27th WEDC Conference Lusaka, Zambia, 2001

PEOPLE AND SYSTEMS FOR WATER, SANITATION AND HEALTH

Monitoring water quality in the developing world

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WATER QUALITY MONITORING is essential for the management of water supplies particularly in the developing world. Within the framework of WHO and local in-country standards, many countries have put surveillance and control of water quality high on their list of national priorities. To this end, a number of developing countries have introduced different ways of managing and monitoring their water quality.

This paper presents an overview of two different approaches in monitoring water quality which are at opposite ends of the monitoring spectrum. There are many other programmes which may be a combination of these. The ones discussed in detail include:

1) The Central Laboratory

Many developing countries have established their own national water quality laboratories. This includes the establishment of the national water quality laboratory in Zimbabwe.

2) On-Site Field Testing

For developing countries whose resources are limited, on-site field testing is a cost effective technique for analyzing the quality of water. This is a technique that has also been successfully applied in many developing countries and this includes Myanmar in Asia.

The National Water Quality Laboratory (NWQL)

In 1990 the British Government via the Overseas Development Administration (ODA), now the Department For International Development, supported a scheme for setting up a new National Water Quality Laboratory of Zimbabwe. The Robens Centre for Public and Environmental Health were contracted to manage this project, led by Guy Howard. Prior to this, Zimbabwe had no central laboratory specializing in the assessment and control of the quality of water. It was decided that laboratory facilities were required to support the following functions:

1) The supply of potable water for domestic purposes and the supply of bulk water for irrigation, industrial and mining activities.
2) River basin management through sediment load and silt surveys in rivers and dams so as to assess the extent of erosion in river catchment areas.
3) Monitoring of pollution levels of industrial, mining and sewerage effluent in rivers and groundwater.
4) Determination of aquifer characteristics of both localized and regional aquifers.
5) Water balance and hydrological cycle studies. (This involves the study of the interaction of groundwater, surface water and atmospheric water using various methods such as water tracing techniques with isotopes and dyes).
6) Monitoring of groundwater and surface water quality.

From these functions it was envisaged that the following benefits on water management would accrue:

A) Improved efficiency in the application of chemicals in water treatment.
B) Increased availability of drinking water complying with WHO guidelines with consequential improvements in health.
C) The data on groundwater quality aquifer characteristics would assist in the efficient development and management of groundwater resources.
D) More information to enable prioritization in the use of limited funds for the provision of new water supplies and the maintenance of existing supplies.
E) Improved monitoring and control of pollution from industry, mining and sewage.
F) More efficient designs of dams and reservoirs.
G) Better information on sediment loads and erosion with the consequence of improvements on environmental management.

The laboratory equipment has been supplied by DFID. The equipment was delivered and installed in the new laboratory in April 1997.

Laboratory

The laboratory building was spacious and well designed for its purpose of carrying out the analysis of water samples. It consisted of eight main laboratories : Microbiology, Organic, Sediment, 2 for Wet Chemistry and Effluent, Instrument, Isotope and a Teaching Laboratory with 5 ancillary rooms serving the main laboratories. Additionally on the first floor there was a Seminar Room a large Library with adequate space for a well-stocked library, an air conditioned Data Processing and Archive room together with twelve offices. On each floor there was a Sample Reception room with an intercom connected to each of the laboratories.

The laboratory was donated a wide range of modern equipment and chemicals for the analysis of all the major parameters that influence water quality. These improved both the speed of analysis and the precision and accuracy of the results. With proper use and management, the laboratories were able to return results to their clients very quickly.

Strategic Plan for the NWQL

The NWQL became an institution within the Operational Section of the Department of Water Resources (DWR) and provided analytical services to all components of DWR. It was envisaged that the laboratory would only undertake all the analysis for the Water Quality Monitoring Program from the start of its operation. However, the laboratory had to provide an efficient and competitive service especially as the water supply service was becoming a semi-privatized parastatal service industry.

The laboratory bid for contracts from the Water Supply Agencies and Local Authorities, industry and other consumers such as farmers groups. The laboratory also bid for activities which were income-generating such as: contract analysis for national and regional bodies; training in water quality related subjects; applied research in aspects of water quality; and advisory and consultancy services for national and regional companies. It was envisaged that the laboratory would become a regional centre of excellence and would be self-sustaining within the initial 7 year period of this strategic plan.

NWQL became operational in early 1997. A consultant from the UK was seconded to the laboratory for four years, to work with the laboratory staff to ensure that they had the analytical and managerial capacity to continue to run the laboratory on a sustainable basis.

Under the original plan, the laboratory would have become the sole analytical wing of the Water Pollution Control section, reporting directly to the Chief Analyst and only carrying out regulatory work with a small amount of independent work. However, given the current financial constraints of the Government of Zimbabwe, it was obvious that such a role would not be viable.

Therefore, under this strategic plan it was envisaged that the laboratory would become an institution within the Operational Department of DWR. This maximized the laboratory's income-generating ability, whilst ensuring that DWR had access to an efficient, well equipped and well staffed analytical facility.

On -Site Field Studies

The monitoring of water quality can be undertaken via a completely different approach. An example of this is in Myanmar, Asia.

A water quality monitoring program was initiated by UNICEF. They co-ordinated the establishment of an expert group consisting of all pertinent Government Departments, NGOs and stakeholders to establish a plan of action to monitor the water quality in Myanmar.

The Functions of the Expert Committee

The roles of the participants for the water surveillance monitoring scheme were defined as follows:

1. **Formulate** action plan and decide two or three themes to be pursued as strategies.
2. **Provide** forum for discussion at least once in every two months, or sooner when required, and co-ordinate the implementation of planned activities among partners. The task force can also develop a networking mechanism to consolidate an approach to laboratory analysis.
3. **Provide** overall direction including technical and managerial guidance. Select key parameters, acceptable standards and set guidelines for action.
4. **Promote** low cost appropriate technology for safe water.
5. **Implement,** action plans on
   (a) Reviewing current situation
   (b) Collecting water samples
   (c) Setting criteria for selecting representative areas
   (d) Feasibility assessment
   (e) Dealing with authorised persons at the targeted areas
   (f) Sampling the water resources and thus analysis
6. **Educate** people on proper handling and storage of water, prevention of pollution, participatory planning, and organizing awareness campaigns to promote water quality control.
7. **Advocate** with authorities to give high priorities to the project as part of the national agenda.
8. **Facilitate** progression of proposed national standards to 'Legal status'.
9. **Provide/seek/mobilize** extra-budgetary resources for the water quality monitoring scheme.

Initially a pilot field study was undertaken of 54 villages and 9 wards in the Ayeyarwady Division. This entailed the water quality assessments of 145 shallow tube wells.

Following that study, eleven main parameters were considered to be important for further investigations. Viz.: pH, temperature, turbidity, electrical conductivity, calcium hardness, arsenic, iron, chloride, nitrate, fluoride, E.coli & total coliforms.

32 field kits were purchased from Wagtech International Ltd. These were distributed to all the partners who were given the responsibility of monitoring different areas of the country.

This was a very innovative cost effective approach which had number of major benefits, including:

1) The unification of up to14 government agencies to unite in this common cause of water quality surveillance.
2) It enabled the establishment of a platform to share in their individual expertise and knowledge.
3) It enabled combined training programmes to be carried out on the analysis and sampling.

4) It enabled sharing of the analytical resources, to assist each other with spares and consumables, etc.

There had never been such a large national monitoring program before and this developed into a very synergistic project which should lead to a huge improvement in monitoring the quality of water, especially in the rural areas. It will also provide an excellent database to target further resources for the treatment and management of water and the associated wellbeing of the population.

Lessons Learnt

1) The establishment of a central laboratory may require a great deal of resources and needs support not only financially, but also a large source of skilled manpower. Therefore the national government needs to give a firm commitment to such a project for it to be sustainable.

2) Though the field sampling scheme requires less financial support, it will also need extensive skilled technicians to carry out the analysis and sampling.

3) For both types of monitoring, reliable equipment is vital. Therefore before procuring the apparatus, it is essential that there is good after-sales support in the form of commissioning, training, troubleshooting and the supply of spares and consumables.

Conclusions

Two main approaches have been outlined in the surveillance of water quality.

These were the establishment of a national laboratory which had the facilities to analyze most of the main components in the water. If this laboratory is established well, it can become a centre of excellence to be used commercially and eventually become self-sustainable. However this does require a firm commitment from the national government and an initial large capital outlay which could be recouped in time.

The second approach is to establish a partnership between all the relevant government departments and stake holders. This expert committee can then set up a working programme to undertake monitoring of the water quality on a national basis, combining forces using a number of field kits and carrying out the study together.

Both these approaches have their advantages and can be excellent mechanisms to analyze, monitor and control the national water supplies in the developing world.

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