Odisha State
Water Quality Management Strategy

Prepared by
Technical and Mangement Support Team
DFID funded Odisha Health and Nutrition Support Project
Bhubaneswar

In consultation with
Odisha State Water and Sanitation Mission
Department of Rural Development
Bhubaneswar

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1. Introduction

1.1 Extent of the problem

All states of India face quality problems, to varying degrees, in both surface and ground water where use is to be made as a source of drinking water supply. Whereas chemical contamination of ground and surface water can be naturally occurring or man-made, bacteriological contamination is largely due to poor sanitation practices in the vicinity of the source. Odisha faces chemical quality problems from fluoride, nitrate, total dissolved solids (TDS) and iron together with contamination from faecal coliforms. Of these all can have health impact on users, depending on concentrations, with iron only giving a measure of unacceptability in use (affects washing, cooking, etc). The state provides testing laboratories in support of its drive to eliminate quality problems and has prepared this strategy document to define what actions at Gram Panchayat level can become standard practice to advise communities where chemical contamination is present in a source and to introduce simple and robust mechanisms at local level to eradicate bacteriological contamination and mitigate impacts.

Clearly the parallel drive of both National and State governments to ensure all Gram Panchayats become Open Defecation Free at the earliest date, will provide a massive support to the complete removal of bacteriological contamination of drinking water sources. Improved drainage, good household storage methods and better personal hygiene will also need to be addressed by Gram Panchayats to ensure that drinking water retains its purity between source and stomach.

1.2 Design of a rural drinking water quality management framework

The heart of a rural drinking water quality management framework requires the articulation of two main components as described below. The efficiency of such a framework will critically depend on the effective interaction between all its constituting sub-components. The proposed strategy will thus be successful provided that all the following sub-components are enforced simultaneously and properly interconnected.

I – Monitoring & Surveillance

(i) Water quality monitoring decentralized at the lowest accountable level
(ii) Health survey with a focus on water borne diseases and fluorosis
(iii) Consolidation in a unified management information system

II - Response capacity

(i) Sanitary Survey for risk assessment and appropriate response approach tailored to local conditions

(ii) Immediate remedial measures with appropriate mix of preventive and corrective actions

Enforcing the framework as described above, is equivalent to commissioning a rural water quality management system. Strengthening the existing system and developing it further will imply some upfront efforts. These efforts will have to be sustained until the system runs smoothly on a routine basis across the whole State and has become an integral part of the rural water supply and sanitation services delivery system. Additional anticipated areas of actions are:

I – Monitoring & Surveillance

(i) Drinking water sources quality baseline

(ii) Capacity building programme for SEMs and other Front Line Workers (FLWs) (Sanjog Partners)

(iii) Development of a computerized WQ Management Information System which can be linked with IMIS.

II - Response capacity

(i) IEC about water quality and health impact and mitigation measures

(ii) Research and Development

As this approach requires intensive and sustained inputs, GoO will support piloting this approach in the Blocks chosen for implementing the proposed Benchmark Model Gram Panchayats and documenting the experiences over a period of one year after implementation. During the implementation it is expected that implementation strategy will be refined. Once successfully implemented, it will be taken up for statewide application.

2. Objective

The objective underpinning this strategy is to ensure sustained supply of safe water to rural communities by bringing the various players into a robust yet simple framework so as to optimize on the many tasks to be covered while ensuring safe quality of drinking water.

The short-term objective will focus initially on improvements on the health front, as it will constitute an immediate way to benchmark the effectiveness of the proposed improved rural DWQM system, both in term of reducing numbers of sources affected by bacteriological contamination and identification of chemically contaminated sources and appropriate mitigation measures. The ultimate objective is to create an enabling environment wherein the rural residents are able to manage their water supply installation and have access to safe drinking water conforming to the Bureau of Indian Standards (BIS) specification on Drinking Water Quality (IS: 10500 – 2012) throughout the year at an affordable price.

2.1 Assumptions

The development of a rural DWQM framework is based on the following assumptions.

Creating awareness about water quality issues, associated adverse health effects, and possible preventive measures among rural communities will certainly go a long way towards minimizing adverse health effects and ensuring improved degree of safety to the drinking water. Nevertheless, given the importance of this subject (direct impact on health, irreversible in the case of chemical pollution with fluoride) and at the same time, its technicality (especially for chemical contamination), rural communities and Gram Panchayats, even when empowered to undertake their own measures to monitor their water quality and remedial actions on a regular basis, cannot be left alone to tackle the issue.

The baseline for developing the proposed rural DWQM framework is thus that, although communities and GPs will be ultimately responsible for the quality of the drinking water delivered by any rural water supply infrastructure in place within their jurisdiction (quality control), they should be given access to information and provided with adequate back up for undertaking any remedial measure. In addition, the higher governmental levels (that is, Chief Engineer responsible for Water Quality) will retain surveillance and risk management functions which should be triggered in case of specific hot spots.

3. Surveillance and Response

Effective surveillance is the backbone of any risk assessment and risk management system. The framework sub-components consist of water quality monitoring and response decentralized at the lowest accountable level. This requires to be linked with health survey with a focus on identification of water borne diseases and fluorosis that are then consolidated within a unified Management Information System and used to indicate impacts over time.

The Uniform Water Quality Monitoring Protocol was first notified in the year 2005 by the Ministry of Water Resources following the provisions under the Environment (Protection) Act, 1986. As this protocol was focused more on pollution aspects of water bodies, a need was felt for evolving a protocol for drinking water. Hence, a Uniform Drinking Water Quality Monitoring Protocol was issued by the Ministry of Drinking Water and Sanitation, Government of India, in February 2013. In view of the increasing importance of ensuring drinking water quality in the face of increased pollution and contamination challenges across the country, the Government of India has earmarked 3% of the State allocation under National Rural Drinking Water Programme (NRDWP) for Water Quality Monitoring and Surveillance. The funds are meant for setting up and or upgrading water quality testing facilities, conduct regular quality tests of samples from drinking water sources, field testing kits (FTK), GPS, and support response measures for addressing remedial or alternative arrangements for drinking water problem areas. The Protocol provides guidance on aspects like minimum infrastructure required, personpower, instrumentation, chemical, glassware at laboratories, sampling and testing procedures, etc.

At the village level, the lowest accountable person is the SEM, who is responsible for testing the chemical parameters using Field Testing Kits (FTK). In case of bacteriological contamination and water borne diseases, it is required to link up with the Health Department.

3.1 Water quality monitoring and response – bacteriological

Role of SEM

At Gram Panchayat level, Self-employed mechanics (SEMs) provide an existing service to communities by looking after spot sources within a GP. SEMs will become the backbone of the monitoring and response to bacteriological quality at grass roots level.

H_2S testing as indicator

Given additional capacity building and in recognition of the currently proposed restructuring of SEM remuneration, it is proposed that SEMs will take water samples in H_2S vials of all sources in their jurisdiction, at least twice a year, depositing them for maintenance at normal room temperature at Block Office, under JE (2).

Testing procedure and response

All results will be shared with EE at Division and fed quickly to GP (VHSC) and SEM. Pass results will be notified to users by SEM, by painting sources appropriately. Fail results will initiate a series of actions, as follows:

a) First the SEM will take a new sample that will be sent rapidly to District / Divisional Laboratory for full MPN testing to confirm bacteriological contamination that has been indicated by H2S test.
b) If the laboratory test indicates no bacteriological contamination SEM will be advised and he will inform community.
c) If test indicates bacteriological contamination, SEM will be advised to carry out a Sanitary Survey of the failed source. The marking and results of this survey will be shared with EE and SEM will be advised what response should be taken (chlorination, removal of contamination at source, rehabilitation of source, abandonment of source, etc). SEM will advise community to stop using source for drinking water. {NOTE: it may be that community agrees to take its own action (boiling, chlorination) and continue using this source, until response is completed}.
d) After response action(s), SEM will take H_2S sample for testing through normal route.
e) Once a Pass response for this source reaches SEM, community will be advised to reuse source for drinking water.

Support actions required

Considering that between 1000 and 1500 sources may be operating in a Block, it will be necessary that:

a) SEMs are capacity built to carry out sampling (surveillance) and response activities.
b) Capacity is made at Block Office for receiving and processing all H_2S samples from all Block sources and for maintaining proper paper records.

c) A mechanism is established for passing samples of failed sources quickly to District/Divisional Laboratory for MPN testing.
d) Management and equipment is made available to meet MPN testing needs generated from Blocks within the district (it may be decided to create additional MPN testing facilities at sub-divisional level to cope with samples generated).
e) Paper formats required for this framework are prepared and tested for adequacy.

Long term testing

Once the majority of sources are free of bacteriological contamination on a regular basis and for a minimum of 6 months, the frequency of testing may be reduced from monthly to quarterly and eventually to pre and post monsoon at the discretion of the EE.

Open Dug wells

Open and sanitary dug well sources of drinking water are special cases where water quality is constantly at risk from contamination from a surface point or through percolation of contamination. It is therefore necessary in the case of open or sanitary dug wells that a regular system of surveillance is implemented by SEMs, as directed by EE, using H_2S vials in the process established for RWSS sources. This will identify any dug well that is not receiving adequate chlorination. Feedback of test results should go to MO and Health Dept. as well as the VHSC and EE. Regular monitoring of residual chlorine levels that will indicate how often chlorination may be necessary should be carried out by Health Dept. nominees. Provision of testing equipment (chloroscope) and chlorine dosing liquid or powder shall be determined by Health Dept. and appropriate training given.

3.2 Water quality monitoring and response – chemical

15 parameter annual test

It is normal national standard to have an inventory of 15 physico-chemical parameters of all drinking water sources. Unlike bacteriological quality, which tends to change over time and with season, chemical quality remains more stable, although trends of change may be noted over a long time frame and sometimes seasonally. It is therefore more practical to invest in a longer period between tests of all 15 parameters. The tests are done by the District and sub-divisional Laboratories on a regular basis; bacteriological analysis is done twice a year while chemical analysis is done once a year. As per GoI protocol, each laboratory shall carry out 3000 samples per year.

It is therefore proposed that an annual rolling test of the full 15 parameters is targeted for every source, which will be entered in the state MIS and monitored for change and to identify at risk areas for contaminants such as fluoride. These will be mapped to produce visible data for GPs within at risk areas so that mitigation measures, such as diet change, can be justified and given through DWSMs to VHSCs and to PHCs. In fluoride affected areas this can have a major impact on the severity of fluorosis. RWSS will coordinate and distribute all mitigation information to GPs, taking the help of organisations such as UNICEF.

GPS location

At the time that a sample is first taken for a source it is required that a GPS location for the source is taken and recorded along with the basic data for the source. This is to ensure that repeat testing or checking of a source is facilitated and mapping is supported. From then on the source becomes unique through its GPS location. Appropriate training will be given to SEMs on use of GPS and EEs will be responsible for issue and inventory of GPS loggers. This logging procedure will also facilitate better and more responsive O&M of sources.

Sampling procedure

It is essential for each Division to draw up a yearly plan of action for collection of water samples from various sources for testing at the laboratories. SEMs will be advised by EE through his team of a schedule of source sampling dates in his area of responsibility. Test location will be specified and a decision taken by EE whether it is considered necessary to appoint external testing companies to augment the RWSS laboratory capability whilst ensuring the target of a rolling 100% of sources are tested every year. Laboratories will be trained and provided computer equipment and software to enable a central database of chemical test information to be generated

Quality assurance

Random testing of a sample of sources at any location will be planned and undertaken by State Laboratory to assess and report to CE, SE and EE on system quality. A survey may be carried out, and appropriate human resource deployed to handle the workload.

Digital information system

It should therefore be possible to quickly develop a sound digital information system with spatial output for all parameters tested. Where this has a health impact, and particularly for fluoride affected areas, this information is paramount and should be disseminated to GP level with appropriate household information leaflets at the earliest time.

Advising community

It is also necessary that communities have a simple way of knowing that a particular source delivers water, with say, fluoride or nitrate at more than normal levels so that appropriate action can be taken by the users in their day to day life. This can be done simply by painting the source with a particular colour, because the numbers of chemical parameters that have social as opposed to health impacts are small. Colours must also be used to show sources providing health affecting water. The following are suggested and will be applied using stencils with a distinctive shape at a location clearly visible to users:

- Fluoride above normal level — blue paint marks
- Iron above normal level — brown paint marks
- TDS above normal levels — yellow paint marks
- Nitrate above normal levels — green paint marks
- Bacteriologically contaminated source — red paint marks

In case all the above contaminants are above normal levels, then the above paint marks may also be painted with one particular colour to indicate that the source is not fit for consumption.

Further, once a particular contaminant is below normal levels, or removed in the case of bacteriological contamination, black paint will be used to cover the earlier colour. The colour system will be finalised by CE RWSS and painting instructions and advice issued to all appropriate persons.

A suitable set of paper formats for recording and disseminating test results shall be developed.

4. Health Survey

4.1 Response to high fluoride levels

Sources having higher than normal (1.5 ppm) levels of fluoride are dangerous to users. If at all possible alternative sources should be located for affected villages, including piped water supply from outside the village as an option. Dilution can be an alternative to lower fluoride levels in a source by adopting recharge methods during the rainy season. High fluoride level sources must be given highest priority by RWSS for resolution. Mapping of at risk areas should be the first priority from test results and by ongoing testing as levels may well be increasing with time. EEs in any at risk area should reconsider test intervals in order to quickly identify new sources with excess fluoride.

EEs in conjunction with MO in at risk areas should set up a special joint task force, involving Sarpanch, ANM, ASHA from affected GPs to implement mitigation measures, including the following:

Diet change

Diet change is advised because users are often also exposed to high levels of fluoride in locally irrigated crops. More green vegetables, stopping of drinking black tea and developing a habit of drinking milk all help mitigate fluoride affects. Toothpaste can also be a source of more fluoride entering the body. Therefore it is essential in at risk areas that appropriate information is provided to all users.

Dental Fluorosis

Fluorosis usually appears first in a community as dental fluorosis in the teeth of children. Therefore in all fluoride risk areas a regular dental fluorosis check will be implemented at schools. Sarpanches, supported by Education Dept. should ensure teachers do at least annual dental fluorosis checks of their students and return data to MO, using appropriate paper formats. These data should also be entered in the WQM MIS.

Skeletal fluorosis

Skeletal fluorosis is an indicator that high levels of fluoride have entered the body and the disease is irreversible. Immediate action is necessary in any village with skeletal fluorosis patients to limit further damage to the population. Incidence should be recorded at PHC level and fed into both Health and WQM MIS. In addition, the affected habitations should also have notices displayed about the contaminants under IEC activity.

Non-skeletal fluorosis

This is a further manifestation of fluoride poisoning but is extremely hard for doctors to diagnose. It is also reversible. Doctors in at risk areas will be advised to be aware of this form of fluorosis. Data giving incidence of NS Fluorosis should similarly be entered into Health and WQM MIS via PHC.

4.2 Water borne diseases

Diseases caused by bacteria, viruses and parasites come from numerous sources in a community, not only from water. Personal and food hygiene also have a tremendous influence on the health of individuals. However, faecal contamination of drinking water, largely through bad sanitation cause water borne diseases to be a clear indicator of the state of a particular village – either in the state of its water supply or the state of its own sanitary practices, or both. The two go hand in hand. Water supply and sanitation are subjects that RWSS has a responsibility to provide support services to communities.

As the strategies defined in this document take hold and have impact across the state the incidence of water borne disease should drop. Hence it is essential to know what is happening to the population in respect of the numbers being affected by water borne diseases.

WB Disease data need to be correlated alongside the water supply surveillance data to determine the relationship and show the results. Assuming that the drive for cleaner villages linked to the removal of open defecation begins to be accepted by the population at large, then the combined effect of better quality water and better sanitation will manifest itself clearly in the WB disease data.

It is therefore intended to collect WB disease data, along with specific data concerning fluorosis from ANM in each village, taking the current weekly disease data that is sent normally to be included in District MIS for Health Dept. It would be beneficial for these data to be disaggregated to habitation level for matching with water quality at that level.

5. MIS

At present water quality and health records are scattered and difficult to access. It is therefore necessary to establish a Management Information System (MIS) integrating water quality, health (water borne diseases and fluorosis), to facilitate objective analysis of data leading to informed decision making for various interventions both at the state and district level.

The software system should be articulated with the Census 2011 administrative architecture, as this would offer an effective interface with data on population, socio-economic status etc.

Availability of reliable public source inventory is indispensable to build the initial architecture of the system. The data will include (location, type of source, number of users, depth of well, water table level, yield, year of construction etc). This inventory should provide each source with a unique ID code and provide the GPS coordinate of each source, so that an interface could eventually be built with other digitalized maps through GIS.

100 % water quality survey data should be provided in the first year in a compatible format that can be automatically uploaded in the computerized MIS – this will form the reference baseline, whereas dynamic updates will be made available through the internal routine monitoring process and changes entered in the database periodically.

It is desirable that the MIS software has an interactive interface with census maps. This will make it a very useful planning tool, as it will provide demographic and socio-economic data along with water quality and health data for a village on the click of a mouse. The currently available software should be studied to investigate if they can be used with or without modification for the proposed MIS. The software should be capable of merging data from various districts and provide analysis by attributes and generate reports and letters.

6. IEC Campaign

An effective and penetrating IEC campaign will be essential support to the scale-up of a state WQM Strategy and will use the following communication vehicles:

- Person to person contact (e.g. SEM/AWW/ASHA/ANM interacting with community members at HH level); in addition, the services of the cluster coordinator and the block coordinator may also be utilized from the BRC.
- Village meetings, Group discussions, Dramas, etc.
- Wall paintings, display boards near PHCs, RHs and district hospitals, District and Divisional HQ.
- Use of electronic and print media (radio, TV and newspaper) to convey relevant messages.
- Involvement of teachers to educate children in environmental aspects, Inclusion as part of school curriculum.
- Involvement of elected representatives, religious and community leaders to propagate messages on health and hygiene practices, water quality, health effects and preventive measures.

IEC materials will need to be focused at GP and HH level and be in Odiya language. The IEC campaign should be launched throughout the state.

7. Research and Development

Research and development is also an important component of a rural DWQM system. This will include assessment of potential consumer friendly technologies (affordable and easy to

maintain), supporting R&D on treatment technologies with potential for large-scale application, nutritional intervention, health studies on effects of high fluoride and nitrate in drinking water. Reputed research institutions may be appointed to undertake R&D agenda. R&D topic work should be such that it has either a potential for application on a large-scale or useful in taking macro-level policy decisions.

8. Implementation of WQMS:

For implementation of the Water Quality Management Strategy, the next steps include: (i) A Review of Innovative Techniques and Technological Solutions to Water Contaminant Problems; (ii) Mapping of Endemic Areas; (iii) Setting up and or strengthening Laboratories at district and sub-district level using the funds available under the NRDWP; (iv) developing systems for water quality data from all drinking water sources through the services of SEM and Jal Surakshak at gram panchayat level; (v) online data entry system; (vi) capacity building of SEM and Jal Surakshaks and any other Front Line Workers; (vii) refresher courses in water testing for new and existing laboratory technicians and chemists; and (viii) developing and implementing a plan for introducing remedial measures for water quality drinking water sources/areas drawing from the Review Study mentioned in (i).

The Review of Innovative Techniques and Technological Solutions to Water Contaminant Problems is completed under the OHSNP; the review covers national and international best practices as well as local proven methods. A simple manual will be developed to present both traditional methods, as well as technological solutions, which can be used both at the household level and the village/gram panchayat level. The manual will also examine use of technology to address management and remedial aspects, including affordability in terms of operation and maintenance costs. The mapping of water quality endemic areas in two districts, Ganjam and Puri will be completed in one year as part of the Benchmark Panchayat implementation. This mapping methodology may be extended with or without modifications to cover the rest of the State by the government. The Benchmark Panchayat implementation in 6 Gram Panchayats across Ganjam and Puri districts envisages demonstration of best practices in drinking water and sanitation, management and delivery through strengthening of village institutions.

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