GUIDELINE FOR THE MANAGEMENT OF WATERBORNE EPIDEMICS, WITH THE EMPHASIS ON CHOLERA

Department of Water Affairs and Forestry

Edition 1 - March 2002
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OF WATERBORNE EPIDEMICS,
WITH THE EMPHASIS ON CHOLERA

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The fear of an epidemic outbreak of a waterborne disease in South Africa had always been a reality in the Department of Water Affairs and Forestry (DWAF). Although isolated incidents of cholera had been reported and dealt with in the past, the latter half of 2000 saw a dramatic increase in the number of reported potential cholera cases, especially in the kwaZulu-Natal Province. Cholera is however only one of a number of waterborne diseases that could reach epidemic proportions. Many communities are still relying on untreated water from surface resources for their daily supply, and/or do not have access to adequate sanitation facilities. It is these communities that are at risk and living under the threat of waterborne diseases. Therefore, DWAF is co-responsible to take certain definite actions in a co-ordinated manner together with other Government Departments to manage and prevent the spread of such highly contagious and potentially lethal diseases.

In terms of the National Water Act (NWA), 1998 (Act 36 of 1998), DWAF is mandated to regulate the water resources of South Africa, and is responsible for the prevention of pollution. Pollution means the alteration of the properties of a water resource so as to make it, among others, “harmful or potentially harmful to the welfare, health or safety of human beings”. In terms of the Water Services Act, Act 108 of 1997, local authorities have to execute their functions as water service providers. DWAF provides support in this regard, especially to those who do not have access to potable water or adequate sanitation, as is the case for many rural communities, as well as to those local authorities which do not have the capacity to fulfil this function at this point in time. DWAF is therefore co-responsible to take certain definite actions in a co-ordinated manner together with other Government Departments to manage and prevent the spread of such highly contagious and potentially lethal diseases. Various different components within DWAF are involved with the management of such problems, and actions by these components also need to be harmonised to avoid duplication and to ensure adequate and effective communication and co-operation.

Following consultation with various directorates and components in the Department, this guideline document was developed to co-ordinate the efforts within the Department towards actions aimed at the management of the problems associated with an epidemic outbreak of a waterborne disease such as cholera. Lessons learnt during the current cholera epidemic has been incorporated into this guideline document, and it contains:

- some background information regarding waterborne diseases, especially cholera, and sampling techniques for confirming the presence of an outbreak;
- a strategy for the co-ordinated management of outbreaks of waterborne diseases;
- a guideline for the involvement and role of DWAF in the co-ordinated management of outbreaks, especially with regard to the surveillance of water supply and sanitation infrastructure to ensure operational efficiency, support functions during emergency conditions regarding the supply of water and sanitation, and water quality monitoring;
- a specific protocol for the predictive, preventative and investigative monitoring of water resources and water supply and sanitation infrastructure, both during normal situations and under outbreak conditions, in the context of national bacteriological monitoring programmes; and
- protocols for inter- and intra-Departmental co-ordination, communication, reporting and funding.

Although the focus of the document is primarily on the epidemic outbreak of cholera and the management of such outbreaks, the principles contained here in could also be applicable to the prevention and management of other waterborne diseases. The aim of this document is therefore to provide a strategy to properly manage, monitor, and communicate about, such situations. The guidelines are to be used by Regional Offices of the Department, as well as by those Directorates in Head Office involved with the provision of water services, water quality management and monitoring, as well as other relevant sectors, until such time it is reviewed and replaced by an updated edition. A secondary aim of the document is to distil comments regarding the use there-of from those involved with cholera management actions, which will contribute towards revision and upgrading of the document.

The broad guidelines contained here-in should be put in place as part and parcel of the Regional strategic plans for containing a cholera outbreak, and should aid in the effective ongoing and future management of cholera epidemics and other related waterborne diseases by the responsible sections in the Department of Water Affairs and Forestry.
DOCUMENT INDEX

WATER QUALITY MANAGEMENT GUIDELINE SERIES:
SUBDIRECTORATE URBAN DEVELOPMENT AND AGRICULTURE

U 1.1: Managing the Water Quality Effects of Settlements: The National Strategy
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U 1.3: Managing the Water Quality Effects of Settlements: A guide to problem analysis: Operational Guideline
U 1.4: Managing the Water Quality Effects of Settlements: Instructor's Guide for Training Course
U 1.5: Guideline for the Management of Waterborne Epidemics, with the emphasis on Cholera - Co-ordination, Communication, Action and Monitoring: Edition 1

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- **Mr K Schaffner** Information Support Services

**Mrs Lorraine Arntzen** from the South African Institute for Medical Research Enteric Diseases Laboratory in Johannesburg is thanked for her valuable inputs.
Many communities are still relying on untreated water from surface resources for their daily supply, and/or have no or limited access to adequate sanitation facilities. It is these communities that are at risk and living under the threat of waterborne diseases. Cholera is only one of a number of waterborne diseases that could reach epidemic proportions. It is a waterborne disease that originated in the Ganges River delta of the Indian subcontinent, where it has been endemic for many centuries. It is an acute intestinal infection caused by the ingestion of contaminated water and/or food containing the bacterium *Vibrio cholerae*. Strains of *Vibrio cholerae* are both agglutinating and non-agglutinating (NAG). Epidemic cholera is caused mainly by the serotypes Ogawa, Inaba, and Hikojima (a very rare type) of the agglutinating O1 serogroup of *Vibrio cholerae*. Most of the over one hundred NAG strains of *Vibrio cholerae* are natural inhabitants of the aquatic environment, and do not cause epidemic cholera. However, some of the NAG strains can cause sporadic cases of diarrhoea similar to gastro-enteritis, but this tends to affect isolated individuals, and does not spread in epidemic fashion, except for the O139 or “Bengal” strain. The NAG O139 strain has so far not caused a cholera epidemic outside the Far East and has not yet spread to Africa. The cause, symptoms, analytical confirmation of dianosis, treatment and spread of cholera are addressed in detail in section 2 of this document.

According to the World Health Organisation (WHO), *“Cholera will ultimately be brought under control only when water supplies, sanitation, personal hygiene and food handling practices are safe enough to prevent the spread of Vibrio cholerae O1.”* When cholera appears in a community, it is thus essential to ensure five basic aspects:

1. appropriate medical assistance;
2. adequate supply of safe drinking water;
3. hygienic disposal of human faeces;
4. proper food and general personal hygiene; and
5. appropriate monitoring of the occurrence and potential spread of the disease.

A guideline for the management measures that need to be taken by those responsible under outbreak conditions, i.e. where confirmed cases of cholera had been identified, is outlined on page vi. In South Africa, the implementation of these measures fall within the mandate of several national government departments, as well as different provincial and local authorities and other role-players, each who have different responsibilities in relation to the management of the problem, as discussed in section 3 of the document. In order to manage the problem effectively, interdepartmental co-ordination and communication is therefore essential. A framework for the structured co-ordination and communication between responsible role-players is illustrated on page vii. Under outbreak conditions, it is of utmost importance to ensure the establishment of co-operative institutions such as “Cholera Management Task Teams” (CMTT) to co-ordinate and plan initiatives, and “Joint Operation Committees” (JOC’s) to actually implement plans. DWAF's contribution to and role in these co-operative structures originates from its legal mandate as custodian of the country’s water resources. DWAF is therefore responsible for certain aspects of a co-ordinated management strategy aimed at the control of waterborne diseases such as cholera. DWAF’s responsibilities in relation to the management of a cholera outbreak are discussed in detail in sections 4 and 5 of the document, and are briefly summarised below:

1. To assist in ensuring communication and liaison with other departments and between role-players by supporting co-ordination structures through providing assistance to the establishment and administration there-of, and by being appropriately represented on them and to assist with the development an integrated management strategy by intergovernmental co-ordination structures that will address the main aspects of cholera intervention (sections 4.2.1, 4.2.2 and 4.2.3).
2. To ensure that input into structures are co-ordinated through internal co-operation and communication between Water Services (WS), Operation and Maintenance (O&M), Water Quality Management (WQM), and other sections in DWAF, both at Regional and Head Office level; and to ensure that all the responsibilities of DWAF towards the management strategy are addressed in an integrated emergency, short, medium and long term action plan (sections 4.2.4, 4.2.5 and 5.3).
3. To assist in the identification of high-risk areas (section 3.4) by surveillance of existing water supply and sanitation infrastructure and on the basis of water quality monitoring results and knowledge of catchment areas, water users and resources; and to provide support with regard to the determination of the operational efficiency of water supply and sanitation infrastructure and the improvement there-of through co-operative governance by assisting with training and financial support where required, and by ensuring compliance with legal requirements (sections 4.3.1, 4.3.2 and 5.2 4.3.2).
4. To act as main support agent in the development of action plans for water supply and sanitation service delivery by providing general guidance on the provision of water supply and sanitation services; assistance with the provision of temporary infrastructure under emergency conditions; and support with regard to the upgrading and rehabilitation of existing infrastructure in the medium to long term, as well as for the establishment and construction of new permanent infrastructure (see section 4.4).
5. To co-ordinate bacteriological monitoring of water resources in high-risk areas in the context of a national microbiological monitoring programme (section 5.1), and to develop a co-ordinated monitoring programme to be implemented in these resources and at all water supply and sanitation facilities (section 5.2).
6. To ensure that reporting of, and communication regarding water quality results are effective and accurate (section 5.3); and to prevent the epidemic from spreading by contributing to the creation of awareness and providing training to relevant stakeholders (section 5.4), and
7. To provide guidance regarding the funding of cholera intervention strategies (as outlined in section 5.5).
Various different components within DWAF are involved with the actions required to manage the outbreak of waterborne diseases, and efforts by these components need to be harmonised to avoid duplication and to ensure adequate and effective communication and management. A proper communication and co-ordination structure between the different Directorates and components within DWAF that are involved with the management of the above-mentioned aspects is indicated on page viii below. A protocol for intradepartmental communication is contained in section 4.2.5.

DWAF may become aware of the existence of cholera when the Provincial Department of Health (PDoH) has diagnosed cholera and has notified DWAF. DWAF may also become aware of the possible outbreak of a waterborne disease through high levels of faecal pollution indicated in its own water quality monitoring conducted as part of a regular bacteriological monitoring programme, or otherwise submitted as part of water use authorisation conditions. In such cases, DWAF must co-ordinate the initiation of pathogen specific monitoring, and if results for a disease causing Vibrio Cholera are positive, notify the PDoH of a possible outbreak. When either of these scenarios occurs, the responsibilities of DWAF are to firstly determine whether a provincial or district CMTT, or a JOC exists. As a matter of principle, it must be emphasised that DWAF cannot act independently, and proceed to provide water and/or sanitation, or initiate an extensive awareness campaign, or conduct monitoring exercises without consultation with and co-operation from the other responsible role-players. An appropriate analysis of the situation and needs must first be conducted and clarity on responsibilities, especially those of PDoH and the local authorities, must be obtained at a CMTT or JOC level.

As part of the development of an effective management strategy, a priority list must be developed, in order to:
- Focus on areas for improvement that will have the greatest impact on mitigating any cholera outbreaks;
- Ensure structured implementation and management of remediation and upgrading to ensure cost effectiveness and socio-economic benefits; and
- Ensure appropriate budgeting and allocation of funds.

With regard to the co-ordinated management of an outbreak, the first priority of these co-ordinating structures would be to identify high-risk and potential high-risk areas (refer to section 4.3). To be able to achieve effective management over time, a key focus area would be the adequate and effective supply of safe water and the hygienic disposal of human faeces in high-risk areas. Therefore, in order to identify high-risk areas, it is necessary to conduct monitoring surveys of water resources to ensure their protection and to determine their status with regard to bacteriological pollution, and surveys of all existing water supply and sanitation infrastructure. DWAF must assist in this in order to contribute to the development of an appropriate short, medium and long term management strategy and action plan. The emergency to short-term strategy should focus on ensuring that rehydration centres, hospitals and clinics, as well as education facilities, have access to adequate and safe water supply and sanitation. The short to medium term strategy should be aimed at the implementation of measures which must focus on the rehabilitation of existing non-functional water supply and sanitation infrastructure that was found to be ineffective during the surveys. Non-functional water supply and sanitation infrastructure operated by DWAF must be upgraded and remediated as a matter of priority. With regard to water supply and sanitation infrastructure, the implementation of control over, and providing assistance to those responsible for operating these facilities, are also of utmost importance. The medium to long term strategy would be to assist local authorities to execute their responsibilities to provide adequate and proper water supply and sanitation services, and ensure that the ability and capacity exist to maintain these services in a sustainable manner.

Throughout the entire process, from before outbreaks until long term objectives have been achieved, two aspects require constant attention, namely monitoring and awareness. It should be evident that water quality monitoring plays an important role throughout the management of a cholera epidemic, since without appropriate and reliable data, high-risk areas cannot be identified, and success cannot be measured. DWAF need not conduct all the water quality monitoring required for the monitoring programme. The extent of DWAF’s responsibilities would rather be to co-ordinate monitoring activities by all stakeholders (local authorities, etc), to conduct compliance monitoring, to monitor water resources, and the works operated by DWAF (drinking water purification and sewage treatment). A protocol for the establishment of a dedicated bacteriological monitoring programme is discussed in section 5.2.

The only way in which to prevent the spread of cholera is to ensure that the general public is informed about the nature of the disease and that people are practising proper food and sanitary hygiene. DWAF should provide the necessary information in this regard, and should ensure that the PDoH and DoE play their roles in respect of awareness and education on hygienic sanitary practices for the affected households and communities, so that awareness creation activities are synchronised. It is however also important that those responsible to manage these types of outbreaks are informed about its nature, and their roles and responsibilities.

It is trusted that this guideline will assist in the effective and co-ordinated management of cholera related problems by officials of the Department of Water Affairs and Forestry.

Department of Water Affairs and Forestry

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1. Emergency Management Strategy and Action Plan

<table>
<thead>
<tr>
<th>Management Strategy</th>
<th>Action</th>
<th>Responsibility</th>
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<tbody>
<tr>
<td><strong>1) (Potential) Problem is identified</strong></td>
<td>a) Actual outbreak: PDoH identify and isolate first cases &amp; obtain full details of patients: Personal identification, origin of patient, movement over preceding period</td>
<td>Provincial Department of Health (PDH)</td>
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<td></td>
<td>b) Potential outbreak: DWAF Region identify potential for outbreak over water quality monitoring: Results on water supplied, water resources or sanitation infrastructure: location &amp; downstream users:</td>
<td>DWAF Region</td>
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<tr>
<td></td>
<td><strong>c) Ensure awareness of possible eruption of disease at all medical institutions</strong></td>
<td>PDoH</td>
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<td></td>
<td>d) Report suspected cases to WHO</td>
<td>NDoH</td>
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<tr>
<td><strong>2) Mobilise Management Structures &amp; Institutions</strong></td>
<td>a) Mobilise Disaster Management Structures: Alert neighbouring District/Municipal Councils (DMCs) &amp; all other role players, incl. the National Disaster Management Centre Prepare Media Statements to alert individuals regarding the possible epidemic nature of the disease and preventative measures to be taken by the general public</td>
<td>Provincial Disaster Management Structures (PDMs)</td>
</tr>
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<td></td>
<td>b) Activate Cholera Management Task Team (CMTT): Determine capacity of District/Municipal Council to manage CMTT Identify all role-players, and establish contact with representatives from responsible departments Initiate first meeting of CMTT in District/Municipal Council of outbreak with representatives from responsible departments</td>
<td>Provincial Department of Local Government Affairs or equivalent (PDLG)</td>
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<td></td>
<td><strong>c) Establishement of Cholera Management Task Team at first meeting:</strong> Appoint chair (District/Municipal Council, if capacity exist, otherwise PDLG, or elected by representatives) Populate CMTT by appointing members well as seconds Determine communication channels, communication strategy in relation to dealing with information, results and media liaison, and appoint media spokesperson of CMTT Allocate human resources, secure special funding and transfer financial resources if required Identify responsible departments, representatives and members for Joint Operational Committees (JOC’s)</td>
<td>All role-players from responsible departments</td>
</tr>
<tr>
<td><strong>3) Assess information and establish Action Plans</strong></td>
<td>a) Determine information status: Determine status of existing support structures (hospitals, clinics, communication structures, laboratories, human resources) Determine logistical requirements (vehicles, tents, supplies, etc) and initiate procedures to obtain such if required Determine information availability of affected and neighbouring communities from all sources Gather information (demographics, access to medical facilities, water supply &amp; sanitation status, migration routes &amp; transport linkages, social connections &amp; socio-economic status, water quality information on faecal pollution status of water resources, operational standards of sanitation infrastructure, etc))</td>
<td>CMTT (chaired by DMC/PDLG/elected chair)</td>
</tr>
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<td></td>
<td>b) Analyse Information: Id &quot;high risk&quot; areas through available survey &amp; monitoring information &amp; determine management objectives to prioritise activities Need for the establishment of emergency facilities – medical re-hydration tents, temporary water supply and sanitation infrastructure and laboratory facilities for monitoring Identify gaps in information and mobilise information gap filling exercise by responsible authorities and other role-players</td>
<td>CMTT</td>
</tr>
<tr>
<td></td>
<td>c) Develop Action Plan: Address the following aspects: Determine priorities and timeframes based on current information &amp; review based on updated information when available Establishment of emergency medical facilities: re-hydration tents; etc with determination of necessary logistical requirements, including water supply and sanitation; Health and hygiene awareness and education actions (mass media – printed press and radio/television, pamphlets; schools, social and religious gatherings, markets, transport hubs, individual household (door to door) contact), communities:</td>
<td>CMTT, JOC’s, Individual departments PDoH, DWAF; PDoH, PDoE, DWAF</td>
</tr>
<tr>
<td>Management Strategy</td>
<td>Action</td>
<td>Responsibility</td>
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</table>
| 3) Assess information and establish Action Plan (continued) | iv) Provision of access to safe water supply and sanitation infrastructure and services to:  
- rehydration centres, hospitals, medical clinics,  
- schools, community centres, transport hubs along strategic access routes, venues of social gatherings (markets, sports events, religious activities), and  
- access to water supply and sanitation to individual households & communities, by means of: 
  - temporary water supply infrastructure: road tankers/static tanks with limited local reticulation networks filled from rainwater harvesting/protected springs/new/existing non-functional boreholes refurbished with hand/mechanical pumps or package water purification plants from surface water abstraction points/small community water supply schemes;  
  - new temporary water sanitation infrastructure: portable/chemical sanitation facilities/VIP’s etc.;  
  - Refurbishment of existing water supply and sanitation infrastructure;  
  - Fast tracking or commissioning of permanent water supply and sanitation schemes under construction; and  
  - Implementation of new permanent water supply and sanitation infrastructure. | CMTT, JOC’s, Individual departments: PDoH & District/Municipal Councils  
PDoH, PDoW;  
PDoE;  
, District/Municipal Council  
Supported by PDoW, PDLG; DWAF Region; SANDF |
| | v) Ongoing information gathering on existing water supply and sanitation infrastructure to check on effectiveness of operation;  
v) Ongoing co-ordinated and cost-effective monitoring of high-risk water resources for faecal pollution, and affected resources for *Vibrio cholerae* to evaluate status of high-risk areas and measure success | CMTT, JOC’s,  
Local authorities, PDoW & DWAF Region |
| | iv) Determine management indicators and establish funding mechanisms | CMTT |
| | e) Determine logistical, training & support requirements of staff, and appointment of responsible personnel/consultants/contractors | Individual departments |
| 4) Implement Action Plan | a) Establish and resource emergency medical facilities/rehydration centres at location of infection:  
- Monitor patients for *Vibrio cholerae*, obtain patient details, confirm infections and prepare and submit reports | CMTT, JOC’s,  
PDoH |
| | b) Communication of possible epidemic nature to general public: Implement awareness & education programme & actions:  
- Prepare standard press releases for mass media; initiate individual (door to door) contact; print and distribute pamphlets  
- Initiate school awareness and education programme | CMTT, JOC’s,  
PDoH |
| | c) Implement access to safe water supply and sanitation services | See responsibilities under (iv) |
| | d) Control of compliance with authorisation conditions of sanitation facilities & support to operators | Local authorities, PDoH, PDoW & DWAF Regional Office |
| | e) Monitoring of supplied water and water resources for faecal pollution and *Vibrio cholerae* |  |
| | f) Training of personnel and operators |  |
| 5) Measure and Assess | a) Monitor Implementation of Action Plan with management indicators, including the following:  
- Number of new reported cases and accessibility to emergency intervention and other medical facilities  
- Coverage of health and hygiene awareness campaigns including effectiveness of personal protection at household level  
- Access to safe water supply and sanitation services and  
- WOM information on water supplied, water resources & sanitation infrastructure | CMTT |
| | b) Evaluate Effectiveness of Action Plan:  
- Analyse trends from detailed statistics of all newly reported & confirmed cases, and repeated infection of initial cases  
- Advise *Cholera Management Task Team* of spread and/or containment of disease | PDoH, PDMS, NDMC |
| 6) Review information & improve action plan | a) Monitoring of Epidemic and Management Interventions  
- Identify possible spreading of disease to neighbouring Municipalities/Districts or other High risk Areas and establish additional *Cholera Management Task Team* if necessary  
- Communicate to National Disaster Management Structures | Provincial Disaster Management Structures |
| | b) Review effective implementation of Action Plan based on management indicators | CMTT |
| | c) Review priorities & timeframes based on current and updated information as it becomes available |  |
2. Inter-Departmental Cholera Co-ordination Structure (Emergency Intervention)

National Department of Water Affairs & Forestry
- Head Office
- Regional Office

National Department of Provincial & Local Government

National Department of Health

SANDF

Provincial Department of Local Government or equivalent (PDLG)

Provincial Department of Education

Provincial Department of Public Enterprises/Works

Provincial Department of Health

Joint Operation Committees
- Chair: Provincial Department of Health

Local Government: District and Local Municipalities

Medical Services
- Health and Hygiene Awareness & Education
- Hospitals & Clinics
- Re-hydration Centres
- Reports on case statistics

Environmental Health Workers

Facilitators

Consultants

Operators and Maintenance

Consultants

Operators and Maintenance

Consultants

Operators and Maintenance

Consultants

Operators and Maintenance

Compliance Reports

DWAF Regional Office Support these Actions, Co-ordinate Water Quality Monitoring and Submit Reports

3. Intra-Departmental Co-ordination and Communication Structure for the Department of Water Affairs and Forestry

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These components must be kept continuously informed of new issues and basic statistics.

Cholera Management Task Team (Chair: District Council)

Joint Operation Committees

Implementing Agents: Water
Consultants
Contractors

Implementing Agents: Sanitation
Consultants
Contractors

Implementing Agents: Water Quality Control & Enforcement
Local Authorities
Hospitals
State Owned sanitation facilities and infrastructure

Implementing Agents Water Quality Monitoring
Consultants
Contractors
Compliance Reports
5. PROTOCOL FOR MONITORING, REPORTING, COMMUNICATION & FUNDING

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GLOSSARY OF TERMS

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<td>communicable</td>
<td>transferred from one host (person) to another</td>
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<tr>
<td>endemic</td>
<td>naturally present</td>
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<tr>
<td>enterotoxin</td>
<td>Agent that attack cells in the intestine, causing vomiting and diarrhoea</td>
</tr>
<tr>
<td>outbreak</td>
<td>area where humans have been confirmed to be infected with cholera</td>
</tr>
<tr>
<td>pandemic</td>
<td>world-wide epidemic</td>
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<tr>
<td>pathogen</td>
<td>disease causing organism</td>
</tr>
<tr>
<td>serotypes</td>
<td>different strains of the same species that are distinguished from each other because they have different antigens</td>
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## ABBREVIATIONS AND ACRONYMS

<table>
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<tbody>
<tr>
<td>ABET</td>
<td>Adult Basic Education and Training</td>
</tr>
<tr>
<td>CD</td>
<td>DWAF Chief Director</td>
</tr>
<tr>
<td>CD:WUC</td>
<td>DWAF Chief Director: Water Use and Conservation</td>
</tr>
<tr>
<td>CD:R</td>
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<tr>
<td>CMA</td>
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<td>Cholera Management Task Team</td>
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<tr>
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<td>Non-agglutinating, for example strain O139 of <em>Vibrio cholerae</em></td>
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<td>National Disaster Management Centre</td>
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<td>National Department of Education</td>
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<td>National Department of Health</td>
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<td>Polymerase Chain Reaction test procedure</td>
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<td>Provincial Department of Local Government or equivalent</td>
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<tr>
<td>VIP</td>
<td>Ventilated Improved Pit-latrine</td>
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1. INTRODUCTION

The World Health Organisation (WHO) recognises diarrhoeal diseases as the leading cause of death in developing countries. South Africa is no exception, and it had been estimated that as many as 43 000 South Africans might die annually as a result of diarrhoeal diseases. Many communities in South Africa are still relying on untreated water from surface resources for their daily supply, and/or have no or limited access to adequate sanitation facilities. It is these communities that are particularly at risk and living under the threat of waterborne diseases.

**Cholera** is one of a number of waterborne diseases that could reach epidemic proportions, since it is communicable. The fear of a cholera epidemic has always been a reality in South Africa. Although isolated incidents of cholera had been reported and dealt with in the past, the latter half of 2000 saw a dramatic increase in the number of reported potential cholera cases, especially in the kwaZulu-Natal Province.

As custodian of the country’s water resources, it is clear that the Department of Water Affairs and Forestry (DWAF) is co-responsible to take certain definite actions in a co-ordinated manner with other Departments to prevent the spread and manage outbreaks of contagious and potentially lethal waterborne diseases, such as cholera.

1.1 DOCUMENT OBJECTIVES

*This document therefore contains the strategy to be followed by responsible authorities, especially DWAF-components, in relation to the key focus areas for cholera control.* It is intended to provide guidance regarding the role of DWAF in the management of outbreak and potential problem areas, especially pertaining to co-operative initiatives, support with regard to water supply and sanitation, water quality monitoring, and communication.
2. SOME BASIC INFORMATION ON CHOLERA

Cholera is a waterborne disease that originated in the Ganges River delta of the Indian subcontinent, where it has been endemic for many centuries. Worldwide, it is now endemic in at least 80 countries and causes 120 000 deaths a year. It is an acute intestinal infection caused by the ingestion of contaminated water and/or food containing the bacterium *Vibrio cholerae*.

2.1 BACKGROUND

Strains of *Vibrio cholerae* can either be agglutinating or non-agglutinating (NAG). Most of the over one hundred NAG strains of *Vibrio cholerae* are natural inhabitants of the aquatic environment, and do not cause epidemic cholera. Some of the NAG strains can cause sporadic cases of diarrhoea similar to gastro-enteritis, but this tends to affect isolated individuals, and does not spread in epidemic fashion like cholera.

The current 7th pandemic (worldwide epidemic) of cholera, which has now surfaced in South Africa, is caused by two serotypes of the agglutinating O1 (biotype El Tor) strain of *Vibrio cholerae*, namely Ogawa or Inaba. This pandemic began around 1961 in Indonesia, and invaded West Africa in the early 1970’s, before which it had been absent for more than a century. The disease quickly spread to a number of countries and eventually became endemic (naturally present) in most of Africa, which have the highest case fatality rates in the world (close to 5% in 1998), although there had been a marked decline since 1970. Until 1992, only the agglutinating *V. cholerae* serogroup O1 was known to cause epidemic cholera. The WHO has identified the threat of an 8th pandemic, caused by a previously unrecognised serogroup of *Vibrio cholerae*, which began in Bangladesh and India in 1992, namely the NAG strain O139, or Bengal strain. The new O139 strain is the only NAG strain that can cause epidemic cholera, but has not yet spread to Africa and the West.

2.2 CHOLERA SYMPTOMS

What makes cholera so feared by all, is that in virulent form it can cause a healthy individual to change from hearty wellbeing to death within a matter of hours. Cholera has a short incubation period between one and five days, and produces an enterotoxin that causes the extremely abrupt onset of massive copious painless watery diarrhoea that depletes all the body fluids very rapidly, which can quickly lead to severe dehydration and death if not promptly treated. Vomiting also occurs in most patients. Both children and adults can be infected. In highly endemic areas, it is mainly a disease of young children, although breastfeeding infants are less affected.

There are many diarrhoeal diseases that can cause dehydration, and may be clinically mistaken for cholera in the early stages, such as viral or bacterial gastro-enteritis caused by other organisms. A patient is diagnosed with cholera only when the presence of *Vibrio cholerae* has been confirmed by culturing and serotyping. Testing the watery stool of the patient for toxic genes can indicate the potential presence of *Vibrio cholerae*, which can be confirmed within 2 to 5 days. More details regarding the sampling and analysis of *Vibrio cholerae* is contained in section 2.6 on page 5.

2.2.1 TREATMENT OF SYMPTOMATIC PATIENTS

When cholera occurs in an unprepared community, case-fatality rates may be as high as 50%, usually because there are no facilities for treatment, or because treatment is given too late. In contrast, a well-organised response in a country with a well-established diarrhoeal disease control programme can limit the case-fatality rate to less than 1%.

Most cases of diarrhoea caused by *Vibrio cholerae* can be treated adequately by giving a solution of oral rehydration salts. During an epidemic, 80-90% of diarrhoea patients can be treated by oral rehydration alone, but patients who become severely dehydrated must be given intravenous fluids. Treatment with antibiotics is not deemed effective and is not recommended for the vast majority of cholera cases.

Re-hydration treatment, whether oral and/or intravenous, is dramatically life saving if it is administered in time, before the dehydration has progressed too far, and reduces the mortality to less than 1%. The treatment of symptomatic patients alone will however not address the spread of the disease.

2.2.2 ASYMPTOMATIC INFECTIONS

When illness does occur, more than 90% of cases are of mild or moderate severity and are difficult to distinguish clinically from other types of acute diarrhoea. Less than 10% of ill persons develop typical cholera with signs of moderate or severe dehydration. Most infected persons do not become ill, but are “healthy carriers” of the bacterium, which is present in their faeces for 7 to 14 days.

Therefore, for every patient with diarrhoea, there are many cases of subclinical or asymptomatic infection in people remaining apparently healthy, although they also secrete the infectious *Vibrio cholerae* in their stools for up to 14 days. The asymptomatic presence of cholera in apparently healthy people with no signs of disease, is one of the reasons why it is difficult to halt a cholera epidemic. *Vibrio cholerae* is a very interesting pathogen, in that it has the ability to switch certain genes off or on (genetic switching), depending on the environmental conditions. This may be one of the reasons why *V. cholerae* causes life threatening cholera in one individual, and only a mild or asymptomatic infection in another. The situation is complicated by the existence of infectious, but not culturable, strains.
2.3 THE SPREAD OF CHOLERA
Cholera is an endemic disease, and the *Vibrio cholerae* bacteria is often found in the aquatic environment, where it can remain dormant for long periods as part of the normal flora of brackish water and river estuaries. It flares up under favourable conditions associated with algae blooms (plankton), which are influenced by the temperature of the water. Infected humans that are temporary carriers are one of the main reservoirs of the pathogenic (disease-causing) form of *Vibrio cholerae*.

Cholera is spread, as most other viral and bacterial diarrhoeal diseases, by contaminated water and food, i.e. the faecal-oral route. Diarrhoeal diseases can therefore occur wherever drinking water or food is contaminated with faecal material, and wherever sanitation and hygiene are inadequate or compromised. The ever-present role of flies and other vectors in the faecal-oral route must be kept in mind. Cholera is rarely transmitted by direct person-to-person contact. A sudden large cholera outbreak is therefore usually caused by a contaminated water supply, and is often associated with poor sanitation and a lack of personal hygiene. There are three main factors that are critical in their influence on the epidemic spreading of cholera, namely:

- Lack of Access to Medical Treatment Facilities;
- Lack of Access to Safe Water Supply and Sanitation Services; and
- Socio-economic Living Conditions.

Of these three factors, the influence of socio-economic living conditions must be emphasised. Poverty causes an inability to afford and access medical treatment and safe water services. Ignorance and/or illiteracy results in individuals and communities that are not aware as to the cause and nature of the disease and such communities are often also not aware of hygienic food preparation and sanitation practices. For example, foods are consumed raw and hands are not washed before food is prepared or consumed, sometimes by hand and from the same dish. Certain cultural practices, such as communal social and religious events at venues without proper sanitation and safe water supply facilities, where food is prepared on a large scale, or the migratory movement of people commuting over large distances between home and workplace, can lead to the spread of the disease to previous uninfected areas.

2.4 EPIDEMIC CONTROL AND PREVENTIVE MEASURES
In terms of the International Health Regulations, cholera is a notifiable disease, and National authorities must therefore submit reports regarding suspected outbreaks to the WHO.

2.4.1 WHAT DOES NOT WORK?
The WHO publication "Guidelines for Cholera Control", summarises that traditional epidemic control methods are not effective in preventing the spread of cholera, for example:

- Routine treatment of a community with antibiotics, vaccination, or immunisation has no effect on the spread of cholera.
- Use of vaccines to prevent or control cholera outbreaks is not recommended because it may give a false sense of security to vaccinated subjects and to health authorities, who may then neglect more effective measures.
- Food import restrictions is not justified based on the sole fact that cholera is epidemic or endemic in a country.
- Restricting travel and trade between countries or regions is not effective or viable as preventative measure in an epidemic outbreak.

2.4.2 WHAT WORKS?
According to the WHO, "Cholera will ultimately be brought under control only when water supplies, sanitation, personal hygiene and food handling practices are safe enough to prevent the spread of *Vibrio cholerae O1*". When cholera appears in a community, it is therefore essential to ensure five basic things:

1. appropriate medical assistance;
2. adequate supply of safe drinking water;
3. hygienic disposal of human faeces;
4. proper food and general personal hygiene; and
5. appropriate monitoring of the occurrence and potential spread of the disease.

Of overarching importance in ensuring these five aspects is that all affected communities, as well as those involved with the management of outbreaks are adequately informed about the disease.

2.5 AWARENESS ABOUT CHOLERA
Health education of the public is essential for the control of waterborne diseases that is spread through the faecal-oral route, such as cholera. The thrust of awareness campaigns should be aimed at disseminating information to make people aware of the following:

- The nature of the disease;
- Precautions that can be taken to avoid infection (e.g. how to ensure household water is safe);
- General food handling and hygienic practices;
- Measures to be taken in case of infections;
- How to handle infected persons; etc.

Messages about these aspects must reach target audiences through the mass media, community leaders, personal contact by health workers, and social, cultural and religious groups.

2.5.1 TARGET GROUPS
The target audiences can be broadly separated into the following sectors:

- Individual households;
- Schools and education facilities;
- Affected communities;
- Social, cultural and religious gatherings, markets, transport hubs, travellers etc.;
- People working with outbreaks in affected areas; and
- The broader public in both affected and unaffected areas.
2.5.2 INFORMATION TO BE DISSEMINATED

The focus of the information transferred to target audiences should be on some or all of the following aspects:

1. The recognition of symptoms of the disease (watery stool) and the nature (death by dehydration) and spread (faecal-oral route) thereof;

2. The treatment of patients with cholera symptoms by providing rehydration fluids (drink lots of liquid, and for each 1 l of water, add 8 teaspoons of sugar and ½ teaspoon of salt); and

3. The location of nearby rehydration centres, clinics and hospitals where treatment can be obtained;

4. The prevention of contracting cholera by taking the following precautions:
   - not drinking water from rivers, streams, boreholes or springs unless it has been treated;
   - treating and disinfecting household water by means of boiling and adding 1 teaspoon of household disinfectant or bleach (e.g. Jik) to 25 l of water, and allow to stand at least 30 minutes before using the water;
   - using clean and closed containers for the storage of household water and foodstuffs;
   - cleaning food utensils with treated water;
   - preventing flies from coming into contact with food, etc.;

5. The prevention of the spread of cholera by:
   - washing hands before, during and after food preparation;
   - preventing children from playing in puddles, streams, stormwater, etc.;
   - not defecating in or next to rivers, or the bush;
   - washing hands after going to the toilet; etc.

6. The location where clean household water and chemicals for purposes of disinfecting household water can be obtained.

The specific needs of some target groups are briefly summarised below:

2.5.2.1 INDIVIDUAL HOUSEHOLDS

Awareness creation at individual households should receive high priority, and should be focussed at improving food and sanitary hygiene on a very basic level. Individual households in affected areas are therefore best targeted by direct one-on-one communication (door to door contact), live demonstrations and radio transmissions, especially in areas where there is a high level of illiteracy. In areas with higher levels of literacy, the distribution of pamphlets may be more effective. The focus of the information transferred to this target audience should address all aspects of points 1 to 6 listed in section 2.5.2 above.

2.5.2.2 SCHOOLS AND EDUCATION FACILITIES

Almost half of the population of most developing countries is made up of children under 15 years. In cases where capacity is limited to visit individual households, a thrust to reach this age group and to thereby spread the message to the households concerned would be most effective. The focus of the information transferred to this target audience should be the same as for individual households (see points 1 to 6 listed in section 2.5.2 above), with an additional emphasis on encouraging children to be examples for their parents.

2.5.2.3 COMMUNITIES

Communities in affected areas or adjacent to affected areas should be a primary target of awareness campaigns, and should also be made aware of the aspects listed under points 1 to 6 listed in section 2.5.2 above. These communities should be targeted by means of dedicated meetings aimed at health and hygiene awareness, especially demonstrations on proper sanitation and sanitation habits, the distribution of pamphlets, etc. The distribution and use of disinfectants should form part of such campaigns where necessary. Communities in all high-risk areas should also be encouraged to practice the harvesting and collection of rainwater. In communities where the ABET programme is being implemented, this could be utilised to educate communities on hygiene matters.

2.5.2.4 GATHERINGS OF PEOPLE

When cholera threatens an area, it is appropriate to discourage gatherings such as religious events (e.g. funerals), sport events, and social gatherings (e.g. markets). Infection can spread rapidly during such events through contaminated food or water, and is further disseminated when infected persons return to their homes. When such events do take place, it is of utmost importance to institute measures to assure a safe supply of drinking water, safe practices for food preparation and sanitary disposal of excreta. The type and focus of information dissemination will depend on the type of social, cultural or religious gathering:

- Certain religious gatherings, can aid in the spread of the disease, even in areas which is not under threat of cholera, due to the use of water for religious purposes, for example baptisms, especially river baptisms and baptisms which involve the immersion of people in water. To address this, individual contact with religious leaders may need to be established. Information provided should focus on the nature and spread of the disease, and such persons should be requested to postpone these types of events.

- Cultural activities such as initiations, etc which involves rituals that require contact with natural and other water sources should also be discouraged for the duration of the epidemic. This would include the establishment of contact with,
and the dissemination of information to, *inter alia*, traditional healers, tribal leaders and other authorities. Persons with a high standing in the community can be extremely valuable in providing assistance in disseminating information to communities regarding the nature and spread of the disease, as well as aspects of hygiene.

**Social** events that entail the recreational use of water, e.g. for fishing, water sport activities, or certain sport events that involve occasional contact with water need to be targeted. In these cases, information regarding the nature and spread of the disease should be provided to event organisers and proprietors of recreational facilities for distribution to those potentially exposed to contaminated water.

According to the WHO, it is ineffective to prevent people from travelling, but *travellers* to and from an area in which a cholera outbreak is occurring, must be made aware of potential risks. For this reason, the dissemination of information regarding the nature of the disease, symptoms and treatment (points 1 to 3 above) at transport hubs such as train and bus stations, airports and taxi ranks are extremely important.

### 2.5.2.5 PEOPLE WORKING WITH OUTBREAKS

#### 2.5.2.5.1 Health and related workers

Staff at hospitals and clinics, as well as community health workers must be aware of, and must be trained with regard to, the recognition of cholera symptoms, accurate diagnosis, effective treatment, information to be disseminated, and the procedures for reporting cholera results.

#### 2.5.2.5.2 People working in or with water

A specific focus should be on people working in or with water, especially those who are involved with cholera management intervention actions. This would include personnel who are taking water quality samples, operators and employees of sanitation facilities, as well as people who are involved with the establishment or construction of infrastructure such as weirs, and water abstraction points in affected rivers. It is also important to target those responsible for the funding of such infrastructure.

### 2.5.2.6 THE BROADER PUBLIC

The general public must also be kept informed regarding cholera outbreaks. Although they may not be at risk or living in high-risk areas, it is important that fear for a disease such as cholera be delayed by creating awareness regarding the nature there-of. It is also important that new outbreaks in previously unaffected areas be communicated to the broad public with specific “cholera warning” bulletins. Also, information regarding achievements and successes of those involved in managing the problem must be communicated to the broader public.

The general public is mainly targeted by means of mass media, i.e. the printed press, radio, and television. To this end, especially with regard to the printed press and television, the availability of suitable visual material is an important part of a campaign. With regard to radio, local stations are an extremely valuable tool to disseminate the information outlined in points 1 to 6 of section 2.5.2 above to remote communities. The focus of information provided to the printed press, radio, and television could therefore be different. In some instances, pamphlets could also be made available to the general public. When communicating through the mass media, it is of utmost importance not to create mass public panic. As discussed above, the outbreak of cholera is only confirmed when *Vibrio cholerae* has been positively identified in a patient. Press releases regarding outbreaks or potential outbreaks of cholera must therefore contain clear statements regarding sampling and results.

### 2.6 SAMPLING FOR CHOLERA AND INTERPRETATION OF RESULTS

When sampling specifically to detect the presence of a *Vibrio Cholerae* strain, the following are of importance with regard to laboratories, sampling techniques, and interpreting analytical results.

#### 2.6.1 LABORATORIES

*Vibrio cholerae* cannot be detected microscopically, except by experts who have had years of dedicated training and practical experience, and there are only a few such professionals in the country. There are two laboratory procedures to be followed to identify the presence of cholera, namely the **Peptone Culture Growth procedure** (Moore Pads) and the **Polymerase Chain Reaction (PCR) procedure**. A process of laboratory accreditation for the accepted methods of cholera determination is currently being undertaken, and some of the laboratories are accredited for both methods, others for one, or not at all. The following laboratories can be contacted with regard to cholera analysis:
- The South African Institute for Medical Research (SAIMR);
- The Council for Scientific and Industrial Research (CSIR);
- The Medical or Natural Sciences Departments of Local Universities;
- Some State Pathology Laboratories;
- Some Local Technikons; and
- Some Water Boards.

It is therefore important to determine if the laboratory has the **expertise** and **capacity** to undertake a specific type of analysis. It is also necessary to always consult with the laboratory **prior** to collecting samples for cholera detection, in order to determine if the laboratory has the resources to conduct the necessary analysis. The IWQS of DWAF can be consulted with regard to sampling methods and test procedures for detecting cholera in water. Note however that that the IWQS is currently **NOT** set up to do cholera analyses, but could extend its capacities to include this in the medium to long term, provided it is cost effective.

#### 2.6.2 SAMPLE COLLECTION FOR CHOLERA ANALYSIS FROM WATER RESOURCES

Since the procedure of cholera determination can influence the sampling method best suited to the particular laboratory, and the laboratory may need to

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prepare culture media, sampling techniques must be discussed with the laboratory before samples are taken. The following are general guidelines towards sampling methods:

2.6.2.1 MOORE PAD SAMPLING METHODS FOR THE PEPTONE-CULTURE GROWTH PROCEDURE

The first sampling method is the Peptone-Culture growth procedure. The test to ask for in the Peptone-Culture growth procedure is the detection of growth of *Vibrio cholerae*, as well as the determination of the specific serotype. For this procedure, it is usually necessary that the sample be collected by means of a Moore pad, which is preserved in peptone water, a substance that stimulates bacteriological growth. No cooling is necessary for the transportation of samples.

2.6.2.1.1 Preparations before Moore Pad sampling

1. Special wide necked bottles containing (double strength) alkaline peptone water are obtainable from the SAIMR branch in Johannesburg (media depot: (011) 489-9450) and the SAIMR laboratory serving a specific area.

2. To prepare peptone water under circumstances where bottles containing pre-prepared peptone water cannot be obtained, follow these instructions for the preparation of single strength growth media. For double strength, just reduce the volume of water by half:

| Add 10.0 grams Peptone and 5.0 grams Sodium Chloride to distilled or de-ionised water, mix thoroughly and bring volume to 1 litre with distilled or de-ionised water. Adjust the pH to 7.2, distribute into wide neck bottles (50 ml per bottle), and sterilise by autoclaving at 121°C for 15 minutes. |

The prepared medium (peptone water) can be stored at room temperature for up to a year, or as long as the medium stays clear. The same is applicable to bottles containing pre-prepared peptone water, which had been obtained from the laboratory or the SAIMR. The dehydrated peptone medium (used for the preparation of peptone water) must be stored below 25°C and used before the expiry date on the label.

3. When sterile bottles cannot be obtained, any bottle, including 2 litre cool drink bottles may be used, as long as they are sterilised by properly rinsing out at least three times with boiling water before use.

4. To sterilise instruments (e.g. forceps and scissors), place them in a jar or flat container with methylated spirits so that they are completely immersed. When the instruments are about to be used, remove them from the jar, close the jar and then hold a lighted match to the instruments to remove all traces of the methylated spirits.

2.6.2.1.2 Collecting Moore Pad samples

The following instructions for the collection and sending of Moore-pads for cholera determination by means of the Peptone Culture Growth procedure are of importance:

1) Sampling in flowing water, when delivery within 6 to 12 hours can be assured:

(a) Use commercially available plain sterile surgical gauze swabs measuring approximately 10 cm². Fold the swab in half, tie it with a length of wire (only use strings if there are no rats present) and immerse it into the flowing river or sewage so that the pad hangs below the surface of the water. The pad should remain in place for 24 to 72 hours, after which it should be pulled out.

(b) Collect the Moore pad by holding it with sterile forceps and place it into the pre-prepared sterile wide neck bottle containing double strength alkaline peptone water (50 ml per bottle). If the swab is too big to fit into the bottle, cut some off with sterile scissors. Close the lid tightly and label the sample bottle.

(c) Place the used instruments (forceps and scissors) back in the jar or flat container with methylated spirits so that they are completely immersed to sterilise them again. On arrival at the next sampling point, remove the instruments from the jar (if needed), close the jar and then hold a lighted match to the instruments to remove all traces of the methylated spirits. Take the next sample as described above.

(d) Send the labelled specimens to the laboratory serving the specific hospital, clinic, area, etc, where it should arrive within 6 to 12 hours from collection.

2) Sampling Borehole or Dam water, when delivery within 6 to 12 hours can be assured

(a) Pour at least 25 to 50 litres of water through a Moore pad in a sterile funnel. Follow the instructions from (b) to (d) above: place the Moore pad in a sterile bottle with peptone water, and take to the laboratory within 6 to 12 hours.

OR

(b) Take a water sample in any sterile bottle to which a suitable amount of alkaline peptone water had been added (discuss with laboratory). The laboratory needs at least 2 litre of water, more if possible. The following are of note when taking samples in this manner:

- The neck of the bottle must face away from the flow of water and the bottle must be completely submerged.
- When the bottle is full, remove, place the cap on and tighten.
- Take immediately to the laboratory.

3) Sampling procedure when delivery within 6 to 12 hours cannot be assured

If the delay from taking the sample to delivering it to the laboratory will be longer than 612 hours, don’t place the Moore-pad into alkaline peptone water. The reason for this is that other enteric organisms present in the pad will overgrow any *Vibrio cholerae* present. Rather place the Moore-pad in a sterile bottle, or just take a plain grab water sample and transport it immediately to the laboratory. The laboratory will then add the alkaline peptone water enrichment medium. This method is however less sensitive than the Moore-pad sampling method.

2.6.2.2 SAMPLING METHOD FOR THE PCR PROCEDURE

The PCR procedure only detects *Vibrio cholerae*, and samples does not require special preservation or prompt delivery. Just take a grab water sample in
a sterile bottle and transport it to the laboratory. The test to ask for is the **detection** of *Vibrio cholerae*.

2.6.2.3 **PRECAUTION BY SAMPLERS**

For all these sampling methods, care should be taken not to contaminate the sample by allowing it to come into contact with the hands of the person taking the samples.

2.6.3 **TESTS & INTERPRETATION OF RESULTS**

Since different laboratories use different conventions in reporting the results of their analysis, it is necessary to have some understanding of the naming conventions for the different strains or *Vibrio cholerae*. This will enable the DWAF-official to establish if a disease causing cholera strain has been detected in the water sample, or whether a relatively harmless strain (such as most of the NAG strains), has been found.

**Epidemic cholera** is caused only by the serotypes **Ogawa**, **Inaba**, and **Hikojima** (a very rare type) of the **O1 strain** of *Vibrio cholerae*, and by the **O139 strain**, called “Bengal”. O139 is the only NAG strain that can cause severe epidemic cholera, but which so far has not yet spread to Africa. Some laboratories can test for this strain. As discussed in section 2.1, some strains of *Vibrio cholerae*, especially NAG (also known as non-O1) strains, are endemic in the water environment. The non-O1 strains cannot be serotyped like the O1-Group. Almost all of these non-O1 strains do not cause epidemic cholera at all, but some can cause gastro-enteritis or diarrhoea similar to *Escherichia coli* (**E. coli**). This is one of the major problems of the monitoring for *Vibrio cholerae* in water, since non-O1-strains are often detected. The NAG *Vibrio cholerae* group is normally found in water and sewage effluent, but not in food.

*Vibrio cholerae* group O1 should not be present in any water, food, or sewerage, and should results be positive, samples **must** be serotyped to confirm Inaba or Ogawa. It is not enough for a laboratory to only **identify** the organism based on biochemical, as the difference between the O1 and O139 organisms cannot be determined just by biochemical reactions.

2.6.3.1 **NEGATIVE RESULTS**

When a result is reported that *Vibrio cholerae* is **negative**, irrespective of the test procedure, this only means that the specific sample of water is negative. This negative result does not mean that the water resource is negative for cholera, it only means that it was negative for cholera **at the time of testing**. The water resource could become contaminated after the sample was taken. The purpose of this kind of result is to indicate that the water source is being checked.

2.6.3.2 **POSITIVE RESULTS**

For positive results, the following are of note with regard to the different test procedures:

**2.6.3.3 PCR TEST**

This procedure entails the testing for the presence of the **gene** responsible for coding for the cholera-causing **toxin**, and this gene is present in *Vibrio cholerae* groups from both the serogroup **O1 AND the non-O1 strains**. This test can therefore **not** be used to distinguish between disease causing *Vibrio cholerae* O1 and NAG *V. cholerae*. This is because of genetic switching: although the toxic gene is present in various strains of *Vibrio cholerae*, as long as it does not express as a serotype of O1 or as O139, it will not cause cholera. A positive PCR result therefore only indicates the **presence** of any type of *Vibrio cholerae*, and must be treated with circumspection, since it cannot be used to distinguish between the O1 and non-O1 (NAG) strains of *Vibrio cholerae*. The occurrence of virulent *Vibrio cholerae* can therefore not be unambiguously detected by means of PCR testing.

However, since the PCR procedure tests for the presence of a gene, which cannot be easily destroyed, samples does not require preservation or prompt delivery and it takes only a day for confirmation, it is recommended to be used as an **indication** of the presence of *Vibrio cholerae*. If the result is positive, i.e. *Vibrio cholerae* is present, the specific group or serotypes **must** be confirmed with culture and serotyping by means of the Peptone-Growth method after re-sampling with Moore-pads to determine if the disease causing organisms are indeed present, or not.

2.6.3.4 **PEPTONE-GROWTH TEST PROCEDURE**

The conventional **peptone-growth** procedure, requires prompt courier delivery after sampling, and requires up to five days for confirmation. This procedure enhances bacteriological growth under controlled circumstances, and if *Vibrio Cholerae* is present in the sample, its growth will also be enhanced. Such growth is compared with control samples of *Vibrio cholerae* and **E. coli**.

If the laboratory result merely reports that *Vibrio cholerae* has been **isolated**, it does not imply that disease-causing bacteria is present, and serotyping must be requested to confirm the presence of a serotype of O1 or O139 before taking further action.

When the result is reported as “**Vibrio cholerae positive - serotype** Inaba or Ogawa”, this means that the organism that can cause **epidemic** cholera has been isolated from the water sample. However, although disease-causing serotypes of *Vibrio cholerae* have been positively identified in a water resource, this does not mean that a cholera epidemic is on the brink of outbreak. A cholera outbreak is only confirmed once a **patient** has been positively tested for *Vibrio cholerae*, and the specific strain had been serotyped.

Once a cholera outbreak has been confirmed, all responsible role-players must be notified, and processes must be mobilised to ensure the effective management of the epidemic in a co-ordinated manner. Such a co-ordinated management strategy is discussed in the following section.
3. CO-ORDINATED AND STRUCTURED MANAGEMENT OF CHOLERA

As outlined in section 2.4.2, when a cholera outbreak is confirmed in a community, it is essential to ensure that the following five aspects are addressed to properly control such outbreaks, and to prevent the disease from spreading in epidemic proportions:

1. Appropriate and immediate medical assistance to and treatment of affected persons;
2. An adequate safe drinking water supply;
3. Hygienic disposal of human faeces in appropriate and effective sanitation facilities;
4. Proper and adequate monitoring and reporting to confirm cases, identify potential new outbreak areas, and establish potential further cause for concern as well as to measure success; and
5. Proper information to potentially affected communities regarding the nature of the disease and the creation of awareness about preventative measures such as proper food and personal hygiene practices, including education regarding these aspects, and communication between role-players.

Since these five aspects cover a wide range of responsibilities, actions and activities, it is vitally important that a well-structured management strategy (how to do it – described in section 3.1) are implemented by all responsible role-players (who must do it – see section 3.2). The responsible role-players must ensure structured co-operation and co-ordination between them (discussed in section 3.3). This will enable them to develop and implement the management strategy in all areas of concern (where to take action – section 3.4) in order to focus their resources on all relevant aspects (what must be done – see section 3.5) in a co-ordinated manner. Underpinning the above is the appropriate prioritisation of actions (when must it be done – see section 3.6).

3.1 MANAGEMENT STRATEGY (HOW?)

In order to find a sustainable solution to the threat of cholera, and to ultimately bring it under control, these five aspects must be addressed to their fullest extent in all affected areas to ensure that the spread of Vibrio cholerae O1 is eliminated. In a developing country like South Africa, this may take years to achieve and the construction of new infrastructure to improve levels of coverage of sanitation and water supply will also require large investments and capital spending.

For this reason, programmes should be formulated and management strategies developed that prioritise intervention actions and aim them at the areas that are under actual threat. This prioritisation must be done according to a realistic assessment of financial and technical resources available, and in the light of the expected impact of each priority action on cholera prevention and the control of the outbreak of epidemics. The main phases of such a process aimed at the development of an effective management strategy, as illustrated in Appendix A on page 32, are:

1. Mobilise management and co-ordination structures between responsible role-players (who);
2. Gather information and identify information gaps to identify risk areas, problems and needs (where?);
3. Develop and Implement action plans (what and when);
4. Monitor the implementation of action plans;
5. Evaluate effectiveness of implementation; and
6. Review and update action plans.

Following these phases in the development of a management strategy will lead to the appropriate involvement of those concerned in targeting of high risk areas with limited resources, and the prioritisation of activities and aspects that requires emergency, short, medium and long term attention in these areas. The management strategy is similar for the short-, medium- and long-term, although the specific action plan may differ for each level of intervention.

3.2 RELEVANT ROLE-PLAYERS & RESPONSIBILITIES (WHO?)

The implementation of the above-mentioned five aspects falls within the mandate of several different national and provincial government departments, as well as local authorities and other role-players, who each have different responsibilities in relation to the management of the problem:

- The co-ordination of emergency actions, where the focus is on crisis management, is the function of the National Disaster Management Centre (NDMC), which functions under the auspices of the National Department of Provincial and Local Government (NDPLG).
- Local authorities, such as District or Municipal Councils (D/MC’s), are the lead-executing agents for the management of emergency conditions, as they are constitutionally responsible for municipal health services. More importantly, their role and function relates to their responsibilities under the Constitution and in terms of the Water Services Act (WSA), No 108 of 1997 as Water Service Providers (WSP’s) for potable water supply, recirculation- and domestic waste-water and sewage disposal systems (sanitation services).
- The Provincial Department of Local Government or equivalent (PDG), must provide support to District and Municipal Councils (D/MC) in the execution of their functions, and are in control of Provincial Disaster Management Structures. In cases where local authorities lack the capacity to execute such functions, the PDG should take the lead in co-ordinating functions aimed at the management of problems arising as a result of the lack of such capacity.
- The National Department of Health (NDoH) is the key policy authority with regard to disease related matters. In terms of the International Health Regulations, the NDoH must submit reports...
regarding the outbreak of cholera in their territory as rapidly as possible to the WHO.

The Provincial Departments of Health (PDoH’s) in the nine Provinces are the lead “early warning” authorities and execution agents for medical intervention under emergency conditions. Both the NDoH and PDoH’s are also responsible for the provision of appropriate medical assistance to affected patients, as well as providing information to affected communities.

The Department of Water Affairs and Forestry (DWAF) plays more than one role in the short, medium and long term management of waterborne diseases such as cholera. Its involvement includes support to local authorities and other WSP’s with the provision of water supply and sanitation infrastructure, as well as water quality management, which includes resource monitoring and performance assessment of sanitation infrastructure. Guidance with regard to these aspects is provided in detail in sections 4 and 4.2.5.

The role of the Provincial Department of Public Enterprises/Works (PDoW) is to assist D/MC’s in the establishment of permanent infrastructure relating to reticulated water supply and sanitation services in the medium to long term. However, in certain areas, the PDoW is still responsible for the operation and maintenance of certain state owned sanitation infrastructure, which had not yet been transferred to local authorities. In other areas, the Operations and Maintenance (O&M) component in certain DWAF Regions are responsible for the management of such works, especially those that used to be managed by the former “homelands”.

The South African National Defence Force (SANDF) is co-opted to assist in the provision of water to affected communities under emergency situations, as they are the main support agents on emergency and disaster intervention.

The National and Provincial Departments of Education (N/PDoE) play a major role in ensuring adequate education and awareness regarding food and sanitary hygiene in the medium to long term.

3.3 MANAGEMENT CO-ORDINATION

Due to the fact that so many different role-players are, or could be, involved in the management of a potential cholera epidemic, interdepartmental co-ordination, and communication is of utmost importance. The first priority in a management strategy would be to adopt an effective inter-departmental co-ordination structure to ensure that all responsible authorities and other role-players successfully implement the appropriate measures in the short, medium and long term in a co-operative manner. A guideline for the structured emergency or short-term management co-ordination is contained in Figure 1 below. Through the establishment of these collaborative bodies, the roles and responsibilities of the relevant role-players, e.g. the NDoH, PDoH, DoW, DWAF, DoE, NDPPLG, PDLG, SANDF, District and Municipal Councils, etc, should be clearly defined.

3.3.1 CHOLERA MANAGEMENT TASK TEAM

When a cholera outbreak occurs in a Province, it is of utmost importance to ensure the establishment of a “Cholera Management Task Team” (CMTT) in order to pro-actively co-ordinate and plan initiatives. The Provincial Disaster Management Structure (PDMS) should initiate the establishment of the CMTT. Other departments who are role-players in the management of cholera, and who become aware of the potential of an epidemic (e.g. positive cases identified by the PDoH) should alert the PDMS of the need for the establishment of a co-ordinating body such as a CMTT. The municipal authority should chair the CMTT, and where capacity is lacking, it should be the PDLG. It is recommended that CMTT’s meet at least once every two months for planning and project management purposes, and to monitor progress.

The first task of this CMTT would be the identification of high-risk areas, which is the second step in the management strategy, and is discussed further in section 3.4 below. This would enable those responsible to determine priorities and develop action plans for the short, medium and long term. “Joint Operation Committees” (JOC’s), can then be established in all potential high-risk districts to ensure the actual implementation of plans, as indicated in Figure 1. The main function of the CMTT will thereafter entail the ongoing planning and co-ordination of actions, including monitoring, as well as decision-making regarding the allocation of special funding, securing of additional funds, the evaluation of success and the continued sharing of information. In order to review the effectiveness of action plans, it is essential that agreement be reached in the CMTT on performance indicators, for which accurate monitoring results are of fundamental importance.

3.3.2 JOINT OPERATION COMMITTEES

The main functions of the JOC’s are the day to day implementation and co-ordination of actual emergency intervention activities. The local or provincial health authority should preferably chair the JOC in a specific area. Members or participants in the JOC’s should communicate on a daily basis and it is recommended that at least fortnightly meetings be held under outbreak conditions.

3.3.3 COMMUNICATION BETWEEN ROLE-PLAYERS

Quick and effective communication and reporting between the responsible role-players participating in the management of a cholera epidemic is paramount. The National Government Communication processes entail information sharing between National, Provincial, and Local Government. The National Ministers of Health, Provincial and Local Government Affairs, and Water Affairs and Forestry are integrally responsible to communicate on matters such as the outbreak of cholera. The NDoH is the responsible authority in relation to health related policy matters, and as such, communication regarding the disease and statistics regarding patients and fatalities must be co-ordinated by them. The Provincial Disaster Management structures and the NDMC, the NDPPLG however also have key functions in overseeing
communication regarding the management of outbreak areas. DWAF has a critical role to play as custodian of our water resources and as support agent in service delivery in relation to water supply and sanitation, and as such must be central to the communication processes and their content, especially with regard to the dissemination of information regarding water quality (see section 0).

Communication related aspects are therefore not the sole responsibility of Provincial Disaster Management Structures. For this reason, the structure outlined in Figure 1 can also be used as a guideline for communication channels between National, Provincial, and Local authorities, with the exception of the National Department of Communications, which liaise directly with the NDMC. Since one of the main aims of co-ordinating structures are the sharing of information and the co-ordination of activities, a communication strategy between the role-players in the CMTT and JOCS must be established by those involved as one of its first activities. The strategy and structure for communication must also address liaison with the press, communities, and NGO’s. In instances of a cholera outbreak, the CMTT should seriously consider the appointment of a media relation officer, and should have press statements ready regarding the nature of the disease, and locations of positive outbreaks, as well as the numbers of those affected.

In the medium to long term, these co-ordinating structures could operate less frequently, or could be mothballed, and co-operation regarding the implementation of long terms strategies could be co-ordinated within existing communication channels between departments.

3.4 HIGH RISK AREAS (WHERE?)

Due to constraints on especially financial resources, management strategies aimed at addressing the five aspects must be focussed on communities who are living in areas or under circumstances where the risk of being exposed to the disease is high. The CMTT and individual role-players involved there in must, as a first priority, identify districts, areas or communities that are regarded as high-risk.

Obviously, areas with cases of cholera, which had been confirmed by the PDoH, would immediately be regarded as high-risk areas. However, these are not the only areas of concern, due to the spread of the disease through asymptomatic infections. It is therefore of utmost importance to identify areas where communities either have no access to water supply and sanitation infrastructure, or where such infrastructure are inadequate or not functioning properly. However, the identification of areas with existing but inadequate or insufficient is of utmost importance, since there could be a false sense of security in believing that, because the infrastructure is there, it is effective. For example, a specific concern is the sanitation facilities operated by many Provincial Hospitals and other medical facilities. Due to the degraded state of some of these hospitals, it could happen that pathogens from patients pass intact through the sanitation facilities and may infect water users in downstream areas. This problem is complicated by the fact that there is a continuous lack of funding for operation, maintenance and monitoring of these facilities. This leads to inadequate sewage treatment, particularly with regard to disinfection, and the downstream spread of waterborne diseases.

Such “high-risk” areas can and should be categorised in order of diminishing risk, and the following categories of areas can be identified:

**Extremely High risk:**
1. Areas with confirmed cases of people with cholera;
2. Areas where people have no access to safe drinking water and proper sanitation, and use water for household purposes (drinking and washing food) from the following sources:
   (a) surface water (rivers and dams) and groundwater in which disease causing cholera had been positively identified through monitoring;
   (b) untreated surface water downstream of known dense settlements or settlements that have no sanitation services;

**Excessively High risk:**
3. Areas where people have no access to safe drinking water and proper sanitation, and use water for household purposes (drinking and washing food) from the following sources:
   (a) untreated surface water downstream of sanitary infrastructure that experience problems (pump-stations, reticulation networks and/or sewage treatment works) or where operation and maintenance of the systems are not satisfactory;
   (b) untreated groundwater in areas with a high density of pit-latrines, French drains and septic tanks;

**Increased risk:**
4. Areas where people have no access to safe drinking water and proper sanitation, and use water for household purposes (drinking and washing food) from the following sources:
   (a) surface water that has a high level of faecal pollution (see Figure 2 on page 24);
   (b) any other untreated groundwater, dam water or river water; and
   (c) treated water, where the operation and maintenance of the water purification facility is not satisfactory.

High-risk areas are therefore firstly identified based on information obtained from the PDoH with regard to cholera patients, as well as from local authorities and DWAF with regard to water supply and sanitation infrastructure and water quality monitoring results. Furthermore, information pertaining to the level of service provision with regard to water supply and sanitation will also be extremely valuable in this regard. In order to ensure the proper identification of high-risk areas, previously obtained water quality monitoring results and knowledge of existing infrastructure, or the lack there-of, are also essential.
Figure 1: Inter-Departmental Cholera Co-ordination Structure (Emergency Intervention)
Table 1: Emergency Management Strategy and Action Plan
## Management Strategy

<table>
<thead>
<tr>
<th>Management Strategy</th>
<th>Action</th>
<th>Responsibility</th>
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<tbody>
<tr>
<td>1) (Potential) Problem is identified</td>
<td>a) Actual outbreak: PDoH identify and isolate first cases &amp; obtain full details of patients: Personal identification, origin of patient, movement over preceding period</td>
<td>Provincial Department of Health (PDoH)</td>
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<td>b) Potential outbreak: DWAF Region identify potential for outbreak through water quality monitoring: Results on water supplied, water resources or sanitation infrastructure: location &amp; downstream users:</td>
<td>DWAF Region</td>
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<td></td>
<td>c) Ensure awareness of possible eruption of disease at all medical institutions</td>
<td>PDoH</td>
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<td>d) Report suspected cases to WHO</td>
<td>NDoH</td>
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<tr>
<td>2) Mobilise Management Structures &amp; Institutions</td>
<td>a) Mobilise Disaster Management Structures: Alert neighbouring District/Municipal Councils (D/MC’s) &amp; all other role players, incl. the National Disaster Management Centre</td>
<td>Provincial Disaster Management Structures (PDMS)</td>
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<td>b) Prepare Media Statements to alert individuals regarding the possible epidemic nature of the disease and preventative measures to be taken by the general public</td>
<td>Provincial Department of Local Government Affairs or equivalent (PDLG)</td>
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<td>c) Activate Cholera Management Task Team (CMTT): Determine capacity of District/Municipal Council to manage CMTT</td>
<td>All role-players from responsible departments</td>
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<td>d) Establishment of Cholera Management Task Team at first meeting: Appoint chair (District/Municipal Council, if capacity exist, otherwise PDLG, or elected by representatives)</td>
<td>CMTT (chaired by D/MC/PDLG/elected chair)</td>
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<td>Information provided by individual role-players, based on existing data &amp; knowledge</td>
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<td>3) Assess information and establish Action Plans</td>
<td>a) Determine information status: Determine status of existing support structures (hospitals, clinics, communication structures, laboratories, human resources)</td>
<td>CMTT</td>
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<td></td>
<td>Determine logistical requirements (vehicles, tents, supplies, etc) and initiate procedures to obtain such if required</td>
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<td></td>
<td>Determine information availability of affected and neighbouring communities from all sources</td>
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<td>Gather information (demographics, access to medical facilities, water supply &amp; sanitation status, migration routes &amp; transport linkages, social connections &amp; socio-economic status, water quality information on faecal pollution status of water resources, operational standards of sanitation infrastructure, etc)</td>
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<td></td>
<td>b) Analyse Information:</td>
<td>CMTT, JOC’s, Individual departments PDoH, DWAF; PDoH, PDoE, DWAF</td>
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<td></td>
<td>Id “high risk” areas through available survey &amp; monitoring information &amp; determine management objectives to prioritise activities</td>
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<td></td>
<td>Need for the establishment of emergency facilities – medical re-hydration tents, temporary water supply and sanitation infrastructure and laboratory facilities for monitoring</td>
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<td>Identify gaps in information and mobilise information gap filling exercise by responsible authorities and other role-players</td>
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<td></td>
<td>c) Develop Action Plan: Address the following aspects:</td>
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<td></td>
<td>i) Determine priorities and timeframes based on current information &amp; review based on updated information when available</td>
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<td></td>
<td>ii) Establishment of emergency medical facilities: re-hydration tents; etc with determination of necessary logistical requirements, including water supply and sanitation;</td>
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<td>iii) Health and hygiene awareness and education actions (mass media – printed press and radio/television, pamphlets; schools, social and religious gatherings, markets, transport hubs, individual household (door to door) contact), communities:</td>
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<tr>
<td>3) Assess information and</td>
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<tr>
<td>Management Strategy</td>
<td>Action</td>
<td>Responsibility</td>
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<td><strong>v) Provision of access to safe water supply and sanitation infrastructure and services to rehydration centres, hospitals, medical clinics, schools, community centres, transport hubs along strategic access routes, venues of social gatherings (markets, sports events, religious activities), and access to water supply and sanitation to individual households &amp; communities, by means of:</strong></td>
<td><strong>iv)</strong> Provision of access to safe water supply and sanitation infrastructure and services to rehydration centres, hospitals, medical clinics, schools, community centres, transport hubs along strategic access routes, venues of social gatherings (markets, sports events, religious activities), and access to water supply and sanitation to individual households &amp; communities, by means of:**</td>
<td>CMTT, JOC’s, Individual departments: PDoH &amp; District/Municipal Councils, PDH, PDoE, District/Municipal Council, Supported by PDoW, PDLG, DWAF Region, SANDF</td>
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<td><strong>vi)</strong> Ongoing information gathering on existing water supply and sanitation infrastructure to check on effectiveness of operation;</td>
<td><strong>v)</strong> Ongoing information gathering on existing water supply and sanitation infrastructure to check on effectiveness of operation;</td>
<td>CMTT, JOC’s, Local authorities, DoW &amp; DWAF Region</td>
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<td><strong>d) Determine management indicators and establish funding mechanisms</strong></td>
<td><strong>d)</strong> Determine management indicators and establish funding mechanisms</td>
<td>CMTT</td>
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<td><strong>e) Determine logistical, training &amp; support requirements of staff, and appointment of responsible personnel/consultants/contractors</strong></td>
<td><strong>e) Determine logistical, training &amp; support requirements of staff, and appointment of responsible personnel/consultants/contractors</strong></td>
<td>Individual departments</td>
</tr>
<tr>
<td><strong>4) Implement Action Plan</strong></td>
<td><strong>a) Establish and resource emergency medical facilities/rehydration centres at location of infection:</strong>&lt;br&gt;Monitor patients for <em>Vibrio cholerae</em>, obtain patient details, confirm infections and prepare and submit reports</td>
<td>CMTT, JOC’s, PDoH</td>
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<td><strong>b) Communication of possible epidemic nature to general public: Implement awareness &amp; education programme &amp; actions:</strong>&lt;br&gt;Prepare standard press releases for mass media; initiate individual (door to door) contact; print and distribute pamphlets</td>
<td>CMTT, JOC’s, PDoH</td>
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<td></td>
<td><strong>c) Implement access to safe water supply and sanitation services</strong></td>
<td>CMTT, JOC’s, PDoE</td>
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<td><strong>d) Control of compliance with authorisation conditions of sanitation facilities &amp; support to operators</strong></td>
<td>Local authorities, PDoH, DoW &amp; National DWAF Regional Office</td>
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<td></td>
<td><strong>e) Monitoring of supplied water and water resources for faecal pollution and <em>Vibrio cholerae</em></strong></td>
<td>Individual departments</td>
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<td></td>
<td><strong>f) Training of personnel and operators</strong></td>
<td><strong>f) Training of personnel and operators</strong></td>
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<td><strong>5) Measure and Assess</strong></td>
<td><strong>a) Monitor Implementation of Action Plan with management indicators, including the following:</strong>&lt;br&gt;Number of new reported cases and accessibility to emergency intervention and other medical facilities&lt;br&gt;Coverage of health and hygiene awareness campaigns including effectiveness of personal protection at household level&lt;br&gt;Access to safe water supply and sanitation services and&lt;br&gt;WQM information on water supplied, water resources &amp; sanitation infrastructure</td>
<td>CMTT</td>
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<td></td>
<td><strong>b) Evaluate Effectiveness of Action Plan:</strong>&lt;br&gt;Analyse trends from detailed statistics of all newly reported &amp; confirmed cases, and repeated infection of initial cases</td>
<td>PDH, PDMS, NDMC</td>
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<td><strong>c) Review information &amp; improve action plan</strong></td>
<td><strong>c) Review information &amp; improve action plan</strong></td>
</tr>
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<td></td>
<td><strong>a) Monitoring of Epidemic and Management Interventions</strong>&lt;br&gt;Identify possible spreading of disease to neighbouring Municipalities/Districts or other High Risk Areas and establish additional <em>Cholera Management Task Teams</em> if necessary&lt;br&gt;Communicate to National Disaster Management Structures</td>
<td>CMTT</td>
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<td><strong>b) Review effective implementation of Action Plan based on management indicators</strong></td>
<td><strong>b) Review effective implementation of Action Plan based on management indicators</strong></td>
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<td><strong>c) Review priorities &amp; timeframes based on current and updated information as it becomes available</strong></td>
<td><strong>c) Review priorities &amp; timeframes based on current and updated information as it becomes available</strong></td>
</tr>
</tbody>
</table>
3.5 MANAGEMENT ASPECTS (WHAT MUST BE DONE?)

Once the CMTT and JOC’s are had been established, and high-risk areas have been identified, the specific activities and particular actions that forms part of the management strategy can be developed by the CMTT and implemented by the JOC. Table 1 contains a summary guideline for such a management strategy, and each of the five management aspects that are to be addressed during the management of a cholera outbreak is discussed below.

3.5.1 MEDICAL ASSISTANCE

In an outbreak or suspected outbreak, one of the most important measures is the early detection and treatment of people with symptomatic cholera, since this will save lives. Secondary, but equally important, is health education and awareness, which must be aimed at preventing asymptomatic sufferers from abetting the spread of the disease. This management aspect is dealt with under 3.5.5 below.

With regard to symptomatic patients, hospitalisation with enteric precautions is desirable for severely ill patients, but strict isolation is not necessary. Less severe cases can be managed with oral rehydration on an outpatient basis or, preferably, in the field.

3.5.1.1 REHYDRATION CENTRES

It must be stressed that it is the opinion of the WHO that ‘cholera is treated in the field, not in hospitals’. This is due to the fact that the risk of spreading the disease increases as patients are transported away from their homes. The setting up of temporary rehydration centres in the field, or the use of clinics and community halls for this purpose, is therefore strongly recommended. The number of rehydration centres must be established based on the need of each affected district. Once high-risk areas have been identified, a survey must be conducted by the PDoH to determine the number of hospitals, clinics, in order to estimate the need for the establishment of rehydration centres in each Magisterial District or Health region in the high-risk areas. The PDoH will be responsible for the establishment and operation of rehydration centres.

If faced with a cholera outbreak, hospitals, clinics and rehydration centres will encounter a logistical challenge of significant proportions. Supplies for intravenous fluids, oral rehydration preparations, and the means to administer these substances will have to be secured in a short time frame. Vehicles to move staff and supplies to and from rehydration centres, to transport patients, investigate outbreaks and to do follow-ups are also an issue that must be considered in advance. Sufficient funding should be secured by those responsible to ensure the availability of adequate resources at these centres and to enable the officials in the field to provide the necessary information and assistance to the communities in the area. Securing additional human resources are also of utmost importance.

The most important aspect is however the provision of safe water and adequate sanitation to these facilities. The PDoH should therefore as a first priority also conduct a survey of the condition of water supply and especially sanitation infrastructure at all hospitals and clinics in high-risk areas.

3.5.2 WATER SUPPLY AND SANITATION

In a 2001 survey conducted in the Eastern Cape, it was found that of 35 hospitals, 7 have poor quality water, 2 have poor sanitation facilities, and at least 1 hospital has poor medical waste disposal. The situation with clinics was found to be much worse, bordering on desperate: Of the 402 clinics in high-risk districts, 201 have inadequate water supplies, and 141 have inadequate sanitation facilities.

While it is of utmost importance that the stools of cholera patients be properly disinfected prior to discharge to the water environment, this on its own will not stop the spread of epidemic cholera. The reason for this is that there are many temporary carriers of the disease who appear healthy. The present epidemic of cholera in South Africa has highlighted the importance of good personal hygiene and of providing disinfected drinking water and proper sanitation facilities to communities.

In order to effectively combat the spread of cholera, it is therefore essential to make sure that effective and adequate water supply and sanitation infrastructure are not only provided to medical facilities, but also to affected communities, schools, venues of social gatherings, individuals, transport hubs, and so on.

Under epidemic outbreak conditions, it may be however be necessary to provide temporary water supply and sanitation infrastructure to especially medical facilities and affected communities, which does not have access to effective or adequate infrastructure. Temporary water supply infrastructure could range from the provision of clean containers to individuals, to small community water supply schemes by means of road tankers or static water tanks, with or without limited local reticulation networks. Such tanks could be filled from rainwater harvesting, from protected springs, new or non-functional existing boreholes which have been fitted or refurbished with hand pumps or mechanical pumps, or from package water purification plants at surface water abstraction points. Temporary sanitation infrastructure includes portable or chemical toilet facilities, or Ventilated Improved Pit-latrines (VIP’s).

It is important to note that the emergency provision of potable water alone will not stop the spread of an epidemic. The only effective solution is proper sanitation, so that human faecal waste is properly disinfected en mass. The provision of appropriate sanitation would contribute not only to combating the disease within the affected areas, but also the spreading there-of to adjacent areas through stormwater wash-off into water resources. An adequate and effective permanent water supply and sanitation infrastructure is thus.
essential for the long-term prevention of the spread of waterborne diseases, and should form a closed loop from water resource (abstraction for water supply) to water resource (discharge of treated effluent). This loop consists of abstraction points (from ground or surface water resources), a water supply purification works, a water distribution network, a sewerage collection and reticulation network, a sewage treatment works, and a discharge point back to the resource (usually surface water). Permanent water supply infrastructure usually includes pumps, pipelines, reservoirs, water supply purification works, and distribution networks. Permanent sanitation infrastructure could range from VIP’s, septic tanks, and French drain systems, to sewerage collection reticulation networks, drains, pump-stations and sewage treatment works, which could range from relatively simple oxidation ponds to advanced activated sludge systems. The irrigation of treated wastewater should be avoided, or carefully controlled within legal requirements. This is to protect groundwater resources against infiltration of pathogens, and to protect surface water from becoming contaminated as a result of run-off.

3.5.2.1 SURVEY OF INFRASTRUCTURE
Existing permanent water supply and sanitation infrastructure must therefore be surveyed by those responsible for their operation (e.g. local authorities (D/MC), DoH, DOW, etc.) as a first priority. The survey must be aimed at determining both effectiveness (i.e. the need to rehabilitate or refurbish or improve operation and maintenance) and adequacy (i.e. the need to establish new temporary or permanent infrastructure). In cases where the operation and maintenance of sanitation facilities (especially pump stations and treatment works) are not in compliance with legal requirements, steps towards enforcement must be taken by DWAF. The actions to be taken by DWAF to ensure that both temporary and permanent water supply and sanitation infrastructure are adequate and effective, are addressed in more detail in section 4.3 on page 20.

3.5.2.2 SURVEY OF PRIMARY WATER SOURCES
The CMTT should conduct a survey of all water sources being utilised by communities as their primary source of water, and develop a priority list for the protection of these sources, especially groundwater. This survey should also include the monitoring of supplied water for bacteriological contamination (see section 5.2). Should such contamination be present, the water will not be safe for human consumption. Once this survey has been completed, the JOC should implement a fast track programme for the protection of uncontaminated water resources, especially groundwater resources. An awareness programme should also be implemented with the adjoining communities to ensure that the protection works are protected and maintained.

3.5.3 MONITORING
Proper management is not possible without effective monitoring to measure success. In order to control the spread of the disease, it is important that the following two components be monitored under outbreak conditions:

- Patients who are suspected cholera cases, for the presence of *Vibrio cholerae*, and if results are positive, serotyping in order to confirm diagnosis; and

- Water quality monitoring, by various role-players, of:
  (a) Water supplied from temporary and permanent infrastructure, for the presence of faecal bacteria, and if found, for the presence of *Vibrio cholerae* in order to ensure safe water supply;
  (b) The effluent from sanitation infrastructure such as sewage treatment works, for the presence of faecal bacteria, and if found, for *Vibrio cholerae* to ensure effective operation and to prevent the further spread of the disease; and
  (c) Water resources in high-risk areas (see section 3.4), for the presence faecal bacteria, and if found, for *Vibrio cholerae*, to determine or investigate possible sources and to prevent the further spread of the disease. The monitoring of water resources includes both surface and groundwater.

General aspects regarding DWAF’s responsibilities towards the co-ordination of water quality monitoring by all responsible parties under cholera outbreak conditions is discussed in section 5.2.3 on page 26. Monitoring results can only be useful if it is conducted in a co-ordinated manner by those responsible and if the laboratory that undertakes the analysis is reliable and able to characterise the organisms. In cases of cholera outbreaks, such laboratories must be identified and notified, so that they can be prepared and secure adequate supplies to perform the necessary analysis. The monitoring of patients is the responsibility of the PDOH, and their responsibilities towards reporting results are discussed below.

3.5.4 REPORTING AND COMMUNICATION
The importance of proper reporting must be emphasised. Since cholera makes headlines, and data and results can be misinterpreted by laypersons, great care must be taken in the reporting both human cases and water quality results.

Governments must report the infected number of infected human cases of cholera in their territory as rapidly as possible to the WHO, since it is a notifiable disease. This reporting is done only after serotypes have been confirmed with cultures. Thereafter, weekly reports must be submitted to the WHO regarding the number of cases and fatalities since the last report, as well as cumulative totals for the year to date. The Council for Industrial and Scientific Research (CSIR) has established a system through which confirmed cases of illness are reported. The reporting system established at the CSIR is only for confirmed cases of illness in...
humans, and not for reporting of water quality monitoring results.

Responsible officials of the PDoH must ensure that information is fed into this system as frequently as practically possible, even daily. The CSIR is also responsible for distributing information on cholera, which is available at the web site http://sandmc.pwv.gov.za/ndmc/cholera/.

Table 1 on page 11 also contains some guidelines relating to communication between role-players in the co-ordinating structures. Based on this guideline, and the responsibility of the PDoH to co-ordinate reporting regarding patients, the following is an example of how communication pertaining to a cholera outbreak would function:

**Municipal Health officials informs the PDoH about a cholera outbreak, based on the positive test results of a patient. PDoH alerts the NDoH, the Provincial Disaster Management Structure, and DWAF. The NDoH informs the WHO. Either the Provincial Disaster Management Structure or the PDoH informs other role-players, who initiate their respective internal communication strategies. A CMTT is established, and a press release regarding the outbreak is prepared and issued by the CMTT, the NDMC or the P/NDoH.**

It is also important that the PDoH report the positive identification of first patients as soon as possible to the Provincial Disaster Management Structure, who must alert all other role-players, and initiate the establishment of a CMTT. The PDoH must also immediately notify DWAF, so that dedicated water quality monitoring can be initiated and assistance with regard to water supply and sanitation infrastructure can be planned.

An example of how communication pertaining to a possible cholera outbreak would function, based on water quality monitoring results in which *Vibrio cholerae* was identified and serotyped as a disease causing strain, is contained in section 5.3.

With regard to the dissemination of information regarding the number of patients and deceased, as well as new areas of outbreaks, the CMTT should have standard press releases prepared, which could only be updated with new information. The PDoH, or the media relation officer of the CMTT should issue such press releases at appropriate times and intervals.

Based on the responsibility of DWAF to co-ordinate communications regarding water resources, DWAF should maintain contact with the PDoH regarding water quality monitoring programmes and results. DWAF’s responsibilities regarding reporting of water quality monitoring results are discussed in section 5.3 on page 27.

### 3.5.5 AWARENESS

The discussions contained in the previous sections would also have indicated the necessity for the dissemination of information by co-ordination bodies to specific sectors of the general public. The dedicated dissemination of health and hygiene information to rural individual households must be emphasised. A dedicated drive aimed at individual households will require additional human resources, and the PDoH may need to supplement its health practitioners in the field, who could also require additional logistical support in the form of transportation, information material and disinfectant.

In addition to the above-mentioned, it may also be necessary to contact individual farmers in high-risk areas. Such farmers should be provided with pamphlets, and requested to assist in the dissemination of information, as well as with the provision of safe water and sanitation facilities.

The PDoH in co-operation with the PDoE should initiate dedicated health and hygiene education at schools, which should include demonstrations and the distribution of pamphlets and health and hygiene education material should be included in the school curriculum. Experience obtained from programmes such as the 2020 Vision project of DWAF, which has already established contact at many schools, can be utilised to create greater health and hygiene awareness.

The outbreak of a cholera epidemic can easily cause public panic, mainly because of a fear of the unknown. An effective and efficient public awareness strategy therefore needs to be developed and implemented that is aimed at creating awareness regarding health and hygiene among the general public. This needs to be supplemented and enhanced by education actions. These aspects and the information that must be provided have been discussed in section 2.5 on page 3.

### 3.5.5.1 AWARENESS OF ROLE-PLAYERS

In many cases, the responsible role-players do not have previous experience with regard to the management of a cholera epidemic. In order to ensure effective co-operation, it may be necessary to ensure that these role-players are made aware of the nature, causes and spread of the disease.

More important in this regard is the creation of awareness amongst those who are constitutionally and legally responsible for service delivery, especially those who make financial decisions regarding the establishment of water supply and sanitation infrastructure. A specific awareness initiative should therefore be aimed at enhancing the process to promote the building and upgrading of sanitation infrastructure, especially among councillors and members serving on the CMTT and JOC’s.

### 3.6 PRIORITISATION (WHEN?)

The five management aspects discussed in section 3.5 above which need to be implemented in high-risk areas in order to control outbreaks should be addressed as emergency or short interventions, medium term actions, and long term prevention, depending on the level of priority:
3.6.1 EMERGENCY/SHORT-TERM ACTIONS
Emergency or short-term intervention firstly entails the immediate provision of adequate medical treatment, safe water and proper sanitation, especially at medical facilities and schools, albeit through temporary infrastructure. Secondly, it entails the identification of sources and high-risk areas through existing information, as well as the dissemination of health and hygiene information to individuals in high-risk areas, affected communities and communities potentially at risk. This calls for the mobilisation of appropriate intervention structures for co-ordination under emergency conditions, which is discussed in more detail in section 3.3 above.

3.6.2 MEDIUM TERM INTERVENTION
In order to combat cholera epidemics effectively, the emergency or short-term programme need to be expanded upon in the medium to long term. Actions in the medium-term include continued surveillance, additional monitoring, health and hygiene awareness campaigns, as well as the upgrading of medical facilities and water services infrastructure. The upgrading of temporary water supply and sanitation infrastructure to new permanent facilities, and the optimum use of existing permanent infrastructure through improvement and rehabilitation to ensure sustainable access to safe water in the areas worst affected is of utmost importance. Securing sustainable sources of funding to eradicate the backlog in provision of water supply and sanitation infrastructure must therefore be addressed in the medium term in order to enable the planning of long-term activities aimed at providing access to basic water services to all.

3.6.3 LONG TERM PREVENTION
Long-term sustainable prevention must be directed at the root of the epidemic outbreak of an endemic disease such as cholera. This inter alia entails the improvement of socio-economic living conditions, improved access to medical facilities and safe permanent water supply and sanitation infrastructure, which would include proper sanitation facilities, as well as the continued appropriate monitoring of resources and the maintenance of both infrastructure and education initiatives. This requires political commitment towards adequate and appropriate funding of the development and maintenance of infrastructure.

3.7 FUNDING OF MANAGEMENT ASPECTS
It is quite evident that the participating Departments will have to provide the necessary funds to cover the operating costs for the implementation of activities identified by them as being of high priority and co-ordinating institutions. High priority activities should be focussed on areas of high risk. Once the roles and responsibilities are defined, each Department or sector should be held accountable for the funding of their respective plans and activities in the high-risk areas. Guidelines regarding funding mechanisms when DWAF provides financial support to assist Districts/Municipalities with the long-term establishment of permanent infrastructure are outlined in section 5.5 on page 30.

The responsibilities of DWAF with regard to each of these management aspects are discussed in detail in the next paragraph.
4. DWAF RESPONSIBILITIES TOWARDS CHOLERA INTERVENTION

DWAF has definite responsibilities towards the management of an epidemic outbreak of a waterborne disease, as well as towards taking measures for the prevention and management of cholera outbreaks. However, Cholera intervention is a joint responsibility of the NDoH, NDPLG, DWAF and other role-players through a local, provincial and/or national framework encapsulating national disaster management principles and frameworks, outlined in the preceding discussion.

The 2001 experience has shown that DWAF intervention in a Cholera outbreak did not always take place within local and provincial structures. Consequently DWAF has, in some instances, done and/or was expected to do what is not its responsibility. It is therefore necessary to provide guidelines for DWAF’s intervention and role in a cholera crisis in terms of its legal mandate.

4.1 LEGAL MANDATE OF DWAF

The Constitution provides everyone the right to an environment that is not harmful to health or wellbeing in s24(a), and s27 guarantees access to water. In terms of the WSA, local authorities have to execute their functions as WSP’s. DWAF provides support in this regard, especially to those WSP’s that do not currently have the capacity to fulfill their water supply and sanitation functions, in order to assist those who do not have access to treated water and adequate sanitation, as is the case for many rural communities.

In terms of the National Water Act (NWA), 1998 (Act 36 of 1998), DWAF is mandated to regulate the water resources of South Africa. The NWA contains specific provisions relating to the prevention of pollution, which means the alteration of the properties of a water resource so as to make it, among others, “harmful or potentially harmful to the welfare, health or safety of human beings”. This function encompasses many aspects, including the control over the authorised users of water as provided for in Chapter 4 of the NWA, especially as it relates to the management of compliance to authorisation conditions. Control over compliance invariably necessitates water quality monitoring, which is linked to the requirements of s139(2)(b) of the NWA, namely the establishment of national water quality information systems.

In executing its legal mandate, DWAF is therefore responsible for certain aspects of a management strategy aimed at the control of waterborne diseases such as cholera. The following are a summary of the roles and responsibilities of various DWAF-components in this regard:

1. To assist in ensuring communication and liaison with other departments and between role-players by supporting co-ordination structures through providing assistance to the establishment and administration thereof (see section 4.2.1) and by being appropriately represented on them (see section 4.2.2).
2. To assist with the development an integrated management strategy by intergovernmental co-ordination structures that will address the main aspects of cholera intervention (section 4.2.3).
3. To ensure that input into structures are co-ordinated, through internal co-operation and communication between Water Services (WS), Operation and Maintenance (O&M), Water Quality Management (WQM), and other sections in DWAF, both at Regional and Head Office level (outlined in section 4.2.4 and 5.3).
4. To ensure that all the responsibilities of DWAF towards the management strategy are addressed in an integrated action plan that is developed for emergency, short, medium and long term scenarios (discussed in section 4.2.5).
5. To assist in the identification of high-risk areas (see section 3.4) by surveillance of existing water supply and sanitation infrastructure (see section 4.3.1) and on the basis of water quality monitoring results and knowledge of catchment areas, water users and resources (see sections 4.3.2 and 5.2).
6. To provide support with regard to the determination of the operational efficiency of water supply and sanitation infrastructure and the improvement thereof through co-operative governance by assisting with training and financial support where required, and by ensuring compliance with legal requirements (section 4.3.2).
7. To act as main support agent in the development of action plans for water supply and sanitation service delivery (see section 4.4) by providing:
   - general guidance on the provision of water supply and sanitation services (section 4.4.1);
   - under emergency conditions, assistance with the provision of temporary infrastructure, especially to medical facilities and schools (discussed in section 4.4.2); and
   - in the medium to long term, support with regard to the upgrading and rehabilitation of existing infrastructure, as well as for the establishment and construction of new permanent infrastructure (see section 4.4.3).
8. To co-ordinate bacteriological monitoring of water resources in high-risk areas in the context of a national microbiological monitoring programme (section 5.1), and to develop a co-ordinated monitoring programme to be implemented in these resources and at all water supply and sanitation facilities (section 5.2).
9. To ensure that reporting of, and communication regarding water quality results are effective and accurate (section 5.3); and to prevent the epidemic from spreading by contributing to the creation of awareness and providing training to relevant stakeholders (section 0).
10. To provide guidance regarding the funding of cholera intervention strategies (outlined in section 5.5).

The following sections will describe DWAF’s responsibilities towards each of these ten aspects in more detail.
4.2 RESPONSIBILITIES TOWARDS CO-ORDINATING STRUCTURES

With regard to co-ordination structures such as CMTT’s and JOC’s, DWAF’s role and responsibilities are as follows:

4.2.1 TOWARDS INITIATION OF STRUCTURES

DWAF may become aware of the existence of cholera when the PDoH has notified DWAF that patients had been positively diagnosed with cholera. DWAF may also become aware of the possible threat of cholera through bacteriological water quality monitoring data obtained as part of a regular monitoring programme in a specific resource, or otherwise submitted. In such cases, DWAF must initiate pathogen specific monitoring, and if results for *Vibrio Cholerae* are positive, DWAF must notify the PDoH immediately (see section 5 for details regarding DWAF’s responsibilities towards water quality monitoring and reporting). When either of these scenarios occurs, the responsibilities of DWAF are however to firstly determine whether a provincial or district CMTT, or JOC exists. If such structures are non-existent, DWAF can set processes in motion by approaching the PDLO to establish a JOC at a local/district level, and/or a CMTT at district/provincial level. The DWAF Regional Office (RO) must also bring the non-existence of these structures to the notice of the DDG:RO&WS in DWAF Head Office (HO), who will notify the NDPLG.

As a matter of principle, it must be emphasised that DWAF cannot act independently, and proceed to provide water and/or sanitation, or initiate an extensive awareness campaign, or conduct monitoring exercises. An appropriate analysis of the situation, as well as clarity on responsibilities, especially those of the PDoH and local authorities, must first be conducted by all responsible role-players. A systematic analysis and review of the outbreak must be executed by the CMTT to address the aspects as described in Table 1 in order to develop a management strategy, and the JOC’s then co-ordinate the implementation of action plans.

4.2.2 REPRESENTATION ON CMTT AND JOC’S

It is recommended that in those Regions which are functioning under a Chief Directorate, the Chief Regional Director (CRD), or in those Regions that are Directorates, the Regional Director (RD), represent the Department on the CMTT. Depending on the seriousness of the situation, this responsibility can be delegated by the CRD/RD to the one of the RD/DD’s in the Region, for example by the CRD to the RD:WRM, or by the RD to the DD:WS or DD:WQM. In some instances, it may be necessary that officials be designated as “Cholera Co-ordination Managers” to manage and co-ordinate specific DWAF activities in the intervention (see section 4.2.4 below). These officials should then be delegated to represent the DWAF RO on the CMTT. The Regional Communication Officer should assist the DWAF-representative on the CMTT.

Dedicated line function officials from the different components up to Regional DD (e.g. WPCO’s and WS Engineers) should represent the Department on the JOC’s.

4.2.3 TOWARDS FUNCTIONS AND STRATEGIES

As input into the functioning of co-ordinating committees (CMTT’s and JOC’s), DWAF-representatives must ensure that:

- there is absolute clarity regarding the responsibilities of the various role-players;
- the affected high risk areas are clearly identified and defined by:
  - sharing information on existing water supply and sanitation infrastructure, and
  - providing ground and surface water quality information, co-ordinating water quality monitoring activities and assist with *ad hoc* sampling of resources and water supplied to affected communities where requested;
- the situation in high risk areas are clearly assessed in respect of both water supply and sanitation infrastructure and from a water quality management perspective;
- there is a clear understanding of the situation in respect of the extent of the outbreak of the cholera epidemic, and the required actions (what needs to be done, by who, where and how);
- resources or options available to the community to empower themselves are clearly identified;
- a systematic allocation of tasks and resources are made to achieve protection of all people in the affected areas;
- there is clarity about resources, financial and human;
- there is a systematic monitoring of the actions and tasks allocated to the different role players; and
- there is a systematic review of the effectiveness of the management of the outbreak.

4.2.4 INTERNAL DWAF CO-ORDINATION

Owing to DWAF’s multiple functionality as described in section 4.1, several different officials, components and directorates within DWAF may be involved with the execution of its mandate with regard to cholera intervention, at different stages and for different reasons. An internal DWAF Cholera Intervention Co-ordination Committee could therefore be established in the DWAF RO especially to co-ordinate actions taken by the Region in relation to the cholera crisis. Officials from both WQM and WS(O&M), if applicable, should participate here, and the Regional Director or CD of the Region should chair it.

An overarching function of this internal co-ordination structure would be to determine the funding requirements for action plans, and how funds should be obtained and managed. It will also be necessary that this committee compile a protocol of actions to be implemented in case of an outbreak, which must include a list of contact persons within DWAF and the other responsible role-players. A checklist for
aspects that should be addressed by DWAF during cholera outbreaks is contained in Appendix B.

In cases where Regional Offices do not have adequate resources to effectively manage and monitor an intervention programme, a dedicated Cholera Manager (at least at the level of Assistant Director) could be assigned the responsibility for co-ordination between WS, WQM, and O&M, as well as for project management, monitoring and auditing.

An effective internal DWAF communication and reporting strategy between the RO and responsible HO components is also paramount. For example, there would be a need to co-ordinate monitoring strategies and consult with the IWQS with regard to the interpretation of results. A guideline for DWAF’s internal co-ordination and communication structure is illustrated in Figure 3 on page 28. Furthermore, reporting to the line functions in DWAF Head Office must be structured according to Figure 3, especially in relation to monitoring results, press releases, and budget requests. These aspects are discussed in more detail in section 5.3.1.

4.2.5 DWAF RESPONSIBILITIES TOWARDS ACTION PLANS

The function of the DWAF Regional Office (and therefore of the DWAF RO Cholera Intervention Co-ordination Committee, should one be established) would be to co-ordinate the development of a short-, medium- and long-term action plan for the provision of adequate and effective supplies of safe water and the hygienic disposal of human faeces in high-risk areas.

In order to develop such an action plan a priority list must be developed in order to:

- Focus on areas for improvement which will have the greatest impact on mitigating outbreaks;
- Ensure structured implementation and management of remediation and upgrading to ensure cost effectiveness and socio-economic benefits; and
- Ensure appropriate budgeting and allocation of funds.

To be able to achieve these objectives, there must be a good grasp on the current status of water supply and sanitation infrastructure. Emergency to short-term action plans should thus be aimed at –

- assisting with the identification of high risk areas in order to develop action plans by surveying all existing water supply and sanitation infrastructure with regard to their operational efficiency;
- ensuring that rehydration centres, hospitals, clinics, and education facilities have adequate safe water and sanitation;
- developing, and assisting with the implementation of an optimised and co-ordinated water quality monitoring programme which would include the monitoring of water sources to determine their status with regard to being cholera free; and
- ensuring the protection of safe water resources.

The short to medium term action plans should be focussed on –

- surveying all existing water supply and sanitation infrastructure to determine requirements for remediation or the need for the establishment of permanent infrastructure;
- ensuring the adequate and effective operation of existing water supply and sanitation facilities in the Region, especially focussing on purification and treatment facilities operated by DWAF;
- assisting with remediation and rehabilitation of existing infrastructure that was found to be ineffective, and implementing these measures at those facilities operated by DWAF, and
- implementing control over those responsible for operating water supply and sanitation infrastructure not operated by DWAF, but by hospitals and local authorities through co-operative governance and legal measures.

Medium/long term action plans would entail providing financial assistance to the development of new permanent infrastructure and the upgrading or rehabilitation of existing infrastructure.

Throughout the intervention process, actions relating to inter- and intra-Departmental communication, reporting and awareness; and determining financial, human resources and capacity building requirements must also be taken.

These aspects need to be harmonised to avoid duplication and to ensure adequate and effective management. To this end, DWAF may have to establish and co-ordinate water supply and sanitation, as well as water quality management and monitoring, subcommittees of the JOC, which can bring together Local Government, NGO’s, CBOs and other role-players to drive the intervention.

4.3 ASSISTANCE IN IDENTIFYING HIGH-RISK AREAS

As discussed in section 3.4, it is of utmost importance to identify those areas where cholera cases have been confirmed, areas where people does not have any access to water supply and sanitation, and areas where existing water supply and sanitation infrastructure are inadequate and/or ineffective as high-risk areas. Areas where people have no access to water or sanitation would immediately qualify as high-risk areas. As part of the functions of the CMTT, a survey of the status of all existing WS&S infrastructure in the province must also be conducted, in order to be able to identify potential risk areas and to develop a priority list for upgrade or rehabilitation of such infrastructure. This survey would entail the determination of adequacy and efficiency through both the physical inspection of infrastructure, and the water quality monitoring of water provided from water supply systems, and of effluent produced by sanitation facilities to determine compliance with legislation.

4.3.1 SURVEYING EXISTING WS&S FACILITIES

The DWAF RO should assist the CMTT and JOC’s in the identification of high-risk areas on the basis of DWAF’s knowledge of catchment areas, water users and resources. Also, the knowledge of officials in the DWAF RO regarding the status of existing water
supply and sanitation infrastructure, and compliance there-of with legislation determined by means of water quality monitoring (see section 5.2) can be a valuable contribution to the identification of high-risk areas.

With regard to water supply and sanitation infrastructure at medical facilities (Hospitals and Clinics) there is often unclarity regarding the responsibilities of DWAF, the PDoH and the PDoW. The DWAF RO should ensure that the PDoH and PDoW have clarity regarding their responsibilities, conduct a survey of the adequacy and efficiency of water supply and sanitation infrastructure at all medical facilities in the Province, and are able to operate the infrastructure.

The status of the adequacy and efficiency of water supply and sanitation infrastructure at schools must also be obtained by the CMTT in co-operation with the PDoE to determine potential areas of concern.

All local authorities in the Province should conduct a survey of the adequacy of their WS&S infrastructure and the efficiency of its operation, which must include the evaluation of reticulation networks and the effectiveness of pumping stations.

Lastly, but most importantly, DWAF RO WS(O&M) should conduct surveys of all water supply and sanitation facilities managed by the Region itself.

DWAF RO WRM/WQM should assist all above-mentioned responsible role-players in the surveillance of WS&S infrastructure, especially pumping stations for sanitation facilities, particularly those located close to rivers, serving high-risk areas, and receiving sewage from hospitals, to establish operational efficiency and to determine why facilities are not functioning effectively.

4.3.2 WATER QUALITY MONITORING

Certain water quality monitoring aspects from part of the surveillance programme. DWAF RO WRM/WQM need not to conduct all monitoring required, but should rather be co-ordinating water resource monitoring, and monitoring activities by all responsible (local authorities, DWAF RO WS(O&M), contractors, etc). DWAF RO WRM/WQM’s responsibilities would be to develop a monitoring programme, and to conduct compliance monitoring at WS&S facilities operated by responsible parties. In addition to these monitoring responsibilities, DWAF (IWQS) is responsible for the establishment and operation of a bacteriological monitoring programme to determine the possibility of water-borne diseases. DWAF’s responsibilities towards the co-ordination of water quality monitoring are discussed further in section 5.2.

4.3.3 ENSURING OPERATIONAL EFFICIENCY

As a matter of priority, DWAF RO WRM/WQM officials must continuously ensure the operational efficiency of all existing WS&S facilities, including those managed by DWAF RO WS(O&M), by ensuring that operators submit monitoring reports (see section 5.3.1.2), and by conducting regular physical inspections and compliance monitoring.

As part of an emergency action plan, DWAF RO WRM/WQM officials should at least inspect the sanitation infrastructure at all medical facilities and schools to determine deficiencies in operation and/or lack of compliance to legal conditions. Specific emphasis should also be placed on improving the efficiency of WS&S infrastructure operated by DWAF RO WS(O&M). DWAF RO WRM/WQM officials should therefore also inspect and monitor these facilities to determine operational efficiency and compliance with legal requirements under outbreak conditions.

During inspections, immediate feedback regarding physical or technical deficiencies must be given to the operators of the water supply and sanitation facilities to ensure that safe water is provided to communities, and that properly treated water is discharged to the resource. Such inspections should also entail the bacteriological monitoring of discharged water, and where necessary, for the presence of *Vibrio Cholerae* (see section 5.2). Once monitoring results are available, immediate feedback must be given by DWAF RO WRM/WQM to the operators of sanitation facilities and water purification works to ensure that safe water is provided to communities, and that properly treated water is discharged to the resource.

All operators of WS&S facilities must submit regular reports regarding the operation of their facilities and the results of monitoring conducted on water supplied or effluent discharged by them to DWAF RO WRM/WQM, in accordance with the guidelines contained in section 5.3.2.1.

In the event that deficiencies in operation and/or lack of compliance to legal conditions have been identified during physical inspections, or indicated in monitoring results, DWAF RO WRM/WQM should give advise to the PDoH, PDoW, DWAF RO WS(O&M) and Local Authorities regarding the operation and/or upgrading of their facilities. Improving the operation and maintenance of water purification and sanitation facilities operated by DWAF RO WS(O&M), when faecal pollution is found in its water distribution networks, effluent or near pump-stations, is of utmost importance, and is not negotiable. DWAF RO WRM/WQM must ensure the improvement of the operational efficiency of sanitation infrastructure currently managed by DWAF RO WS(O&M) by co-ordinating the provision of training to operators of such facilities, which should assist in improving poor performance (see section 5.4.2).

Once the survey of the operational status of all existing WS&S infrastructure has been completed, the CMTT and/or JOC must ensure that a priority list and action plan is prepared for the rehabilitation of non-functional water supply and sanitation facilities, and/or the upgrading of inadequate facilities. The CMTT must also ensure that this plan is implemented by those responsible for the facilities, that funding is secured and that a fast track program for implementation of the priority list is developed.
DWAF RO WRM/WQM can assist in this regard by ensuring that those responsible for the facilities actually implement this action plan for the upgrade and/or rehabilitation of infrastructure. If required, financial assistance can be requested from DWAF HO WS for the rehabilitation or upgrading of such facilities. Refer to section 5.5 in this respect.

Controls and actions in terms of co-operative governance and legislation should be initiated against those sanitation facilities operators who do not attempt to improve their performance in terms of compliance to authorisation conditions.

4.4 SUPPORT ON WATER SUPPLY & SANITATION INFRASTRUCTURE

DWAF RO WS should take responsibility for the effective co-ordination of inputs and intervention into provision of water services (WS&S) by all stakeholders (public and private institutions). While DWAF has a national water supply and sanitation oversight responsibility, the implementing agent is the relevant local authority, which operates under the auspices of the PDLG. It must therefore be ensured that this is clearly understood and accepted by role-players in the CMTT, and implemented as such by the JOCs.

4.4.1 GENERAL GUIDELINES

Once the functions and responsibilities of the different role-players had been clarified at the CMTT, and decisions regarding implementation by the JOC made by the CMTT, DWAF should assist with the provision of the necessary agreed upon water supply and sanitation services, within the following guidelines:

1. Water Supply

- DWAF RO WRM/WQM must ensure that the current water provision facilities, e.g. water schemes in rural areas, are adequate and effective, and that the WSP is providing safe water in urban and rural areas by conducting surveys and monitoring compliance.
- As a matter of highest priority, DWAF RO must ensure that no water is supplied by WSP’s unless it has been given a clean bill of health in relation to sufficient levels of chlorination, measured by the absence of faecal coliforms.
- Where water supply is not adequate or effective, where the WSP lacks ability or capacity, or where responsibility of water supply still rests with DWAF, potable water can be augmented under emergency conditions through other means, such as tankers by DWAF RO WS.
- The most cost-effective means of providing water, to benefit as many people as possible, must be implemented. Providing water with temporary infrastructure such as tankers may bring relief in and emergency situation, but is not a sustainable long-term solution.

- DWAF RO can provide support regarding the provision of disinfectants such as chlorine or bleach, since this enables all affected people to safeguard themselves. This may be done through PDoH or Local Government structures as required.

2. Sanitation

- DWAF RO WRM/WQM must ensure that the sanitation facilities, especially in rural areas, are adequate and effective, and that the WSP is treating the domestic effluent from urban and rural areas in accordance with legal requirements by conducting surveys and ensuring compliance.
- DWAF RO WS must ensure that appropriate approaches to physical provision of sanitation are well thought through and evaluated. For example, chemical toilets may be brought in as a temporary measure of provision of sanitation. However this may compound rather than alleviate cholera in the medium term, since if these temporary structures are not well maintained and hygienic, other diseases may result, or groundwater may be contaminated.
- The need for the establishment of special distribution or reticulation networks will depend on each situation, and must be assessed by DWAF RO WS within site-specific circumstances, and in consultation with DWAF HO.

4.4.2 EMERGENCY WS&S INFRASTRUCTURE

The most important aspect under emergency conditions is the provision of safe water and adequate sanitation at rehydration centres and other medical facilities. As an emergency measure, a programme for the tankering of water to clinics and rehydration centres could be implemented. In the short term, DWAF, in liaison with the PDoH, could provide tanks and construct temporary sanitation infrastructure, such as VIP’s, at the medical facilities with inadequate water services infrastructure. In order to resolve the matter in the longer term, the feasibility of assisting the PDoH to provide all clinics with dedicated water supplies must be investigated.

A similar intervention to that described above for the medical facilities should also be considered at schools in high-risk areas, in this case in co-ordination with the PDoE. Similarly, for specific hot spots in high-risk areas, such intervention could be contemplated in co-ordination with the District or Municipal Council. The funding of short-term actions is discussed in section 5.5.

4.4.3 PERMANENT WS&S INFRASTRUCTURE

With regard to obtaining assistance from DWAF with regard to the upgrading or rehabilitation of existing infrastructure, or the development of new permanent infrastructure in the medium to long term, the responsibility rests with the local authority, and normal funding mechanisms apply (see section 5.5).
5. PROTOCOL FOR MONITORING, REPORTING, COMMUNICATION & FUNDING

It should be evident from the aforementioned that water resource monitoring and the communication of monitoring results play an important role in a cholera intervention strategy. In this paragraph, the bacteriological monitoring of water and sewage is discussed in the context of the national microbiological monitoring programme (section 5.1).

Secondly, a protocol indicating requirements and responsibilities with regard to the establishment of a bacteriological monitoring programme for waterborne diseases, under both conditions of actual outbreak and normal conditions, is outlined in section 5.2. A protocol regarding the reporting of, and communication with regard to, water quality monitoring information is included in section 5.3, since these although results are extremely important to ensure effective intervention during a cholera epidemic, it must be handled with care. Water quality monitoring results also play a major role in the identification of high-risk areas, and some guidelines regarding the responsibilities of DWAF towards creating awareness in such areas and education are included in section 0. Lastly, intervention measures during a cholera epidemic carries huge financial burdens, and aspects relating to the funding of both DWAF-actions, and actions by other role-players, are addressed in section 5.5.

5.1 BACTERIOLOGICAL MONITORING OF WATER & SEWAGE

It is customary practice throughout the world to judge the microbiological safety of drinking water, and the risk of disease from drinking water, by the use of faecal bacterial indicators such as Total coliforms, Faecal coliforms or Escherichia coli. Sewage contains several million faecal coliform bacteria per 100 ml whereas safe drinking water should ideally contain no faecal coliforms at all. Faecal coliforms or E.coli are therefore customarily used as indicators for microbiological water quality monitoring, because they are found in the faeces of every human being, and indicate the presence of mammalian faecal pollution.

Most rivers could have elevated levels of faecal bacteria due to the activities of mammals near or in them, as well as the lack of adequate or efficient sanitation facilities. The higher the number of indicator organisms such as Faecal coliforms, or E.coli in a water sample, the higher the chance of finding other, disease-causing, micro-organisms such as cholera, or any other of the waterborne pathogens, such as those causing gastro-enteritis, typhoid, amoebiasis, etc. in the water.

These pathogens will however only be found when the faeces from a person infected with the particular disease has contaminated the water. Thus the pathogens are only found in water samples either during an epidemic or are occasionally present, for example where a disease is endemic in an area.

5.1.1 NATIONAL MICROBIOLOGICAL MONITORING PROGRAMME

It is necessary for a developing country like South Africa to have an appropriate national microbiological monitoring system in place that can act as an early warning system to detect the potential for infections before outbreaks reach epidemic proportions. In terms of section 139(2)(b) of the National Water Act, no 36 of 1998, a national information system on the quality of water resources, which includes bacteriological monitoring, must be established. The IWQS must co-ordinate the management of water quality information. The National Microbiological Water Quality Monitoring Programme (NMMP), initiated by the IWQS, has been developed for this purpose and is currently in the Demonstration Implementation Phase.

The aim of the NMMP is to assess, on a national scale, the potential health risks related to faecal pollution of South Africa’s fresh water resources used for potable, recreational and irrigation purposes. The specific objectives of the NMMP are to –

- locate, assess and prioritise those areas in the country where potential health risks related to faecal pollution of surface water resources are the highest;
- provide information on the status and trends in the extent of faecal pollution in terms of the microbiological quality of surface water to identify potential high-risk areas;
- provide information to help assess the potential health risk to humans associated with the possible use of faecal polluted water resources; and
- help assess the effectiveness of measures to protect water resources against faecal pollution in terms of trends in the microbial water quality.

It is important to note that the NMMP was not designed for in depth site-specific regional monitoring. DWAF Regional Offices, the PDH, Local Councils, and Water Boards are responsible for regional or site-specific (local) bacteriological monitoring, which caters for their specific needs. The NMMP extracts the data needed for its reports to a large extent from these local programmes.

The NMMP has been implemented only to a limited extent in five water management areas. Reporting on potential health-risks in the areas monitored is done on a two-monthly basis. Issues such as financial responsibilities, data handling and storage, and information dissemination are still of concern, and need to be addressed before the NMMP can be extended. Results from this programme can however give a useful indication of areas with potential high health risks due to faecal pollution, as illustrated in Figure 2 below.
5.2 MONITORING PROGRAMME FOR WATERBORNE DISEASES

As stated in section 4.3.2, DWAF RO WRM/WQM need not to conduct all monitoring, but must co-ordinate monitoring activities between local authorities, the PDoH, the IWQS, and themselves in order to prevent duplication.

The source of infection of cholera is classically from contaminated groundwater, as in the 1854 epidemic of cholera in London, UK, where the source of infection was a contaminated shallow ground water supply - the Broad Street pump. DWAF RO WRM/WQM must co-ordinate the monitoring of both surface- and in particular groundwater resources by all role-players, and must monitor these resources themselves where information is lacking to ensure that information regarding the quality of water resources are up to date and are continuously available so that preventative measures can be taken where necessary.

This implies that DWAF RO WRM/WQM must develop and co-ordinate the implementation of a proper bacteriological monitoring programme to ensure the predictive, preventative and investigative monitoring for the potential occurrence of waterborne diseases, irrespective of whether such diseases are prevalent or not. The programme may however require intensifying in the event of the outbreak of a waterborne disease, and may also require modification, depending on the specific disease. This programme should be implemented by all responsible parties (DWAF RO WRM/WQM, DWAF RO WS(O&M), local authorities, contractors, etc), and the IWQS must be involved with regard to links with and inputs into the NMMP.

Such a bacteriological monitoring programme must contain specific details regarding sampling locations, frequency of sampling, variables to analyse for, test methods and laboratories to be used, responsibilities towards sampling and reporting, and follow-up actions to be taken in the event that results indicate potential problems. These aspects are described in more detail in the following sections, using the current cholera epidemic as an example at hand.

5.2.1 GENERAL ASPECTS

Sampling locations for the bacteriological monitoring programme for waterborne diseases should include both ground- and surface water resources, and water purification and sanitation facilities.
Sampling frequencies will differ, depending on whether a waterborne disease is prevalent or not.

5.2.1.1 SAMPLING VARIABLES
It is generally regarded as too costly and impractical to monitor for all potential pathogens in all sources and resources. Should any indication of faecal contamination however be found in water supplied from water purification facilities, the water source should not be deemed fit for human consumption.

General bacteriological monitoring of selected locations in water resources for indicators of faecal pollution such as faecal coliform or *E. coli* will indicate the potential risk for all waterborne diseases. Even during outbreaks of a particular waterborne disease, pathogen specific monitoring should only be conducted if levels of indicator organisms at a specific location in a water resource are exceedingly high (more than 5 000 organisms/l).

Epidemic *Vibrio cholerae* will only be found in sewage draining a given population during a cholera epidemic, as well as just prior to the outbreak of clinical cases. Even under outbreak conditions, the effluent from sanitation facilities should be monitored only for indicators of bacteriological pollution, and not for specific cholera strains, except when levels of bacteriological pollution indicators are unacceptable.

5.2.1.2 TEST METHODS FOR VIBRIO CHOLERAE
When unacceptably high levels of faecal pollution indicators such as faecal coliforms or *Escherichia coli* are found at any location, it may be necessary to conduct investigative monitoring for the presence of *Vibrio cholerae* at an increased frequency by means of the PCR test (see section 2.6.2.2 for sampling techniques and section 2.6.3.3 for interpretation of results).

The PCR method is recommended to monitor for the presence of *Vibrio Cholerae*, since it will provide quicker results. In the five days it takes for confirmation of the Peptone Growth (Moore Pad) method, the water that potentially contains the pathogens has moved five days downstream, and information on the day-to-day status of the sampling point is not available.

Moore pad sampling (see section 2.6.2.1) should only be used at locations where the presence of *Vibrio cholerae* was already indicated by the PCR test. Moore pad sampling would then allow for the serotyping of *Vibrio cholerae* by means of the Peptone Growth method (see section 2.6.3.4 for the interpretation of results), to establish whether it is a disease causing strain, or not.

In addition to the above, the following aspects must be addressed when developing a monitoring programme under normal circumstances:

5.2.2 MONITORING PROGRAMME WHEN CHOLERA IS NOT PREVALENT
Under normal (non-outbreak) conditions, it is not regarded as practical or cost effective in terms of staff, transport, and laboratory expenses to monitor water resources or water purification/sanitation facilities for specific pathogens, for example to detect *Vibrio cholerae* O1 strains.

5.2.2.1 MONITORING FREQUENCY, VARIABLES AND LOCATIONS
When cholera is not prevalent, the DWAF RO WRM/WQM should ensure that a regular monitoring programme be implemented by those responsible for the monthly monitoring (especially during summer months) of all water resources and water purification/sanitation facilities at the locations described below and for the following variables:

In order to determine operational efficiency and compliance with legislation (compliance monitoring) sanitation facilities and other associated infrastructure such as pumping stations must be monitored for faecal coliforms and chlorine.

In order to determine the safety of water supplied and compliance with drinking water standards, water supply systems such as the inlets and outlets of water purification facilities, reservoirs, ground water resources, etc must be monitored for faecal coliforms and *Escherichia coli*.

In order to predict hotspots for potential outbreaks of waterborne diseases (predictive monitoring), *rivers* must be monitored for faecal coliforms at the following locations:

- Where it flows through high risk areas (areas where people do not have proper sanitation); and
- Downstream from sanitation infrastructure (below effluent discharge points, pumping stations, etc).

When unacceptably high levels of bacteriological pollution has been found in a specific sample taken at a specific location, investigative monitoring must be conducted at this location for additional parameters, such as *Vibrio cholerae* as described under section 5.2.1.2.

5.2.2.2 RESPONSIBILITIES FOR MONITORING
The DWAF RO WRM/WQM should conduct regular compliance water quality monitoring of water supplied from all purification works and effluent discharged by all sanitation facilities, including water supply and sanitation facilities managed by DWAF RO WS(O&M).

Local authorities should conduct the following monitoring under non-outbreak conditions:

- For *faecal coliforms and chlorine* as well as other parameters prescribed in authorisation conditions (general authorisation, license, permit or exemption) at the discharge points of sanitation facilities, according to the frequency prescribed in the authorisation.

- For *faecal coliforms and Escherichia coli* at the inlets and outlets of water purification facilities, water supply reservoirs, ground water resources, etc to determine compliance with drinking water standards.
When unacceptably high levels of bacteriological pollution have been found in a specific sample taken at a specific location, investigative monitoring must be conducted at this location for additional parameters, such as *Vibrio cholerae* as described under section 5.2.1.2.

In those Regions where DWAF RO WS(O&M) is responsible for the operation of water purification works and/or sanitation facilities, they have the same monitoring responsibilities as local authorities.

Sanitation facilities that receive sewage from hospitals (both those operated by the hospitals themselves and by other parties such as local authorities) is at a greater risk to allow pathogens to pass through into the water resource, and monitoring for faecal coliforms alone will therefore not be sufficient. These facilities must therefore be monitored by the owner/operator (PDoh/DoW/Local authority) in the same manner as described above, with the following exceptions:

- the presence of pathogenic organisms, including for *Vibrio Cholerae*, as described in section 5.2.1.2, must be determined on a monthly basis in both the sewage influent as well as effluent; and
- the percentage die-off that occurred must be determined, in order to establish the efficiency of the operation of the works.

5.2.2.3 RESPONSIBILITIES FOR FOLLOW-UP ACTIONS
The responsibilities of local authorities, operators of sanitation facilities that receives hospital sewage, and DWAF RO WS(O&M) are to report the following situations immediately to DWAF RO WRM/WQM:

- Where levels of faecal coliforms at sanitation facilities exceeds regulatory standards;
- Where there is any indication of faecal coliforms in the water supplied from purification works; and
- Where monitoring indicates insufficient operation of sanitation facilities receiving hospital sewage through increased levels of faecal coliforms or through unsatisfactory die-off of pathogens, including *Vibrio Cholerae*, and to take corrective actions with regard to the operation of their respective facilities.

The responsibilities of DWAF RO WRM/WQM, once these situations have been reported to them, would be to provide assistance to the operators of the facilities to ensure improved operation, as described in section 4.3.3, by giving advice and training, and by enforcing compliance to authorisation conditions.

Further responsibilities towards communication and reporting between role-players are discussed in section 5.2.3

5.2.3 MONITORING PROGRAMME WHEN A CHOLERA OUTBREAK IS CONFIRMED
Since one of the first priorities of the CMTT is to identify high-risk areas (see section 3.4 on page 10), existing monitoring information on faecal coliform levels will be extremely valuable towards this end, and should be provided by the DWAF RO to the CMTT. This information will be even more valuable if it is immediately available as results obtained from monitoring conducted prior to outbreaks in water resources, at water purification works and sanitation facilities, either from results submitted to DWAF by the operators, or from compliance monitoring.

Once an outbreak has occurred, the DWAF RO WRM/WQM must assist the CMTT, with designing and ensuring the implementation of a dedicated monitoring programme in all high-risk areas.

5.2.3.1 MONITORING FREQUENCY, VARIABLES AND LOCATIONS
Monitoring actions taken as part of a programme developed for cholera outbreak conditions would entail the following:

1. The monitoring programme described above for normal conditions should continue without amendment in unaffected areas.
2. In affected areas (areas where cases have been confirmed), the monitoring programme described above for normal conditions should continue with the following amendments:
   - Monitoring of water sources that are part of the water supply programme, especially springs and boreholes in the high-risk areas, must be conducted on a daily basis to determine effective chlorination and suitability for human use.
   - These water sources should be monitored weekly for levels of faecal coliforms, and if any such organisms are found, the use of the source must be discontinued and replaced with a clean source to ensure that safe water is indeed supplied to communities that are potentially at risk.
   - Investigative monitoring of selected locations in rivers, such as downstream of dense settlements where cholera had not yet appeared, must be conducted weekly or fortnightly to determine the presence of specific pathogens such as *Vibrio Cholera* by means of the PCR test, to enable preventative action.
   - Operators must monitor sanitation infrastructure (both treatment works and pumping stations) weekly or fortnightly to determine the presence of *Vibrio Cholera* by means of the PCR test.
   - The monitoring frequency for all other variables specified in the normal programme should be increased to weekly or fortnightly.
3. Serotyping by means of Moore pad sampling and the Peptone-Growth procedure must be conducted to determine specific serotypes at any sampling location where the presence of *Vibrio Cholera* is indicated by the PCR test.
4. Compliance monitoring by DWAF RO WRM/WQM must receive high priority and must immediately be conducted at all facilities in affected areas.
5.2.3.2 MONITORING RESPONSIBILITIES
A monitoring programme for the monitoring of water supplies and water resources by DWAF RO WRM/WQM, and the monitoring of sanitation facilities by operators (local authorities, hospitals, DWAF RO WS(O&M), etc) as well as the co-ordination of monitoring activities by DWAF RO WRM/WQM must be prepared by DWAF RO WRM/WQM and submitted to the D:WQM for approval. Once approved, this monitoring programme should be implemented in a co-ordinated manner by those responsible for the specific water supply and/or sanitation infrastructure (i.e. local authorities, PDoH, DoW, DWAF RO WS(O&M), etc), and by DWAF RO WRM/WQM for compliance purposes.

5.2.3.3 FOLLOW-UP ACTIONS
The follow-up actions required under normal circumstances must be rigorously followed under outbreak circumstances (see sections 4.3.3 and 5.2.2.3). The following additional follow-up actions may also be necessary:

- In cases where a ground water source is contaminated with faecal coliforms, this source (borehole or spring) should be sealed off to prevent further usage there-of for domestic purposes.
- If monitoring results in rivers are positive for disease causing cholera strains, signs indicating the risk of using water directly from these affected rivers should be erected at the side of the rivers where it is normally accessed for use.

Furthermore, the reporting and communication of monitoring results should be conducted as discussed below.

5.3 REPORTING & COMMUNICATION PROTOCOL
With regard to water quality results, it is of particular importance that a balance is maintained between not communicating results, causing the spread of the disease to uninfected areas, and being over cautious by possibly reporting unconfirmed cases or uncontaminated water resources, causing public panic.

Based on the responsibility of DWAF to co-ordinate communications regarding water resources, the following Box contains an example of how communication pertaining to a potential new cholera outbreak, through the reporting of water quality results would function.

From this example, it is clear that reporting and communication (and awareness) activities are closely intertwined, and that both internal communication between DWAF components, and external communication with other role-players, government departments and stakeholders should receive an equal amount of attention. Also refer to section 3.5.4 in this regard.

5.3.1 DWAF INTERNAL COMMUNICATION AND REPORTING
An effective internal Reporting and Communication protocol between DWAF HO and DWAF RO components is of paramount importance. Communication between the line functions in DWAF Head Office and DWAF RO should be structured according to Figure 3 below, especially in relation to monitoring results, press releases, and budget requests. These aspects are discussed in more detail below.

5.3.1.1 REPORTING BY DWAF REGIONAL OFFICE
If pathogenic cholera organisms are positively isolated from any of the water samples analysed, whether such results had been submitted by other parties (e.g. sanitation facilities operators) or obtained from DWAF’s own monitoring activities, the DD:WQM:R must immediately submit reports regarding such results to the D:WQM. The format of reporting such results to the D:WQM is contained in Appendix C.

Irrespective of whether a cholera outbreak has been confirmed in a specific area or not, or if pathogenic Vibrio cholerae had been positively identified in a monitoring exercise, a cholera status report must be submitted on a monthly basis by the DD:WQM:R to the D:WQM in the format outlined in Appendix D.

Results regarding positive or suspected positive results for pathogenic Vibrio cholerae in suspected new areas of outbreak must be submitted to the D:WQM and the CD: Regions before other parties are notified or press releases are issued (see section 5.3.2.2.1). The D:WQM will, in consultation with the IWQS, decide on the status of the results, and when necessary, will informing the Region that a risk exists.

When new areas of potential outbreak are identified by means of water quality monitoring, and had been confirmed by the D:WQM, the Region must immediately notify the Regional Director, RO Communication Officer, Community Development Officer; Operation and Maintenance, Planning and Development, District managers.
These components must be kept continuously informed of new issues and basic statistics.
5.3.1.2 REPORTING BY DWAF HEAD OFFICE
In instances where potential new areas of outbreak have been identified by means of water quality monitoring, the D:WQM will inform the CD:WUC who will communicate this to the DG, the DDG:RO&WS and the CD: Communications. In cases where rivers are shared with neighbouring countries as international boundaries, the D:WQM will also inform the D:International Liaison in order to establish communication with appropriate counterparts in these areas.

5.3.2 EXTERNAL COMMUNICATION AND REPORTING

5.3.2.1 REPORTING TO DWAF REGIONAL OFFICE
Under outbreak conditions, results of water quality monitoring at sanitation facilities must be submitted on a daily basis by the operators to DWAF RO WRM/WQM and the PDoH, to allow follow up actions by the Environmental Health Officers of PDoH and by the WPCO’s of DWAF RO WRM/WQM. In the case of hospital sanitation facilities, such reports to DWAF RO WRM/WQM must also include details regarding patients with notifiable diseases.

Under such conditions, local authorities should conduct a survey of their water supply and sanitation infrastructure and the efficiency of operation thereof, including a survey of reticulation networks and the effectiveness of pumping stations, and submit a report regarding this to DWAF RO.

All sanitation facilities and water purification works operators should report on a weekly basis to the DWAF Regional Office regarding whether water had been adequately treated, or whether effluent had been adequately disinfected which should commence immediately on notification of the first cases of cholera. Should any problems be identified in the day to day operation of the works (especially works at hospitals), this must be immediately reported to the DWAF Regional Office.

5.3.2.2 REPORTING BY DWAF REGIONAL OFFICE
The responsibility of DWAF Region is primarily to ensure that downstream users of affected water resources are informed regarding the possibility of a waterborne disease based on water quality monitoring data. This implies that although it is the responsibility of DoH and DoE to conduct awareness campaigns, DWAF Region must make sure that information regarding water quality results are accurately and adequately disseminated.

Immediate feedback must be given to operators of pump stations, water purification works and sanitation facilities regarding both operational standards and compliance monitoring results to ensure that purified water is provided to communities and that properly treated water is discharged to the resource.

5.3.2.2.1 Press Releases
With regard to existing areas of cholera outbreak, which is managed by a CMTT, the issuing of press releases dealing with water quality monitoring results could be issued by the CMTT, provided that the results had been confirmed by the D:WQM and the press release had been sanctioned by the CD:Communications.

With regard to water quality monitoring results that indicates potential outbreak or high-risk areas, DWAF is responsible to ensure that this information is disseminated to downstream users, specifically the target groups discussed in section 2.5.1. However, due to the fact that it is not easy to monitor for *Vibrio cholerae* in water resources, the issuing of press releases must be handled with circumspect.

In instances where potential new areas of outbreak have been identified by means of water quality monitoring, and confirmed by the D:WQM as outlined above, the Region can continue with the drafting and issuing of a press release in consultation with their Communications Officer and the CD:Communications in order to alert downstream users and the broader public.

In instances where results for pathogenic cholera was negative, but the resource has high levels of faecal pollution or NAG strains of *Vibrio cholerae* had been identified, people should also be warned not to use water directly from the river. This press release should specifically state that cholera was not found in the resource, but that care should be taken with regard to the use of the water and measures to be taken to treat the water before use for domestic purposes should be indicated.

When such new areas of potential outbreak have been identified by means of water quality monitoring, and had been confirmed by the D:WQM, the Region must immediately notify the PDMS and the PDoH. Contact should be established with doctors in the PDoH regarding a potential new outbreak, and information on sample locations, results, and other actions should be provided to the PDoH.

5.4 DWAF RESPONSIBILITIES TOWARDS AWARENESS AND EDUCATION

Almost the most important of the five aspects that need to be addressed in the effective management of a cholera epidemic is awareness and education regarding the nature of the disease.

5.4.1 TOWARDS AWARENESS
Awareness of role-players in a specific catchment must be enhanced, and in areas where CMA’s are being established, or have been established, meetings of such bodies must be used to create awareness among the other users of the resource. At such meetings, information regarding the nature of the disease, affected areas, preventative measures, etc, can be disseminated, and in some cases, the stakeholders of the CMA can be co-opted to assist with the management of the problem.
An additional responsibility of DWAF would thus be firstly to identify potentially affected downstream users (individuals, farmers, communities, tribal leaders, etc), and to provide the correct information to PDoH and PDoE to inform and create awareness among those potentially affected.

DWAF RO should furthermore assist the PDoH and PDoE with their responsibilities in respect of awareness creation activities and education on hygienic sanitary practices for households and communities and that such activities are synchronised. In this respect DWAF could contribute by:

- Immediately implementing the communication plan prepared by the CMTT where certain responsibilities had been assigned to DWAF;
- Reproducing and distributing resource material and ensure that such pamphlets or documents are available in both English and at least another language prevalent in the area;
- Ensuring that health and hygiene awareness education is undertaken at every project being implemented by DWAF; and
- Extending its own health and hygiene awareness programme to include all areas where DWAF has a presence and is active.

5.4.2 TRAINING
Training should be provided to DWAF personnel involved with the management of cholera intervention actions to ensure informed participation in the CMTT and JOC. This should include training with regard to the nature of cholera, importance of providing properly purified water and adequate sanitation, and the responsibilities of DWAF in co-managing the problem. In some instances, it may also be necessary to train PDoH personnel to enable them to conduct extensive health and hygiene education, specifically with regard to water supply and sanitation.

Training must also be provided to enable the operators of purification works and sanitation infrastructure, especially those managed by DWAF, O&M to understand how inadequate operation of such works affect the community and the water resource. In the interim, a properly informed person should provide this training in the Regions, until proper training can be provided by suitable training institutions.

5.5 FUNDING OF DWAF ACTIONS
Under emergency conditions, funding for especially water supply and sanitation provision could normally be obtained from national and/or provincial disaster funds. All programmes should be funded from the following sources in order of priority:
- Special Disaster Prevention Funding made available by Provincial Government;
- Special Disaster Prevention Funding made available by National Government;
- Normal exchequer allocation to Local Government from Division of Revenue;

In the short to medium term, and only for those aspects that DWAF is directly responsible for, funding could be obtained from reprioritisation and reallocation of current projects/funds on the RO’s budget. Should this be insufficient, once the extent of DWAF’s involvement with the cholera intervention is known, a Business Plan containing *inter alia* the cost implications of DWAF’s involvement must be submitted by the Regional Director through the CD:Regions to the DDG:WS&RO in order to arrange funding.

The following are guidelines for a funding mechanism when DWAF provides financial support to D/MC’s for the the medium to long term construction of new permanent infrastructure or the upgrading or rehabilitation of existing infrastructure:
1. The D/MC prepares a WSDP as part of its IDP, in which needs are identified, and projects prioritised on the basis of a pre-feasibility investigation.
2. DWAF provides a medium term (3 year+) expenditure framework indicating allocations to water, sanitation or special programmes from all funds.
3. The D/MC schedule projects to available funding, nominates an implementing agent and applies to DWAF for project funding.
4. DWAF considers the project for funding allocation, the capacity of the implementing agent to implement the project, and earmark project funding.
5. The D/MC appoints the approved implementing agent, performs a project feasibility investigation, develops a project business plan, adjusts scheduling based on updated information, and submits a project business plan.
6. DWAF considers the project business plan, and allocates funding within a DWAF-D/MC agreement.
7. The D/MC manages and monitors implementation, submit reports and forward bills to DWAF.
8. DWAF conducts a monitoring and evaluation programme and supports the municipality.

It must be noted that a social and institutional development programme must accompany all water services infrastructure provision projects. In line with normal Government Community Water Supply and Sanitation Programme principles, all projects must be constructed using appropriate labour intensive practice with maximum community involvement and benefit. Programmes must utilise “sweet equity” provided by the beneficiaries instead of relying on a cash contribution towards the construction of infrastructure.
6. SUMMARY

The broad guidelines contained here-in should be put in place as part and parcel of the regional strategic plans for containing a cholera outbreak, which should aid in the effective ongoing and future management of cholera epidemics and other related waterborne diseases by the responsible sections in the Department of Water Affairs and Forestry.

REFERENCES

Department of Water Affairs and Forestry, April 1997: White Paper on a National Water Policy for South Africa.
Department of Water Affairs and Forestry, April 1991: Water Quality Management Policies and Strategies in the RSA.
WHO Press Releases, Guidance documents and Information Fact Sheets on the WHO home page http://www.who.int/.
Appendix A: Generic Model of the Management Process for Environmental Issues

CONTINUOUS IMPROVEMENT

Redefine Purpose and Re-establish Plan

Assess information and establish action plan
- Identify risk areas & objectives
- Set priorities
- Define responsibilities
- Develop time schedules
- Secure funds

Implement Plan
- Ensure capacity
- Support actions

Establish Structures & Institutions and obtain commitment

Identify Problem

Measure and Assess
- Monitor implementation
- Audit effectiveness

Review information and improve action plan
- Review
- Corrective action

Adapted from ISO 14001
### Checklist regarding Assistance in relation to Interventions during Cholera outbreaks

**CHECKLIST: CHOLERA OUTBREAK INTERVENTION: DWAF**

<table>
<thead>
<tr>
<th>Name of the Place where the outbreak occurred:</th>
<th>Location/Province</th>
</tr>
</thead>
</table>

Indicate whether the following has been attended to by answering yes (Y), no (N), or not applicable (N/A).

1. **Contact and co-operation:** Have it been established with the following?
   a) Provincial Department of Health
   b) Provincial Department of Local Government
   c) Provincial Department of Education
   d) Provincial Department of Works
   e) Local authority(ies)
   f) Others? (Please indicate)

2. **Water supply and sanitation:**
   a) Have support been provided to ensure the following?
      - Safe water supplies at hospital/clinic/re-hydration centre(s) where patients are treated?
      - Adequate & effective sewage treatment at hospital/clinic/re-hydration centre(s) where patients are treated?
      - Water supply to local schools
      - Sanitation at local schools
      - Water supply to Community centres
      - Sanitation at Community centres
   b) Have surveys on water supply and sanitation infrastructure been conducted?
   c) Is potential cause of outbreak due to a lack of water supply and/or sanitation infrastructure?
   d) Are additional support needed with regard to water supply and sanitation infrastructure?

3. **Water quality management functions if potential source is a sanitation facilities**
   a) Does the sanitation facilities have a valid authorisation (license/GA/ELU)?
   b) Does the sanitation facilities comply with authorisation conditions?
   c) Does the sanitation facilities have an effective Operation and Maintenance Plan?
   d) In your opinion, is the operation and maintenance of the sanitation facilities efficient?
   e) In your opinion, is the reticulation networks and pumping stations in a good/effective working condition?
   f) Does the sanitation facilities experience financial difficulties?
   g) Does the sanitation facilities need support in relation to maintenance/treatment chemicals/infrastructure?

4. **Monitoring**
   a) Are water resources (ground and surface water) and water supplied being monitored?
   b) Is investigation of potential sources or causes upstream of positive river sampling point conducted?

   **If potential sources are sanitation facilities:**
   c) Does the sanitation facilities have a Water Quality Monitoring Plan?
   d) Does the sanitation facilities monitor for increased levels of faecal coliforms?
   e) Does the sanitation facilities monitor for pathogens?
   f) Does the sanitation facilities monitor for the presence of *Vibrio Cholerae*?
   g) Does the sanitation facilities monitor for *Vibrio Cholerae* serotypes?

5. **Communication and Reporting: External**
   a) Information provided to potential users downstream of positive river sampling point
   b) Dissemination of information to General Public? By whom?
   c) By means of: Pamphlet distribution
   d) By means of: Radio Broadcasts
   e) By means of: Other:

6. **General Communication and Reporting: Internal**
   a) Was a cholera project management report submitted to the DDG:RO&WS?
   b) Was a cholera incident report submitted to the D:WQM?
   c) Was a bacteriological and cholera monitoring report submitted to the D:WQM?
   d) Was a copy of Press release submitted to the CD:Communications?

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**Name of official(s) completing the CHOLERA INTERVENTION CHECKLIST**

**Date:**
### WATER QUALITY MONITORING: CHOLERA

<table>
<thead>
<tr>
<th>Region</th>
<th>File No.</th>
<th>Date</th>
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**Name of officer preparing report**

**Location of water quality sampling point(s)**

(Indicate co-ordinates of location on a 1:50 000 locality map and attach to report)

**River/Catchment**

**Sample date**

**Name of person taking the sample**

**Sample taken by**

<table>
<thead>
<tr>
<th>DWAF</th>
<th>Yes</th>
<th>No</th>
<th>Other Party</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

**Name of Laboratory used for analysis**

**Type of test requested**

**Type of test conducted**

**Results submitted by**

<table>
<thead>
<tr>
<th>Laboratory</th>
<th>Yes</th>
<th>No</th>
<th>Other Party</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

**Vibrio cholerae Results**

<table>
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<tr>
<th>Positive?</th>
<th>Yes</th>
<th>No</th>
<th>Negative?</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

**If results are Positive:**

- Indicate Serotype
  - Inaba
  - Ogawa
  - Hikojima
  - O139

**If sample taken by other party, date report was submitted to Region:**

**Date of Analysis**

**Background Information/History/Description of Incident /Possible Source of Cholera**

(Can responsible party be identified?)

**Downstream Users (Who are they)? Impact on and awareness of Downstream Users?**

**Actions of Region (to create awareness with users and actions against responsible party)?**

**Actions of Responsible Party?**

**Actions taken to prevent a recurrence /further spread?**

**Seen by Deputy Director**

<table>
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<tr>
<th>YES</th>
<th>NO</th>
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Please complete this form after receiving reports of positive results for cholera in ground or surface water resources, or from sanitation facilities operators submitting results regarding effluent testing positive for cholera, and submit completed report immediately to D:WQM for national statistics purposes.
<table>
<thead>
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<th>Region</th>
<th>Date</th>
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<td>Report prepared by</td>
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Has there been a cholera outbreak in the Region since Winter 2000?  
YES □ NO □

When were the first cases reported to DWAF?  

Who reported the first cases to DWAF?  

Where did the first outbreak occur?  

For this period of (Last reporting date) to (date), please supply the following information regarding cholera outbreaks:

Outbreak period (date of first case reported to date of last case reported)  

Total number of confirmed cholera cases reported to date:  

Total number of confirmed cholera fatalities to date:  

Average number of new daily cases reported to date:  

Highest number of new daily cases reported to date:  

District/Catchment with highest incidence of occurrence (most patients):  

Irrespective of an outbreak or not, please supply the following information regarding bacteriological monitoring:

Is bacteriological monitoring being conducted in water resources?  
YES □ NO □

<table>
<thead>
<tr>
<th>Name of water resource</th>
<th>Number of sampling points</th>
<th>Sampling Frequency</th>
<th>Sampling done by</th>
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Is bacteriological monitoring being conducted at other WS&S facilities?  
YES □ NO □

<table>
<thead>
<tr>
<th>Name of facility</th>
<th>Number of sampling points</th>
<th>Sampling Frequency</th>
<th>Sampling done by</th>
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List names of WS&S facilities that is regarded as a potential human health risk due to unacceptable levels of bacteria:

<table>
<thead>
<tr>
<th>Name of facility</th>
<th>District/Municipality</th>
<th>Operated by</th>
<th>Reason for concern/potential problem</th>
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General Statement regarding bacteriological status of water resources in the Region (e.g. levels of Faecal coli)  

General Statement regarding actions taken by Regional Office to address possible cholera outbreaks  

Deputy Director  

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<tr>
<th>Name</th>
<th>Signature</th>
<th>Date</th>
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This report must be compiled on a monthly basis by all Regions, and submitted to the D:WQM on Fridays, irrespective of whether a cholera outbreak had been confirmed in the Region or not. Please also complete this form and submit completed report to D:WQM immediately after the finding of positive results for cholera reported by sanitation facilities operators, in ground or surface water resources, or from the Department of Health relating to patients testing positive for cholera.
Your comments on the Cholera Guideline will be of great value in improving the document. To comment, please complete the following and fax or mail it to the address below, or send us the information by e-mail (the Reply Sheet can be e-mailed to you on request for completion, if you prefer).

Comments should be addressed to:

Cholera Guideline Co-ordination Committee  
c/o The Director: Water Quality Management  
Department of Water Affairs and Forestry  
Private Bag X313, Pretoria, 0001  

For Attention: Carin Bosman  
Phone: (012) 336-7556, Fax (012) 323-0321;  carin@dwaf.gov.za

Title (Mr/Ms/Dr) ………………  First name and surname ………………………………………………………………………………………………….  
Organisation ……………………………………………………………………………………………………………………………………………………………….  
Position ……………………………………………………………………………………………………………………………………………………………….  
Postal address ……………………………………………………………………………………………………………………………………………………………..  
Tel: (……………) ……………………………………………………  Fax: (……………..) …………………………....  
Email: ……………………………………………………………….  Cell: …………………….………………………..

I suggest that you ensure the following people/organisations are contacted for their comments (please include any contact details you may have at your disposal):

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I wish to make the following comments at this stage on the Cholera Guideline:  
(please use another page if necessary)

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GENERAL COMMENTS:

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