

# Guidelines for Drinking-Water Quality Volume 3

## Session Objectives

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- To describe the scope, purpose and content of Volume 3 of the Guidelines for Drinking-water Quality and the process of its development.
- To describe the basic concepts incorporated within Volume 3 of the Guidelines and show how these should be addressed within the context of monitoring development.
- To describe the implementation of surveillance programmes in small communities and to emphasise the use of sanitary surveys, source protection and minimum treatment requirements in these areas.

## ***Guidelines for Drinking-Water Quality Volume 3***

### ***History and Development***

The first edition of WHO *Guidelines for Drinking-water Quality* was published by WHO in 1984-1985 and was intended to supersede earlier European and international standards. Volume 1 contained guideline values for various constituents of drinking-water and Volume 2 the criteria monographs prepared for each substance or contaminant on which the guideline values were based. Volumes 1 and 2 of the Guidelines are therefore intended to be supportive of risk assessment. In translating the information they contain into risk management, largely through standard-setting, Member States are encouraged to take social, economic and cultural factors into consideration.

Volume 3 was concerned with the monitoring and management of drinking-water in small communities, particularly those in rural areas - a problem of world-wide concern. In contrast to the first two volumes it therefore includes relatively extensive coverage of technical, managerial and organizational aspects.

A number of important principles were established in the first edition of Volume 3 of the Guidelines, published in 1985. These included:

- the distinct and complementary roles of the water supplier and the surveillance agency;
  - the unique nature of the problems associated with the monitoring of small community supplies;
  - the central role of microbiological monitoring of supplies of this type, including the concept of critical parameter testing; and
  - the importance of ensuring that surveillance leads to engineering improvements and other remedial measures.
- It also noted the importance of remedial measures and of community participation.

During the International Drinking-water Supply and Sanitation Decade 1981 - 1990 considerable experience was gained in the surveillance and improvement of small community supplies. The first edition of Volume 3 of the Guidelines for Drinking-water Quality provided a basis for a number of pilot projects and country programs in central and south America, Africa and various parts of Asia and the Pacific, several with the support of the Overseas Development Administration of the United Kingdom (ODA) and the United Nations Environment Program (UNEP). Regional and national training courses were conducted which were also supported by the Danish International Development Agency (DANIDA) and which allowed for the review and evaluation of the approaches and materials proposed in the Guidelines. In particular the experience gained through three demonstration projects supported in part by WHO in Indonesia, Peru and Zambia was reviewed and published in 1991.

Experience gained during the Decade highlighted the importance of additional concepts which were integrated into the second edition of Guidelines Volume 3. These included:

- the need to consider water quality not in isolation but as one of a number of water supply service parameters which influence health;

- an understanding of the linkages between monitoring and improvement which then provided the structure of the document;
- the fundamental importance of sanitary inspection and of its systematization;
- practical means to compare and present information on supply service quality to assist in decision-making; and
- the importance of addressing small community supplies of all types, including those to small peri-urban settlements.
- And the second edition therefore also included increased attention to human resource development and communication issues.

The preparation of the second edition of the Guidelines Volume 3 was made possible through a grant provided by ODA to the Robens Institute, University of Surrey, UK and through the support of DANIDA to the second review meeting. The process began at a review meeting held in Harare, Zimbabwe 24 - 28 June 1991, when proposed changes were reviewed and a detailed outline agreed. A draft of the revised Volume 3 was reviewed at the Final Task Group Meeting on the Revision of the WHO *Guidelines for Drinking-water Quality* held in Geneva 21 - 25 September 1992. That meeting endorsed the general content of the draft, made specific recommendations for finalisation and recommended that a revised draft be reviewed at a technical meeting in Tirana in 1993 before publication. The final version of Volume 3 reflected the experience of the three demonstration projects in Indonesia, Peru and Zambia and many other projects concerned with improving the quality of water services undertaken during the Decade.

### **Scope and Applicability of Volume 3**

Volume 3 of the Guidelines specifically addresses the specific problems associated with the surveillance of 'community supplies'. The precise definition of a 'community water supply' will vary. Whilst a definition based upon population size or type of supply may be appropriate under many conditions, it is often administration and management that set aside community supplies. The involvement of ordinary, often untrained and sometimes unpaid community members in the administration and operation of water supply systems is often characteristic of small communities and this provides already distinction between community water supplies and those of larger towns and cities. However water supplies in peri-urban areas around larger towns and cities may be organizationally similar to those of rural communities and may also be classified as 'community water supplies'.

In addition to the voluntary and local nature of the operation and management of many community supplies, they present additional challenges to the surveillance function. These challenges include the fact that the quality control function which would normally be undertaken by the supply agency may be entirely absent - a local volunteer is unlikely to be able to undertake analytical quality control - and the role of the surveillance agency may have to be modified accordingly.

Similarly, especially rural community supplies are often disperse and sometimes distant from the bases of operation of the surveillance agency. Organizing programs of regular visits to such communities presents a particular challenge and may be costly.

Finally, evidence clearly indicates that microbiological contamination is the principal health concern for community water supplies world-wide. Since microbiological contamination

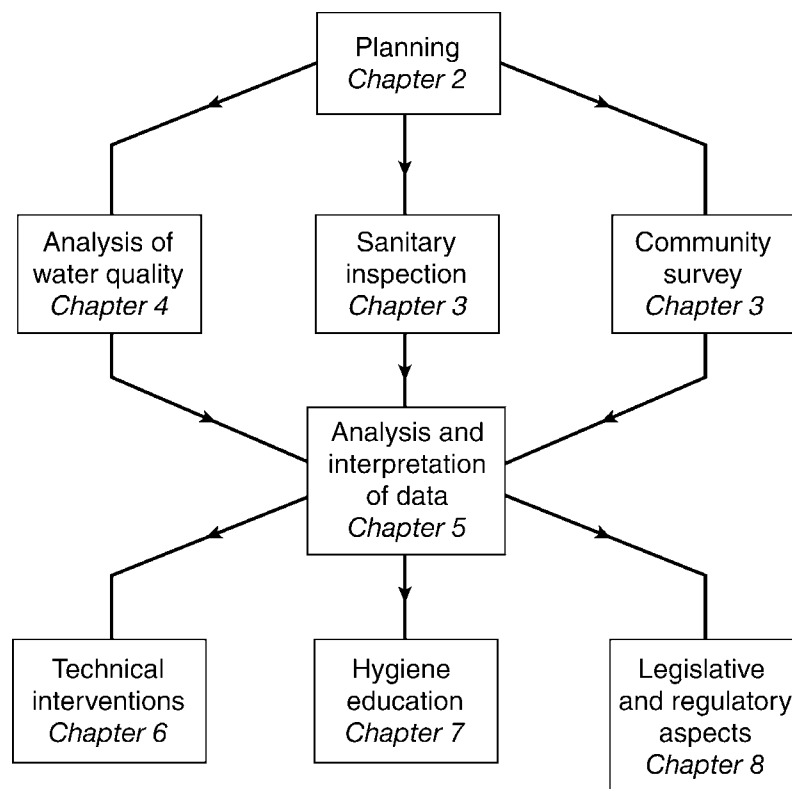
may vary widely and rapidly, approaches based upon sampling and analysis may be entirely inadequate in such supplies and great reliance must be placed upon preventive measures and sanitary inspection in order to ensure microbiological safety.

While conditions vary between countries and regions, as a result of differences in economic, geographical, cultural and social conditions, the strategies and procedures described in Volume 3 should be widely applicable.

### **Content and Structure**

Volume 3 describes the methods employed in the surveillance of drinking-water supply and quality in light of the special problems of small-community supplies and outlines the strategies necessary to ensure that surveillance is effective. It is also concerned with the linkages between surveillance and remedial action and with the form that remedial action should take.

The structure of Volume 3 reflects the principal stages in the development of surveillance and is shown in Figure 1 below.



**Figure 1: Structure of Volume 3 of the GDWQ**

Chapter 2 covers planning and subsequent chapters deal with the procedures used in the collection of information - sanitary inspection and community surveys (Chapter 3), and the analysis of water quality (Chapter 4). Chapter 5 considers the analysis and interpretation of the information gathered and its use in improving water supply services. The final three chapters cover strategies for improvement - technical interventions (Chapter 6), hygiene education (Chapter 7) and legislation and regulation (Chapter 8).

### **Basic Concepts**

#### **The distinct and complementary roles of the water supplier and the surveillance agency**

Organizational arrangements for the improvement of water supply services should take into account the vital and complementary roles of the agency responsible for surveillance and the water supplier.

In most countries the agency responsible for surveillance of drinking-water supply services is the Ministry of Health and its regional or departmental offices. In some countries there is an environmental protection agency; in others environmental health departments of local government may have some responsibility. Its responsibilities should encompass: the monitoring of compliance with supply service standards including quality, coverage, quantity, continuity and cost by water suppliers; approving sources of drinking-water, and; surveying the provision of drinking-water to the population as a whole.

The surveillance agency should be given the necessary powers to administer and enforce laws, regulations and codes concerned with water quality. Surveillance is indispensable for the development of rational strategies for the improvement of the quality of water-supply services.

Water suppliers should be responsible at all times for the quality and safety of the water that they produce, and they achieve this through a combination of good operating practice and preventive maintenance, supported by quality control. Water quality control is the responsibility of the supplier and involves the establishment of safeguards in the production and distribution of drinking-water as well as routine testing of water quality to ensure compliance with national standards.

Quality control is distinguished from surveillance on the basis of institutional responsibilities and the frequency of monitoring activities conducted. The surveillance agency is responsible for an independent (external) and periodic audit of all aspects of safety, whereas the water supplier is responsible at all times for regular quality control, and for the monitoring and ensuring safe operations.

These two functions - surveillance and quality control are best performed by separate and independent entities because of the conflict of interests that arises when they are combined.

#### **The central role of microbiological monitoring**

As noted above, evidence clearly indicates that microbiological contamination is the principal health concern in community water supplies world-wide. Furthermore, since microbiological contamination may vary widely and rapidly, approaches based upon sampling and analysis

may be entirely inadequate in such supplies and great reliance must be placed upon preventive measures and sanitary inspection in order to ensure microbiological safety.

There are three principal components to the strategy which should be adopted and promoted. Firstly, systems should be intrinsically well-designed and capable of supplying safe water continuously. For groundwater sources this is generally achieved through source protection measures; whilst for surface water sources the selection of treatment processes and system capacity should take into account the quality and quality variations in the source water.

Secondly, regular inspections should be made to ensure that the system continues to operate safely. These sanitary inspections should take account of the whole of the supply system - from source to point of supply; and should systematically assess the condition of the system. Considerable information is included in Volume 3 including examples of sanitary inspections forms for adaptation to local circumstances. Sanitary inspections may be performed by both the surveillance agency and by the community itself. Community inspections help to ensure a higher frequency of surveillance activity than the surveillance agency itself might be able to perform. When sanitary inspections are carried out, they must use standardized methodologies to allow the consolidation of data at regional and national levels in order to prioritize interventions and investment on the basis of greatest need.

Finally, not all sources of contamination are detected by sanitary inspection, however carefully performed, and it is therefore essential to undertake occasional sampling and analysis for the critical parameters of drinking-water quality.

### **The importance of ensuring that surveillance leads to improvement**

For water supply surveillance to lead to improved drinking-water supply services it is vital that the mechanisms for promoting improvement are recognized and used. Information alone does not lead to improvement. It is the effective management and use of the information generated by surveillance that makes possible the rational improvement of water supplies - where 'rational' means that available resources are used for maximum public health benefit.

The ways in which surveillance may lead to improvements in water supply provision are dealt with in some detail in chapters 5 to 8 and are summarized in Table 1 below which is taken from Volume 3.

**Table 1: Mechanisms for the improvement of water-supply services based on the results of water-supply surveillance**

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- **Establishing national priorities**  
When the commonest problems and shortcomings in water-supply systems have been identified, national strategies can be formulated for improvements and remedial measures; these might include changes in training (of managers, administrators, engineers, or field staff), rolling programmes for rehabilitation or improvement, or changes in funding strategies to target specific needs.
  - **Establishing regional priorities**  
Regional offices of water-supply agencies can decide which communities to work in and which remedial activities are priorities; public health criteria should be considered when priorities are set.

- **Establishing hygiene education**

Not all of the problems revealed by surveillance are technical in nature, and not all are solved by supply and construction agencies; surveillance also looks at problems involving private supplies, water collection and transport, and household treatment and storage. The solutions to many of these problems are likely to require educational and promotional activities coordinated by the health agency.

- **Enforcement of standards**

Many countries have laws and standards related to public water supply. The information generated by surveillance can be used to assess compliance with standards by supply agencies. Corrective action can be taken where necessary, but its feasibility must be considered, and enforcement of standards should be linked to strategies for progressive improvement.

- **Ensuring community operation and maintenance**

Support should be provided by a designated authority to enable community members to be trained so that they are able to assume responsibility for the operation and maintenance of their water supplies.

### **Parameters of water supply service quality**

While the safe quality of water supplied to communities is an important consideration in the protection of human health and well-being, it is not the only factor that affects the health of consumers. Access to water is of paramount concern and other factors such as the population served, the reliability of the supply and the cost to the consumer must therefore be taken into account. At the United Nations Conference at Mar del Plata in 1977 which launched the International Drinking-water Supply and Sanitation Decade, this philosophy was unambiguously and the Conference Declaration included the statement that: *'all peoples, whatever their stage of development and social and economic condition have the right to have access to drinking-water in quantities and of a quality equal to their basic needs'*.

Access to water may be restricted in several ways, e.g. by prohibitive charges, daily or seasonal fluctuations, breakdown, or lack of supplies to remote areas. Seasonal, geographic and hydrological factors may conspire to deprive households, communities or regions of a continuous, reliable supply of safe drinking-water. Such problems are not confined to poorer countries: they are also experienced in industrialized countries where the management of demand has failed or population growth has outpaced the rate of development of water resources for example.

If the performance of a community water supply is to be properly evaluated a number of factors must be considered. Quantitative service indicators for this purpose may include:

quality	the proportion of samples or supplies that comply with guideline values for drinking-water quality and minimum criteria for treatment and source protection
coverage	the percentage of the population that has a recognizable (usually public) water supply system

quantity	the average volume of water used by consumers for domestic purposes (expressed as liters per capita per day)
continuity	the percentage of the time during which water is available (daily weekly or seasonally)
cost	the tariff paid by domestic consumers

### **Need to address the population as a whole/all community supplies**

It is those persons with inadequate or no water supply who are at greatest public health risk. It is technically possible, effective from a public health viewpoint and ethically desirable to identify such populations and to target them for improvements. Thus whilst the supply agency should be responsible for the quality of the service they provide, the surveillance agency should seek to assess the water supply to the population as a whole - including identifying the extent of supply within 'supplied' communities, identifying communities with no supply and determining the means of provision employed by the 'disperse' population.

### ***Implementation***

Surveillance is an investigative activity undertaken to identify and evaluate factors associated with drinking-water which could pose a risk to health. Surveillance contributes to the protection of public health by promoting improvement of the quality, quantity, coverage, cost and continuity of water supplies. It is also both preventive - detecting risks so that action may be taken before public health problems occur - and remedial identifying the sources of outbreaks of waterborne disease so that corrective action may be taken promptly.

Surveillance requires a systematic program of surveys that combine sampling and analysis, sanitary inspection and institutional and community aspects.

### ***Conclude presentation with a summary:***

This presentation has covered:

- the history of Volume 3, its special character and purpose in addressing a specific problem of world-wide concern.
- the key principles underlying the volume and concerning surveillance of community supplies.
- the structure and content of volume and how it relates to the implementation of a surveillance program.



## Guidelines for Drinking-Water Quality Volume 3

### Presentation Plan

Section	Key points	OHP
<b>History and Development</b>	<ul style="list-style-type: none"> <li>• first edition of the GDWQ published 1984-5 in 3 volumes</li> <li>• volume 1: guidelines; volume 2: criteria and supporting information; volume 3: community water supplies</li> <li>• volumes 1&amp;2 provide risk assessment, whilst volume 3 emphasises implementation in small community water supplies and covers other aspects</li> <li>• 1st edition established key principles (see OHP2)</li> <li>• in IWSSD (1980s) considerable experience in small community water supplies and pilot projects used to test and refine volume 3</li> <li>• this led to additional concepts included in volume 3</li> <li>• volume 3 reviewed at 2 meetings and finally Tirana in 1993</li> </ul>	<b>1, 2, 3</b>
<b>Scope and applicability of Volume 3</b>	<ul style="list-style-type: none"> <li>• volume 3 specifically addresses community-based water supplies</li> <li>• community supplies defined on the basis of management/ administration rather than population size or type of supply</li> <li>• community supplies may cover both peri-urban and rural water supplies operated and managed by non-professional community members</li> <li>• community water supplies present unique monitoring problems, there is often no quality control function and thus modified surveillance role</li> <li>• rural communities often dispersed and many in number making surveillance costly</li> <li>• need to emphasise preventive actions and non-analytical approaches to surveillance to ensure microbiological quality</li> </ul>	<b>4</b>
<b>Content and Structure</b>	<ul style="list-style-type: none"> <li>• volume 3 outlines methods for surveillance in community water supplies and in particular the linkage of surveillance to improvement of water supplies</li> <li>• the structure of the document reflects the stages of surveillance development for community supplies</li> </ul>	<b>5</b>



Section	Key points	OHP
<b>Basic Concepts</b> <i>(continued)</i>	<p><i>Parameters of water supply</i></p> <ul style="list-style-type: none"> <li>• must address all aspects of water supply</li> <li>• access must be seen as the key priority</li> <li>• also take reliability, coverage and cost into account</li> <li>• there can be many reasons why access to water supplies may be restricted</li> <li>• when evaluating performance of community water supplies, can use five quantitative indicators: quality, quantity, continuity, coverage &amp; cost</li> </ul> <p><i>Need to address community as a whole</i></p> <ul style="list-style-type: none"> <li>• those parts of population with inadequate or no water supply at greatest risk</li> <li>• should target these groups for investment</li> <li>• supply agency responsible for ensuring adequacy of supply to the ‘supplied’ population</li> <li>• surveillance agency should assess whole population, identify those not supplied and determine mechanisms to rectify this</li> </ul>	
<b>Implementation</b>	<ul style="list-style-type: none"> <li>• surveillance is an investigative public health-based activity</li> <li>• surveillance protects health through promoting improvement in water supply</li> <li>• it is both preventive and remedial</li> <li>• surveillance is systematic and includes analysis, inspection, institutional and community aspects</li> </ul>	
<b>Conclusions</b>	<ul style="list-style-type: none"> <li>• have covered summary of volume 3</li> <li>• shown the principles underlying volume 3</li> <li>• provided structure and content of volume 3 &amp; its implementation</li> </ul>	

# WHO Guidelines for Drinking-Water Quality

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Volume 1	Recommendations
Volume 2	Health Criteria and other Supporting Information (IPCS)
Volume 3	Surveillance and Control of Community Supplies



## Principles Underlying Volume 3

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- Suppliers and surveillance agency have distinct and complementary roles
- Small & community water supplies have unique requirements and require a different approach to monitoring
- Critical parameter testing is of paramount importance
- Surveillance must be linked to improvements in water supply
- Many small supplies are community managed and therefore community participation is essential



## Lessons learnt during the IDWSSD

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- Key parameters: quantity; quality; continuity; coverage; and cost
- Linkages between monitoring and improvements must be clearly understood
- Sanitary inspections are essential and should be systematic
- Water supply monitoring data must be comparable to be of use
- Community supplies, including those in peri-urban areas, must be addressed
- Human resource development and communication of monitoring information are vital



## Scope and Applicability of Volume 3

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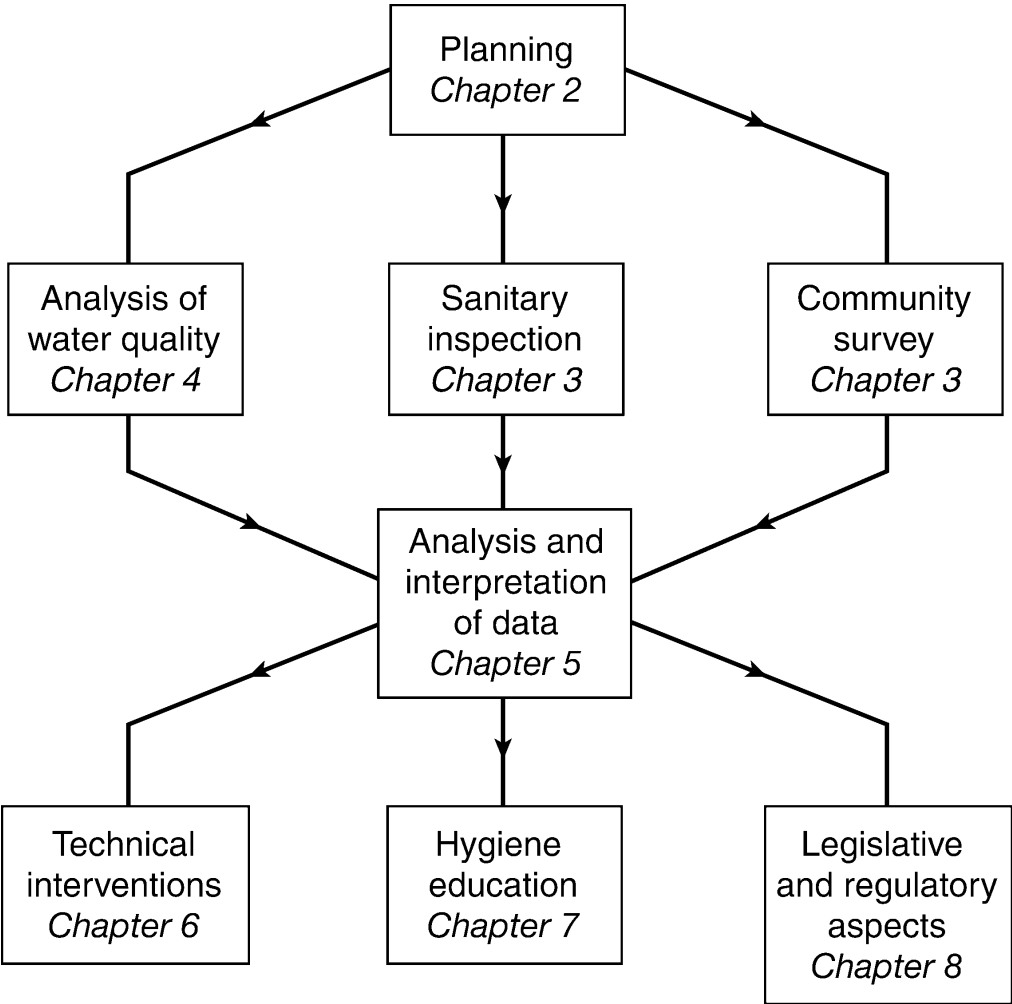
- Specifically addresses community-based water supplies
- Community supplies may cover both peri-urban and rural water supplies operated and managed by non-professional community workers
- Community water supplies present unique monitoring problems often with no quality control
- Rural communities often numerous and dispersed thus making surveillance costly
- Need to emphasise preventative actions and non-analytical approaches to surveillance to ensure microbiological quality



# Structure of Volume 3 of the GDWQ

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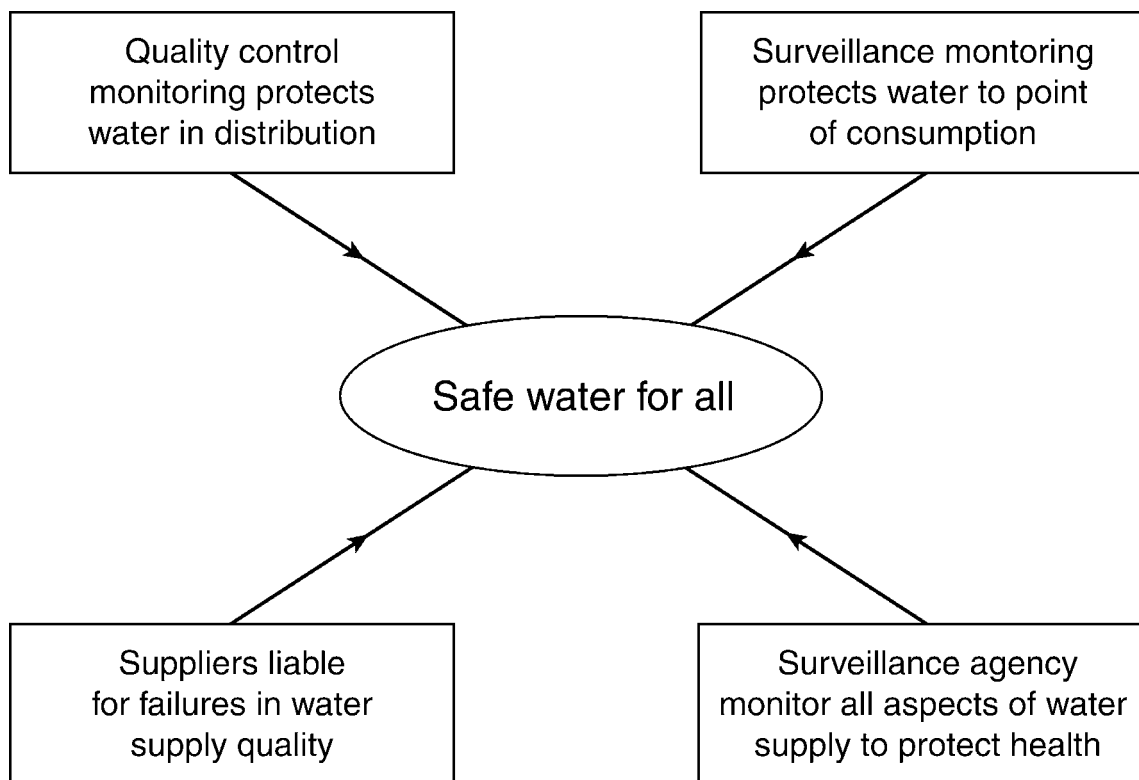




# Distinct and complimentary roles of suppliers and surveillance agencies

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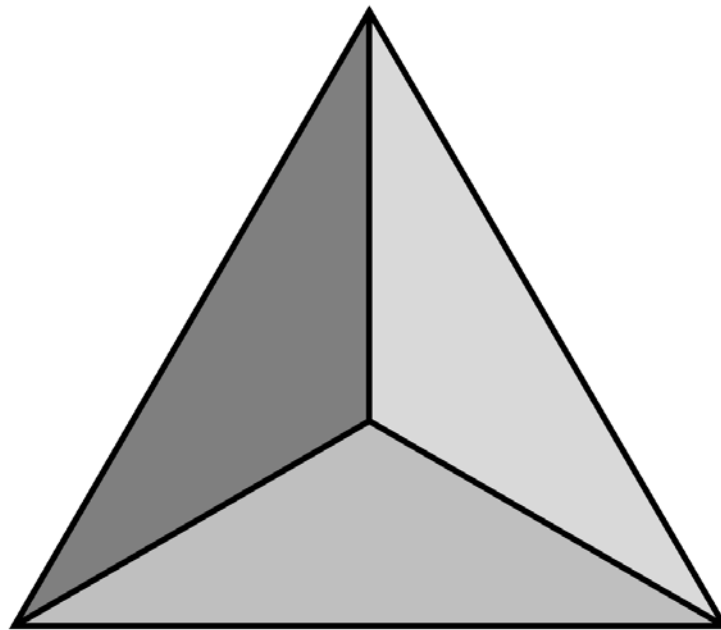


# Strategy for water supply quality protection and improvement

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Source protection and/or  
minimum treatment  
requirements



Water quality  
surveillance and  
assessment

Sanitary  
inspection



## Critical Parameters

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<b>Parameter</b>	<b>Recommended Level</b>
Faecal coliforms	0 per 100 ml
Turbidity	<5 NTU
Disinfectant residual	0.2 - 0.5 mg/l
pH	6.5 - 8.5

Note: Samples must be analysed within six hours of taking the sample from a water supply. In areas where transport or roads are poor and this is not possible, portable water testing kits can be used.



# Use of monitoring data to improve water supply

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- Establishing national priorities
- Establishing regional priorities
- Establishing hygiene education
- Enforcement of standards
- Ensuring community operation and maintenance
- Human resource development and communication of monitoring information are vital



# Five Key Parameters of Water Supply Service

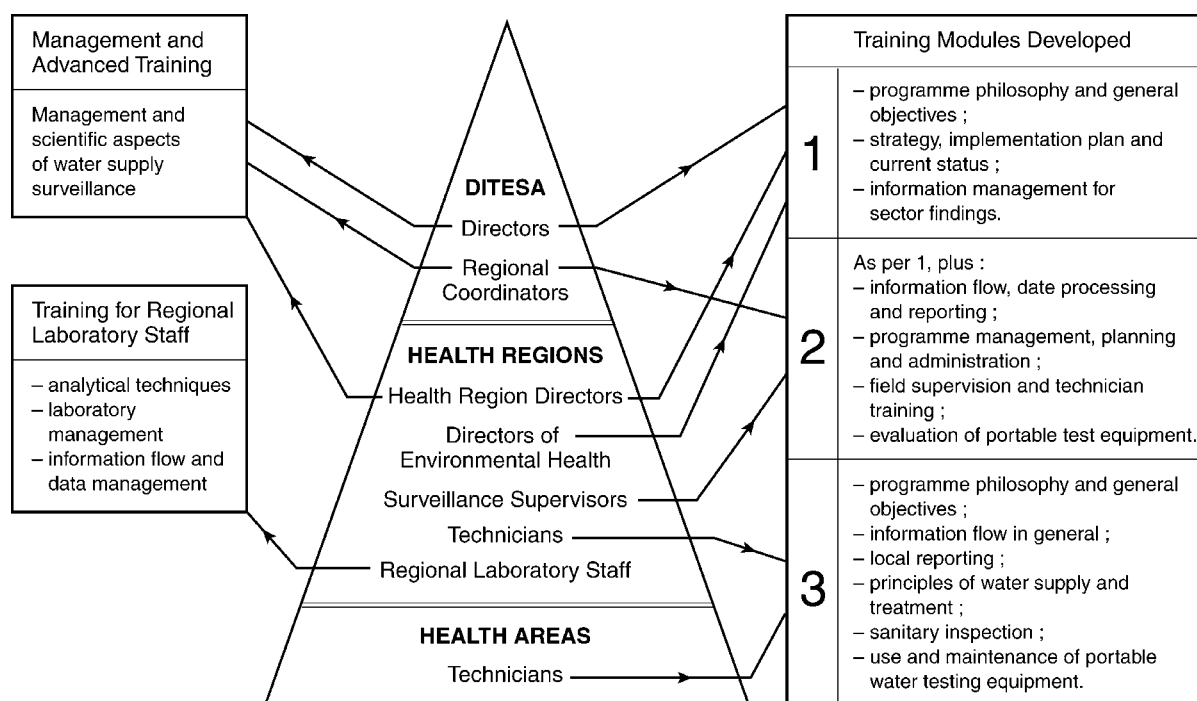
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- Quality
- Coverage
- Quantity
- Continuity
- Cost



# Human Resources Development for Water Supply Surveillance in Peru



Source: Lloyd et al., 1991

