achieved through collective responsibility with mutually reinforcing roles played by the various sectors and partners at each level. This will ensure that 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 in the other sectors.

6.3.1 The Roles and Responsibilities of the Health Sector at All Levels

The health sector at all level is responsible to conduct assessments of organizational capacities of service providers, sanitary survey and physicochemical water quality analysis at all levels with remedial action proposal that will be implemented by the water sector. This can be addressed through organizing a task force composed of the stakeholders at all levels. Data generated through sanitary survey and laboratory findings need to be processed and properly documented with the appropriate formats and remedial actions recommended should be monitored for its timely implementation. The other role of the health sector is to promote safe and adequate water provision including the scaling up of household water treatment and safe storage techniques with such a wide area of contact between health professionals and the general public.

6.3.2 The Roles and Responsibilities of the Water Sector at All Level

The water sector as a service provider is expected to achieve safe and adequate water provision to consumers and always assure both physicochemical and Microbiological drinking water quality standards. This can be achieved by preparing proper Water Safety Plan to protect water from source to consumption. However, when the standard of drinking water qualities deteriorate and reported by health sector i.e. the surveillance agency, it should immediately act to take remedial actions including maintenance of the water delivery system and environmental conservation to protect potential risk of contamination of the water discharge areas. The water sector is also expected to ensure proper institutional arrangements that are capable of proper operation and maintenance of water supply facilities in achieving safe and adequate water provision throughout the country as indicated in the universal access plan.

6.3.3 Role of Woreda administration and municipalities

Woreda administrations and municipalities coordinate and support water utilities and WASHCOs to play a critical role in protecting source water. Protective actions must be tailored to unique local situations. Water utilities and WASHCOs should immediately respond to notify the users about the status of the drinking water quality and implement the recommendation and remedial action of the water quality surveillance reports.

6.3.4 The Roles and Responsibilities of Kebele Administration and Users

Kebele administration and communities can develop zoning requirements to ensure that investments using hazardous materials are not located near water supplies and can protect land in the source water area from development through acquisition or conservation easements. Private sectors and individuals can also take actions to protect drinking water sources. Private sectors can institute management practices to reduce their use of harmful contaminants or ensure their wastes do not discharge into ground or surface water. Individuals can reduce their use of pesticides and ensure that their septic systems are properly maintained. This is particularly important for those individuals who obtain their drinking water from private wells and must rely on ground water free of contamination.

7. Data Management, Documentation, and Reporting

Data generated through sanitary survey and laboratory findings need to be processed and properly documented with appropriate formats and remedial actions recommended should be monitored for its timely implementation. The storage of data could be done using manual and computerized technologies. Regional and other laboratories can use either the manual data storage or can store it in a dedicated computer. Spreadsheet software, such as Excel and Access, can be used to develop individual data management systems at each laboratory level. Data obtained from in-situ measurements using field kits will use manual data storage.

Reporting of water quality monitoring and surveillance data from kebelle and woreda levels up the chain to the Regional and federal Ministry of Health should follow and utilize the WASH and HMIS systems. Utilizing the HMIS and WASH information systems will not only avoid the creation of redundant database system for WQMS, but also augment the information base that flow through the systems. Relevant indicators need to be incorporated to the existing reporting systems.

The right of consumers to health-related information on the water supplied to them for domestic purposes is fundamental. An essential element of a successful surveillance programme is the reporting

of results to stakeholders. It is important to establish appropriate systems of reporting to all relevant bodies. Proper reporting and feedback will support the development of effective remedial actions The ability of the surveillance programme to identify and advocate interventions to improve water supply is highly dependent on the ability to analyse and present information in a meaningful way to different target audiences.

The target audiences for surveillance information will typically include:

- public health officials at local, regional and national levels;
- water suppliers;
- local administrations;
- communities and water users; and

Communication strategies should include:

- procedures for promptly advising of any significant incidents within the drinking-water supply, including notification of the public health authority;
- summary information to be made available to consumers – for example, through annual reports and on the official websites of the sector ministries; and
- Establishment of mechanisms to receive and actively address community complaints in a timely fashion.

8. Indicative Budget Requirements

The strategy implementation depends on budget availability, proper allocation and utilization. Thus, resource mobilization is very critical for the realization of this strategy. The indicative budget estimation also take in to consideration the National Hygiene and Sanitation Strategy Action Plan(NHSSAP)(20011-2015) which included budget for routine water quality monitoring and surveillance. Therefore, this indicative budget covers mainly the system strengthening for water quality monitoring and surveillance, advocacy, communication and promotion and monitoring and evaluation. For the estimation of indicative budget national public health laboratory, regional public health laboratories, rapid water quality test kits considered for Woreda level and Kebele were taken into consideration. A total of **21, 830,622 USD** is required to implement this strategy. The indicative budget estimated by key activities for five years is depicted below (table 1).

Table 1: Estimated Indicative Budget for National Water Quality Monitoring and Surveillance Strategy Implementation (2011-2015)

Key activities	Estimated Budget in USD					
	2011/12	2012/13	2013/14	2014/15	2015/2016	Total
System strengthening and mainstreaming(Subtotal)	2830000	3084000	3379300	3734510	4138697	17166507
Conduct needs assessment in relation to laboratory equipment, material, human resource, training, necessary guidelines and procedures.	30000	0	0	0	0	30000
National public health laboratory (EHNRI) reagents and other water quality test and analysis equipment	120000	144000	172800	207360	248832	892992
Regional Public Health laboratories (12-15 laboratories) reagents and other water quality test and analysis equipment	900000	990000	1089000	1197900	1317690	5494590
Provision of water quality test kits to Woreda health offices including consumable reagents	700000	770000	847000	931700	1024870	4273570
Provision of simple water quality test kit and formats for Health Posts (HEW) including sanitary surveillance of community water point	1000000	1100000	1210000	1331000	1464100	6105100
Training for health professionals at all levels at national, regional and woreda level	50000	55000	60500	66550	73205	305255
Water Quality Monitoring and surveillance guideline development, printing and distribution	30000	0	0	0	10000	40000
Development WQMs database system	0	25000	0	0	0	25000
Water Quality MS(subtotal)	once the system is in place it can be part of routine activity					
Microbiological quality testing						
Physicochemical quality testing						
Sanitary Survey/inspection						
Advocacy and promotion(subtotal)	405000	75000	230000	20000	30000	760000
Multi-level advocacy	105000	45000	30000	0	0	180000
Media communication (print and electronic)	300000	30000	200000	20000	30000	580000
Sanitation marketing	Covered by other strategy/ National Sanitation and Hygiene Action Plan					
Monitoring and Evaluation(Subtotal)	125000	162500	186050	222251	278664.02	974465
Review meetings and Supervision	125000	127500	130050	132651	135304	650505
Regular reporting	Use the existing reporting system of MoH/RHBs					
Operational research	0	35000	56000	89600	143360	323960
Total	3360000	3321500	3795350	3976761	4447361	18900972
5% administrative cost						945048.
Contingency (10%)						1984602
Grand Total						21830622

9. Monitoring and Evaluation

The purpose of monitoring of the implementation of water quality and surveillance is to track the progress of the implementation of the strategy activities at all levels, identify challenges and draw timely corrective actions in the process. In addition it is to ensure all stakeholders and institution are achieving the intended outcome using their potential , determine the relevance, effectiveness, efficiency and sustainability of approaches and activity outcomes, proper documentation for sharing and rewarding lessons learned from the implementation of the strategy.

The proposed tools that can be applied for monitoring and evaluation are regular HMIS and WASH inventory reports, field level supervision integrated with other programs, through organizing periodic review meetings or conducting national rapid water quality assessment surveys. However, there should be agreed progress and performance indicators at all levels. The following are output level indicators to choose from:

9.1 System Strengthening and Mainstreaming Indicators

1. % of public health laboratories equipped with standard instrumentation and proper logistic arrangements
2. % of water supply service providers annually inspected
3. % of water supply service providers with Water Safety Plan in their program,
4. % of water supply service providers implementing remedial actions proposed by the surveillance agency.
5. Number of Woredas equipped with rapid water quality test kits

9.2 Water Quality Monitoring and Surveillance Indicators

1. % of water supply facilities inspected as planned
2. %of water supply facilities with water quality test as planned
3. % of water samples negative test for E. coli in drinking water at the point of sampling,
4. % of water supply facilities meeting water quality standards,
5. % of households with negative test for E. coli in drinking water at the point of use
6. % of households with chlorine residual as per the national standards in drinking water treated with a chlorine product
7. Number of professionals trained on water quality monitoring and surveillance
8. Proportion of trained professionals practicing water quality monitoring as per training

9.3 Promotion, Advocacy and Communication Indicators:

1. % of households that use an improved drinking water source (urban and rural)
2. % of households practicing correct use of recommended household water treatment technologies
3. % of households storing treated water in safe storage containers
4. % of households with access to improved drinking water sources from a recommended provider
5. % of households spending up to 30 minutes to collect drinking water from an improved source

6. % of respondents who agree that their drinking water needs to be treated at home
7. % of respondents who believe others treat drinking water at home
8. % of respondents that feel confident they can improve the quality of their drinking water
9. % of respondents who know at least one location where they can obtain recommended household water treatment product(s)

10. Operational Research

The operational research need to be conducted to check whether the trend of water quality and safety practices at utility, community and household levels are implemented as per the National Water Quality Monitoring and Surveillance Strategy. It requires to improve household water treatment practice and to identify proven water treatment methods at point of use. The finding result analysis will support the Water Safety Plan improvements. This will be help full to document, disseminate and scale up the Monitoring and Surveillance of drinking water quality.

Moreover, it can be used by the higher officials for decision making and supporting the implementation of the national water quality standards set in the country. Similarly the academia will use it as one of the teaching-learning and research areas for their students especially for public health practitioners, social scientists, economists and water sectors. The main focuses of the operational research will be on the producer, regulator and consumer issues of water quality concerns including the linkage between the health and water.

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12. S***IXTY-FOURTH WORLD HEALTH ASSEMBLY A64/24Provisional agenda item 13.15, April 2011***

Annex I: Glossary

Safe water: Safe water is to say that drinking water need to be free of pathogenic organisms, toxic substances, an over dose of minerals and organic materials as well as it should be pleasant (free of colour, turbidity, odour and taste).

Source water: is untreated water from streams, rivers, lakes or underground aquifers that is used to provide public drinking water, as well to supply private wells used for human consumption. Protecting source water is an important part of providing safe drinking water to the public, so public utilities treat most of the drinking water before it enters the home.

Safe water: Safe water is to say that drinking water need to be free of pathogenic organisms, toxic substances, an over dose of minerals and organic materials as well as it should be pleasant (free of colour, turbidity, odour and taste).

Safe water chain: Protecting water at the source is the first critical step in a multiple-barrier approach that also includes treatment for contaminants, monitoring to ensure that health-based standards are met, and adequate infrastructure maintenance, especially of distribution pipes that carry water from the treatment plant to customers. An informed public with an understanding that everybody plays a role in water protection is critical to protect our drinking water now and for the future. Safe water chain includes application of household water treatment and safe storage of drinking water until consumption.

Monitoring: systematic verification of water quality standards through laboratory/or spot analysis of samples taken at critical points of the water supply system.

Surveillance: ceaselessly watching and protecting drinking water from potential source of contamination through sanitary survey and water quality analysis of samples taken at different points.

Monitoring and surveillance: in relation to water quality is to say ceaselessly watching and protecting drinking water from possible contamination risks. This requires a continuous and systematic sanitary inspection and water quality testing of samples taken at different points of the delivery system. Monitoring and surveillance of drinking water is conducted with the objective of ensuring acceptability level of drinking water established standards from public health point of views.

Sanitary Survey: Sanitary survey is the regular inspection of drinking water delivery systems and defines the land area contributing water to each public water system to identify possible potential contamination risks. It is an on-site inspection and assessment including water supply facility condition, health hazard application and practices around all schemes including connections and other critical points of the pipe networks. In this way, the

survey identifies the major potential sources of contamination that could affect the drinking water and then determines how susceptible the public water supplies are to these potential contaminations.

Hazard Analysis and Critical Control Point: A risk management approach that has been used in the food manufacturing industry for a number of decades. It is an understanding of the system, prioritising risks and ensuring that appropriate control measures are in place to reduce risks to an acceptable level. These principles have been refined and tailored to the context of drinking-water by water utilities and brought the development of the Water Safety Plan approach.

Critical areas of water supply system: This includes areas and points that hazardous chemicals and pathogens may enter to drinking water through seepages or discharge from septic tanks, sewage treatment facilities, and because of natural soil formations. Bacteria from these sources can enter wells that are either open at the land surface, or because they do not have water-tight casings or caps. In addition, insects, rodents or animals may enter through overflow and other openings on the structure. Old wells which were dug by hand and lined (cased) with rocks or bricks are more vulnerable for such contamination. These wells usually have large openings and casings that often are not well-sealed. This makes it easy for insects, rodents, or animals to enter the well and contaminate drinking water. Therefore, water samples should be drawn from critical points including treatment plants, reservoirs, pressure breaks, and pipe connection areas dead ends of net works, delivery points and also at point of uses.

Water Safety Plan *:* 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.

Micro-biological water quality test: Micro-biological contamination of drinking water is the existence of organisms in water including viruses, bacteria, protozoa and algae deteriorating water quality. This type of contamination cannot be detected by sight, smell or taste. The only way to know if a water supply contains bacteria is to have it tested. To do Microbiological water quality analysis, total coliform test is chosen that this group is relatively easy to culture and safe to work with in the laboratory that these organisms are only mildly infectious. However, coli form bacteria are not pathogenic, though they are naturally occurring in the intestinal tract of warm blooded animals including man. If large numbers of coli forms are found in water, there is a high probability that other pathogenic bacteria or organisms exist. Most drinking water guidelines require public drinking water supplies to demonstrate the absence of total coliform per 100 ml of drinking water.

Annex II: Ethiopian Drinking Water Quality Standard

ETHIOPIAN STANDARD

ES 261:2001

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Drinking water — Specifications

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Drinking water— Specifications

1 Scope

This Ethiopian Standard specifies the physical, chemical and bacteriological requirements of water for drinking and domestic purpose.

3 Definitions

For the purpose of this standard, the following definitions and terms defined in ES ISO 6107 shall apply.

3.1
maximum permissible level
a requirement level whose non-fulfillment would disqualify the water for drinking and domestic use because of its probable hazard to health

3.2
palatable water
water that is safe to drink, pleasant to the taste and useable for domestic purpose

3.3
quality water
water intended for drinking and domestic use that conforms with all the requirements specified in this Ethiopian Standard

3.4
safe water
water intended for drinking and domestic use whose limits for toxic substances, bacteriological and organo leptic levels conform to the requirements of this standard.

4 Requirements and test methods

4.1 Physical requirements

The physical characteristics of drinking water shall conform to the levels specified in Table 1.

Table 1 – Physical characteristics of drinking water

Characteristic	Maximum permissible level	Test method
Odour*	Unobjectionable	ES 605
Taste	Unobjectionable	
Turbidity, NTU	5	ES ISO 7027
Colour, TCU	15	ES ISO 7887

* Threshold number, Max. = 3

4.2 Chemical requirements

4.2.1 Palatability properties

Characteristics that affect the palatability of water shall conform to the levels specified in Table 2.

4.2.2 Content of toxic and/or disease causing substances

a) When tested, the characteristics that affect the safety of drinking water shall conform to the levels specified in Table 3.

b) If nitrates (expressed as N) are present in concentrations in excess of 10 mg/l, the water may be unsuitable for use by infants under one year of age, and an alterative source of supply must be found for such infants use or the water from the same source should be corrected in case of lack of other sources.

Table 2 – Characteristics that affect the palatability of drinking water

Substance or characteristic	Maximum permissible level	Test method
Total hardness (as $CaCO_3$)	300	ES 607
Total dissolved solids mg/l, Max	1000	ES 609
Total Iron (as Fe) mg/l, Max	0.3	ES ISO 6332
Manganese (as Mn) mg/l, Max	0.5	ES ISO 6333
Ammonia (NH_3+NH^+_4)* mg/l, Max	1.5	ES ISO 7150-2
Residual, free chlorine mg/l, max	0.5	ES ISO 7393
Anionic surfactants, as mass concentration of MBAS mg/l, Max	1.0	ES ISO 7875-1
Magnesium (as Mg) mg/l, Max	50	ES ISO 7980
Calcium (as Ca), mg/l, Max	75	ES ISO 7980
Copper (as Cu) mg/l, Max	2	ES ISO 8288
Zinc (as Zn) mg/l, Max	5	ES ISO 8288
Sulfate (as SO_4) mg/l, max.	250	ES ISO 9280
Chloride (as Cl), mg/l, Max	250	ES ISO 9297
Total alkalinity (as $CaCO_3$) mg/l, Max	200	ES ISO 9963-1
Sodium (as Na), mg/l, Max	200	ES ISO 9964-1
Potassium (as K), mg/l, max	1.5	ES ISO 9964-2
pH value, units	6.5 to 8.5	ES ISO 10523
Aluminium (as Al) mg/l, Max	0.2	ES ISO 12020

* The term ammonia includes the non-ionized (NH_3) and ionized (NH^+_4) species.

NOTE 1 - Several of the inorganic elements for which maximum permissible levels has been settled are recognized to be essential elements in human nutrition. No attempt has been made here to define a minimum desirable concentration of such substances in drinking water.

Table 3 – Content of toxic and/or disease causing substances of drinking water

Substance or characteristic	Maximum permissible level	Test method
Barium (as Ba) mg/l, Max	0.7	ES 606
Total mercury (as Hg) mg/l, Max	0.001	ES ISO 5666-3
Cadmium (as Cd) mg/l, Max	0.003	ES ISO 5961
Arsenic (as As) mg/l, Max	0.01	ES ISO 6595
Cyanide(as CN) mg/l, Max	0.07	ES ISO 6703-1
Nitrite (as NO_2), Mg/l, Max	3	ES ISO 6777
Nitrate as NO_3 Mg/l, Max	50	ES ISO 7890-3
Phenolic compound as phenols , mg/l, Max.	0.002	ES ISO 8165-1
Lead (as Pb) mg/l, Max	0.01	ES ISO 8288
Boron (as B) mg/l, Max	0.3	ES ISO 9390
Selenium (as Se) mg/l, Max	0.01	ES ISO 9965
Fluoride (as F) Max	1.5	ES ISO 10359-1
Chromium (as Cr) mg/l, Max	0.05	ES ISO 11083
Pesticides and Organic constituents, Mg/l, Max		
a) DDT	2	ES ISO 6468
b) Heptachlor and heptachlor epoxide	0.03	
c) Hexchchlorobenzene	1	
d) Lindane (Gamma – BHC)	2	
e) Methoxychlor	20	
f) Aldrin/Dieldrine	0.03	
g) 1,2 Dichloro ethane	30	ES ISO 10301
h) 1,1,1- Trichloro ethane	2001	
i) – Trichloro ethene	70	
j) Trichlorobenzenes (total)	20	
k) Hexachlorobutadiene	0.6	

NOTE - 2 Because of the possibility of simultaneous occurrence of nitrite and in drinking water, the sum of the ratios of the concentration of each to its standard value should not exceed 1, i.e. $\frac{C_{nitrite}}{SV_{nitrite}} + \frac{C_{nitrate}}{SV_{nitrate}} \leq 1$,

Where, C is concentration and SV is standard value.

NOTE – 3 The limit value for fluoride should consider climatic conditions, volume of water consumed and intake from other sources provided the limit specified in the above table is satisfied.

4.3 Other constituents

4.3.1 Radioactivity if present shall not exceed the following levels, when determined according to ES ISO 9696 and ES ISO 9697 respectively :

a) gross alpha activity 0.1 Bq/l max.

b) gross beta activity 1Bq/l max.

NOTE – 4 If a screening value is exceeded, more detailed radionuclide analysis is necessary. Higher values do not necessarily imply that the water is unsuitable for human consumption.

4.4 Bacteriological requirements

4.4.1 When tested with the corresponding test methods, the bacteriological requirements of treated drinking water shall not exceed the levels shown in Table 4.

4.4.2 If any coliform organisms are found in a sample, a second sample shall be taken immediately after the tests on the first sample have been completed and shall be free from coliform organisms.

4.4.3 Not more than 2 percent of the total number of water samples from any one distribution system tested per year may contain coliform organisms.

4.4.4 Any treated water shall not contain faecal and coliform organisms when tested with the corresponding test methods.

4.4.5 Any treated water shall not contain any faecal streptococci when tested according to ES ISO 7899-1 or ES ISO 7899-2.

Table 4 – Bacteriological levels

Organism	Maximum permissible level	Test method
Total viable organisms, colonies per ml	must not be detectable	ES ISO 4833
Faecal streptococci per 100ml	must not be detectable	ES ISO 7899-1 ES ISO 7899-2
Coliform organisms, number per 100 ml	must not be detectable	ES ISO 9308-1
E. Coli, number per 100 ml	must not be detectable	ES ISO 9308-1 ES ISO 9308-2

5 Sampling

5.1 Sampling for bacteriological examination.

5.1.1 Frequency of sampling

Sampling should be regular (see the guide given in Table 5) and its frequency will mainly depend on the following factors:

a) quality of the water harnessed;

b) type of treatment for drinking worthiness;

c) risks of contamination;

d) background of public water supply network; and

e) number of people served.

Table 5 — Minimum sampling frequencies for drinking water in the distribution system

Population served	Samples to be taken monthly
Less than 5,000	1 sample
5,000 - 100,000	1 sample per 5,000 population
More than 100,000	1 sample per 10,000 population plus 10 additional samples

5.1.2 Collection, transportation and storage for samples shall be in accordance with ES ISO 5667-5.

5.2 Sampling for physical and chemical examination

5.2.1 Frequency of sampling

Sampling frequency for the examination of physical and chemical characteristics shall be carried out at least twice per year; one is in the rain season and the other one is in the dry season the frequency of this examination shall be increased when toxic substances are known to be present at sub-tolerance levels in the source of supply, or in

certain special circumstances as, for example, when new industries that may be discharging toxic wastes are established in the area and the danger of epidemic arising.

5.2.2 Collection, transportation and storage of samples shall be in accordance with ES ISO 5667-5.