

A drinking water quality framework for South Africa

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Abstract

In recognition of the importance of safe drinking water to public health, DWAF initiated a project to draft a *Drinking Water Quality Framework for South Africa* to enable effective management of drinking water quality and the protection of public health. The Framework is based on a preventative risk management approach, which is comprehensive from catchment to consumer. The approach promotes an understanding of the entire water supply system, the events that can compromise drinking water quality and the operational control necessary for optimising drinking water quality and protecting public health. However, the Framework also recognises the challenges facing water services authorities (WSAs) in South Africa, and advocates a continual incremental improvement approach towards long-term targets. Short- and medium-term intervention strategies were developed as well as a longer term Drinking Water Quality Management Strategy to achieve the vision of 'Effective Drinking Water Quality Management Ensuring Safe Drinking Water'. The drinking water quality management project also developed a number of supportive documents and tools to provide the water sector with the information needed to monitor, manage, communicate and regulate drinking water quality.

Keywords: drinking water, *Drinking Water Quality Framework for South Africa*, monitoring, public health, catchment to consumer

Introduction

Access to safe drinking water is a basic human right and essential to people's health. Safe drinking water that complies with the South African National Standard (SANS) 241 Drinking Water Specification does not pose a significant risk to health over a lifetime of consumption, including different sensitivities that may occur between life stages (babies and infants, the immunocompromised and the elderly). Improving access to safe drinking water can thus result in tangible benefits to public health and every effort should be made to achieve a drinking water quality that complies with national safety standards.

Since 1994, significant progress has been made in the provision of basic services, including drinking water and sanitation. However, notwithstanding this progress, service delivery backlogs still exist in key areas including the provision of safe drinking water. The quality of the drinking water being provided at point-of-use is of vital consideration. Current investigations show that an unacceptably high incidence of poor drinking water quality occurs in non-metro South Africa. Reasons for failure of drinking water standards include:

- A lack of understanding by WSAs regarding the requirements for effective drinking water quality management
- Inadequate management including monitoring of drinking water services
- Inadequate asset management
- Inadequate WSA institutional capacity (staffing, funding, expertise, education)
- Lack of intervention to address poor drinking water quality when detected.

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In recognition of these challenges faced by WSAs in South Africa, the Department of Water Affairs and Forestry (DWAF), as the lead institution for the regulation of drinking water quality in South Africa, identified key stakeholders and appropriate mechanisms for their involvement in a task team and subsequent development of a *Drinking Water Quality Framework* for South Africa. Key stakeholders included:

- DWAF, National and Regional Offices
- Department of Health (DoH)
- South African Local Government Association (SALGA)
- Department of Provincial and Local Government (DPLG)
- Water Research Commission (WRC).

The outcome of this project was a *Drinking Water Quality Framework* for South Africa and a number of supportive tools to enable the effective management of drinking water quality and the protection of public health.

The drinking water quality framework for South Africa

The Framework is based on an integrated system of approaches and procedures which address the key factors that govern drinking water quality and safety in South Africa. The Framework focuses on a preventative risk management approach, which is comprehensive from catchment to consumer. This approach promotes an understanding of the entire water supply system, the events that can compromise drinking water quality and the operational control necessary for optimising drinking water quality and protecting public health.

Recognising the challenges facing WSAs in South Africa, a continual improvement approach is also advocated in the Framework, with emphasis on fulfilment of minimum legislated requirements and achievement of interim goals and milestones as set by the Water Services Authority to improve drinking water quality.

The *Drinking Water Quality Framework* for South Africa addresses four key areas:

1. Commitment to Drinking Water Quality Management: Institutional Roles and Responsibilities

Successful implementation of this Framework requires the support and commitment of all water sector stakeholders. A number of institutional stakeholders are responsible for drinking water quality management in South Africa:

Water services authorities (WSAs)

The primary responsibility for ensuring the provision of safe drinking water rests with WSAs. WSAs have a legal responsibility to:

- Monitor the quality of drinking water provided to consumers
- Compare the results to national drinking water standards
- Communicate any health risks to consumers and appropriate authorities

as described in the regulations to the Water Services Act (No. 108 of 1997) *Compulsory National Standards for the Quality of Potable Water*.

Department of Water Affairs and Forestry (DWAF)

DWAF supports and regulates the role of WSAs with regards to drinking water quality by:

- Developing and maintaining a national *Drinking Water Quality Framework*
- Managing information, including a sector database and information sharing system covering key aspects such as tracking WSA monitoring systems and drinking water quality data;
- Undertaking periodic regulatory audits of the drinking water quality data and management systems of WSAs
- Developing appropriate, practical and sustainable technical support documents and tools
- Assisting WSAs by reviewing *Water Services Development Plans*, to ensure that drinking water quality monitoring is included.

Catchment management agencies (CMAs) will be responsible for water resource planning and management at the catchment level, including licensing of water use and discharges, monitoring abstractions and discharges, and overseeing land-use activities. The CMAs will also be responsible for the implementation of the National Monitoring Programmes which monitor resource quality at the catchment level.

Department of Health (DoH)

The DoH supports the drinking water quality management function by:

- Collecting information on the incidence of waterborne diseases (for example, diarrhoea) and the use of this information to facilitate interventions
- Being the lead 'early warning' authority and execution agents for medical intervention under emergency drinking water quality conditions.

At district municipality and metropolitan level, the environmental health officers support the drinking water quality management function by assuming the primary responsibility for health and hygiene education related to water and sanitation services, and undertaking drinking water quality monitoring as a routine

audit function at point-of-use. DoH drinking water quality monitoring will focus on health-risk related constituents, particularly indicators of faecal contamination.

Department of Provincial and Local Government

The Department of Provincial and Local Government (DPLG) supports the drinking water quality management function by the allocation of a municipal infrastructure grant, capacity building grant and equitable share to address areas of need impacting on effective drinking water quality management.

Civil society

Government is committed to promoting the active involvement of civil society in the provision of sustainable and affordable water services, including drinking water quality management. The Strategic Framework for Water Services (2) notes that '*the most important and effective monitoring strategy for the sector is strengthening the voice of the consumer*'. DWAF will therefore establish mechanisms of engagement with civil society (organised groups of citizens) to ensure that amongst others, drinking water quality concerns of consumers are addressed.

2. System Analysis and Management

Effective management requires an understanding of the entire water supply system (from the catchment and its source water, through to the consumer, and back into the water system), an assessment of the hazards and events that can compromise drinking water quality, and the implementation of preventative measures and operational controls necessary for ensuring safe and reliable drinking water.

As part of the drinking water system management, WSAs are required to undertake operational monitoring, which is used as a trigger for immediate short-term corrective actions to operational procedures as required. A key element is the identification of parameters that control performance so that their status can be used to predict ultimate output quality and provide adequate lead-time for corrective action. Wherever possible, online and continuous monitoring of key parameters should be undertaken (for example chlorine residual, pH and turbidity).

Planning should be undertaken to establish appropriate procedures for immediate preventative and corrective action required to re-establish process control when operational monitoring indicates that target limits have not been met. Adoption of internal operating guidelines that are more stringent than the *South African National Standard (SANS) Drinking Water Specification* limits acceptable for lifetime consumption, and acting when these guidelines have been exceeded, will reduce the chances of exceeding SANS 241 limits in the final waters. Operating procedures should be documented and include instructions on required adjustments and process control changes and should clearly define responsibilities and authorities including communication and notification requirements. Documented procedures should include the actions required to be taken in response to exceedance of internal target limits. Where appropriate, these actions may include re-sampling, additional monitoring and/or confirming the results by additional operational monitoring.

WSAs are also required to undertake drinking water quality compliance or verification monitoring to check that the barriers and preventative measures implemented to protect public health are working effectively. Verification of drinking water quality provides an assessment of the overall performance or compliance of the system and the ultimate quality of drinking water being supplied to consumers. This incorporates monitor-



Figure 1
Drinking water quality compliance monitoring

ing drinking water quality as well as assessment of consumer satisfaction. Drinking water quality compliance monitoring is a wide-ranging assessment of the quality of water after treatment before it leaves the treatment plant, in the distribution system and as supplied to the consumer.

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Although demonstrating compliance with regulatory limits is necessary as verification, it should be recognised that monitoring of drinking water quality is only one aspect of an overall management strategy to assure a safe and reliable drinking water supply. Monitoring for drinking water quality should never be used as a replacement for preventative drinking water quality management.

Monitoring of consumer comments and complaints can provide valuable information on potential problems that may have gone unidentified in performance monitoring of the water supply system. A consumer complaint and response programme which details mechanisms for logging, recording and evaluating consumer complaints should be established and documented for prompt response to any potential problems in the water supply system. WSAs are required to have a Consumer Service (Regulation 16 of Section 9 of the Water Services Act (No. 108 of 1997)) which can serve as a conduit for consumers to report non-compliance to their WSA.

However, notwithstanding the best possible raw water sources, adequate treatment infrastructure and optimal treatment processes, unexpected incidents can disrupt water supplies and pose a significant health risk to consumers. The *Drinking Water Quality Framework* includes a drinking water failure emergency response model comprising three alert levels to respond to acute drinking water quality failures:

- **Alert Level I:** Routine problems including minor disruptions to the water system and single sample non-compliances (internal WSA response only)
- **Alert Level II:** Minor emergencies, requiring additional sampling, process optimisation and reporting/communication of the problem (internal WSA response only)
- **Alert Level III:** Major emergencies requiring significant interventions to minimise public health risk (engagement of an active emergency management team).

3. Supporting programmes

Support for effective drinking water quality management includes basic elements of good practice to ensure that the system has the capacity to operate and adapt to meet challenges. This includes training of employees within the water sector, community involvement and awareness creation, research and development, validation of process efficiency, and documentation and reporting systems.

Appropriate documentation provides the foundation for the establishment and maintenance of an effective drinking water quality management system.

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Documentation also provides a basis for effective communication within the organisation as well as with the community and various stakeholders. A system of regular reporting, both internal and external, is important to ensure that the relevant people receive information needed to make informed decisions about the management or regulation of drinking water quality. The *Drinking Water Quality Framework* recommends monthly, quarterly and annual reporting on drinking water quality performance to ensure a high level of transparency and public accountability.



Figure 2
WSA staff are required to be trained on all aspects of drinking water supply systems

A drinking water quality management information system, aligned with existing DWAF data management systems, will be developed to facilitate drinking water quality data management to a wide range of stakeholders and, in particular, allow active participation by consumers. The developed system will not replace implemented local application systems used by WSAs but will be used in places where no system exists.

In acknowledgement of institutional capacity problems, the drinking water quality framework also proposes a number of possible funding mechanisms that have been identified to support WSAs.

4. Review

Ongoing evaluation of water quality data and audit processes to ensure that the management system is operating satisfactorily provides a basis for continual improvement. DWAF, as the sector regulator, will undertake drinking water quality management system regulatory audits where a wide-ranging assessment of sector performance (including compliance to national norms and standards) will be undertaken. A set of agreed drinking water quality management key performance indicators, measures and targets will be developed to assess WSA performance when implementing the drinking water quality management system regulatory audit.

Implementation of the framework

Due to the need for immediate action, the perceived lack of resources and capacity within certain WSAs to conduct the required drinking water quality monitoring and management, and the perceived lack of understanding of these WSAs regarding governance requirements, responsibilities and accountabilities, both short- and medium-term intervention strategies and a longer term drinking water quality management strategy have been prepared.

A phased approach will be adopted to ensure that:

- Areas of severe failure are identified and addressed in the immediate short term
- Early wins are secured in the short term, thereby demonstrating the inherent value of the approach
- Coordinated development and implementation of a drinking water quality regulation strategy over the longer term is possible.

This approach will limit the disruption of existing operational procedures whilst ensuring an effective service to stakeholders.

Short-term intervention strategy

The goal of '*Improved Drinking Water Quality Soonest*' will be implemented *via* a number of short-term actions, to be implemented within one year.

Action 1: Highlighting the profile of drinking water quality management at provincial service delivery fora

It is proposed that at a provincial level, the profile of drinking water quality management is raised to drive improved delivery of safe drinking water. Where service delivery fora currently exist, drinking water quality management is recommended to be formally admitted onto the agenda for attention. Where fora do not yet exist, it is recommended that they be established to address provincial drinking water quality issues. These fora

should allow for the involvement and full participation of all stakeholders.

A task team is proposed to initiate and oversee the formation of the drinking water quality management forum, or to modify existing fora to highlight the profile of drinking water quality management. The task team will comprise senior representatives of at least the following key sector members:

- DWAF Regional Office
- Provincial Department of Local Government
- Provincial Department of Health
- SALGA.

The task team will be led by an agreed 'lead agent', with the default lead agent being DWAF Regional Office. An alternate lead agent may, however, be determined by the task team, dependant on the relative strengths and existing sector initiatives. In most provinces (seven out of nine), these forums currently exist.

Action 2: Awareness creation and communication of responsibilities for urgent cases

A drinking water quality management communication campaign is planned, including:

- A pamphlet to inform WSAs of their duty to undertake monitoring and communication as dictated by the regulated compulsory national standards, as well as the minimum requirements for effective drinking water quality management
- A pamphlet to increase consumer awareness of drinking water quality issues
- Provincial road-shows to communicate the *Drinking Water Quality Framework* to all sector stakeholders, and obtain feedback to improve the document.

Action 3: Support and intervention

Where evidence exists that a WSA is providing water of unacceptable quality, or where the WSA is not undertaking any water quality monitoring, the Regional Director: DWAF will communicate *via* a letter to the municipal manager pointing out the WSA's responsibilities and request compliance within a reasonable timeframe. DWAF will, however, render support if the need has been identified. This support will include advising on the WSA's regulatory requirements, provision of an information pack on drinking water quality management, and provision of practical guidelines for implementation of effective drinking water quality management. In cases of severe drinking water quality failure, emergency response will also be instituted.

Medium-term intervention strategies

Drinking water quality will be improved by the implementation of two medium-term actions, to be executed within two to three years:

Action 4: Implementation of drinking water situational assessments

Action 4a: A baseline assessment of drinking water quality should be undertaken to gather current data from all WSAs as well as to inform them of their requirement to undertake systematic monitoring and communication of drinking water quality results as specified in the regulated Compulsory National Standards.

Action 4b: DWAF will undertake drinking water quality management system assessments where a wide-ranging assessment

of WSA performance is conducted. The results of these assessments will also be used to indicate the level of support required from Provincial and National Government.

Action 5: Initiation of provincial drinking water quality consultative audits

Since many WSAs do not adhere to the compulsory national standards for the quality of potable water, a process needs to be initiated by Provincial or National Government to rectify the situation. The provincial forum may consider the initiation of consultative audits, similar to those practised monthly in the Free State. These co-operative governance-oriented drinking water quality audits are not planned to replace the required drinking water quality monitoring and self-regulation to be undertaken by WSAs or the recommended regulatory audits undertaken by DWAF, but are seen as an interim supportive measure to be undertaken until capacity is built at the local level and WSAs can undertake their mandated requirements of drinking water quality monitoring, management and communication.

Information arising from the Consultative Audits can be:

- Communicated to provincial drinking water quality management fora, where the problem areas identified through the above process are discussed and prioritised (ranked). These audits can be used to determine required regulatory intervention, assess progress with achieving drinking water quality compliance, and recommend municipal infrastructure grant (MIG) and capacity building grant (CBG) funding where capacity is lacking..
- Captured onto a DWAF drinking water quality management database and made available *via* an internet based system.

Longer term drinking water quality management strategy

To achieve the longer term vision of '*Effective Drinking Water Quality Management Ensuring Safe Drinking Water*', WSAs are required to fulfil their mandated requirements of drinking water quality monitoring, management and communication, with DWAF fulfilling the role of national policy-maker, supporter and regulator.

The ideal long-term drinking water quality management objective is that:

- WSAs are supported to undertake effective drinking water quality management from catchment to consumer, using a comprehensive, preventative risk-management approach, ensuring safe drinking water and protection of public health. As verification of the performance of their drinking water quality management system, WSAs are required to undertake drinking water quality compliance monitoring, at frequencies appropriate to factors such as the population served, the volume of water treated and the frequency of water quality problems. The purpose of this monitoring is to provide confidence in the provision of safe drinking water. However, in recognition of limited capacity within WSAs, minimum requirements for effective management of drinking water treatment have also been proposed.
- The provincial supportive consultative audits are gradually phased out in provinces which demonstrate effective drinking water quality management. The frequency of consultative auditing is recommended to decrease with increasing conformance to the Water Services Act (No. 108 of 1997) monitoring requirements and compliance with the SANS 241 Drinking Water Specification.

- DWAF, as the sector regulator, will undertake drinking water quality management regulatory audits, where a comprehensive assessment of drinking water quality management is undertaken. These regulatory audits will be aligned with the overall National Water Services Regulation Strategy, and are likely to be random and unscheduled, with an emphasis on verified self-reporting by WSAs.
- Where there is lack of adherence to the monitoring requirements specified in the Water Services Act (No. 108 of 1997), or there is evidence of drinking water quality problems of an acute or chronic nature, it is recommended that DWAF intervene in a proactive manner according to the Drinking Water Quality Regulatory Strategy. In cases of severe drinking water quality failure, emergency response will also be instituted.

Drinking water quality management regulation: Incentives and sanctions

DWAF is committed to performing its role as sector regulator in a supportive and developmental manner. When capacity problems are identified that may prevent a WSA from being compliant, avenues of support will be explored until such time that the WSA is capable of being compliant. The focus is thus on incentive-based regulation. However, in cases of reluctance or negligence by the WSA management to rectify identified non-compliant activities relating to drinking water quality management, while being capable of doing so, then punitive actions will be considered.

Should a WSA fail to meet its legislated obligations regarding service delivery according to the promulgated Norms and Standards under Section 9 or 10 of the Water Services Act (No. 108 of 1997), it will be in the best interests of the consumer if the National Regulator follows a defined course of action in order to obtain compliance from the defaulting authority.

Proposed capacity building and supportive measures

Many WSAs in South Africa are overwhelmed by the mandated drinking water quality monitoring and management requirements and have difficulty in establishing priorities. DWAF have proposed a number of capacity-building initiatives to support WSAs to implement effective drinking water quality management, including:

- Simple protocols and implementation manuals indicating and prioritising step-by-step actions for effective drinking water quality management.
- On-site mentoring demonstrating the use of the implementation manuals by experienced staff from performing WSAs.
- The introduction of accredited drinking water quality management training courses for sector stakeholders, with particular emphasis on WSA operation staff and DWAF regional office water services staff.
- Regional DWAF staff (technical) are to be trained to operate in technical advisory capacity when requested or when regulatory investigations highlight shortcomings that require communication and rectification. Staff capacity in the DWAF regional offices may need to be increased to undertake this support function effectively.
- DWAF regional office staff assisting WSAs with the prioritisation of maintenance and refurbishment of water treatment infrastructure projects in their INTEGRATED DEVELOPMENT PLANS, to ensure that these projects are eligible for municipal infrastructure grant funding.

Drinking water quality management tools and products

The drinking water quality management project resulted in a number of documents and tools being developed to provide the water sector with the information needed to monitor, manage, communicate and regulate drinking water quality in order to protect public health. These documents and tools include:

The **Drinking Water Quality Framework for South Africa** is the overarching document in the series and includes information on drinking water quality management and regulation, as well as the institutional arrangements necessary to implement the strategies presented in the Framework.



The **Drinking Water Quality Management Guide for Water Services Authorities** is intended to assist WSAs and water services providers to manage their drinking water supply systems holistically and effectively.



The **Drinking Water Quality Regulation Strategy** is intended to provide DWAF, Water Services Regulation, National and Provincial Government and WSAs with an understanding of the short-, medium- and longer-term drinking water quality regulation strategies, and the associated institutional arrangements, necessary for effective drinking water quality regulation.



The **Water Services Authority Awareness Pamphlet** is intended to assist WSAs and water services providers in their legal responsibilities to manage their drinking water supply systems holistically and effectively.



The **Disinfection Awareness Pamphlet** is intended to assist WSAs to understand the role of disinfection in the provision of safe drinking water.



The **Consumer Awareness Pamphlet** is intended to make information more widely available and encourage people to gain a better understanding of the processes required for the provision of safe drinking water for the communities of South Africa.



A **Drinking Water Quality Management Model** is intended to assist WSAs to cost out and budget for the minimum requirements necessary for effective drinking water quality management.



A **Drinking Water Quality Management Diagnostic Tool** is intended to assist WSAs to get an understanding of the possible reasons for, and the implications of, drinking water quality failures.



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