

Drinking-water quality monitoring and surveillance

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Providing a safe and adequate supply of water to all communities is one of the major infrastructural tasks of any nation. In countries where natural water sources cannot meet demand, where water is reused, or where water systems are not designed, operated, and managed properly, health problems are guaranteed. In response, government health departments are setting up nationwide monitoring and surveillance systems.

The first step is to identify a lead agency that will develop a conceptual framework for the development of a national programme. The Ministry of Health is the automatic choice because it will have well-established links with the WHO.

WHO engineers or consultants should then be engaged, and the training of Ministry of Health officers in those countries where such programmes have been successfully implemented, must be undertaken. Together, these professionals constitute a core group within the lead agency which can design and implement the national action plan.

Ideally, the core group should consist of public-health engineers, senior public-health inspectors, microbiologists and technicians. This group prepares the necessary programme documentation for formal approval by the Ministry of Health. The national government needs to issue a clear directive to all ministries and agencies to provide assistance and co-operation to the Ministry of Health in its activities. The formal approval process is critical in securing the full backing and commitment of the government and its departments, and in justifying any expenditure that may be incurred during the preparation of the national action plan. Failure to obtain approval may jeopardize the implementation stage of the programme, and lead to difficulties in international fundraising.

ment plants, or in areas where there is only partial treatment or no treatment at all.

To be truly effective, therefore, monitoring and surveillance programmes must be planned properly, and receive full commitment from government. The components essential to the success of a programme are listed in the box opposite.

Setting up the programme

International organizations such as the World Health Organization (WHO) have a role to play in making monitoring and surveillance programmes a priority in developing countries; including initiating pilot programmes with the help of national governments, such as Malaysia's, which have experience in implementing them.

Planning a monitoring and surveillance programme — ten essential elements

- **Efficient organization**, based on a wide-ranging network of trained personnel with adequate resources
- **A dynamic action plan** covering all elements of monitoring and surveillance, with full government backing
- **Monitoring activities**, such as regular water-sampling, to screen for bacteriological and chemical contamination
- **Regular surveys of sanitation facilities**, conditions, and practices
- **Analytical support services** based at central and regional laboratories
- **Adequate training** for staff in taking samples, analysis procedures, and quality control
- **Research and development**
- **Public education** in water-quality issues;
- **Information management**; necessary for effective administration and efficiency in decision-making processes
- **Remedial action**: initiated when a monitoring parameter is violated or a deficiency noted during a survey.



THE MONITORING AND surveillance of drinking-water quality is an important preventative health measure, given the deterioration of raw water quality, the poor management of water systems, and the increasingly contaminated water sources in developing countries.

The need to strengthen water-monitoring programmes is acute, because of the potential spread of water-borne diseases caused, primarily, through the biological and microbiological contamination of drinking-water. For example, conventionally designed water-treatment systems cannot handle the removal of high-pollution loads; the contamination of treated water in storage reservoirs and the distribution system is common; and the home itself poses health risks when unhygienic storage and handling practices lead to the contamination of otherwise safe water. There is good documentation of outbreaks of disease resulting from improperly functioning water-treat-

Following approval, the core group, in co-operation with WHO and other funding-agency consultants, prepares to develop the national action plan. This will involve extensive data collection, field studies, analysis of different sectors, assessment of the present situation, identification of problems and issues, and brainstorming, through workshops, meetings, and seminars. A high-profile steering committee should be formed, with the Minister of Health as the chairperson, and other committee members drawn from the ministries responsible for the environment, works and utilities, and local government. A technical committee, consisting of senior technical officers from the Ministry of Health and other relevant ministries, will be responsible for the development of the action plan which is submitted to the steering committee. Upon endorsement, this action plan must be routed through the administrative and political channels for approval, forming, eventually, national policy.

Programme details

The core group, consultants, and the technical committee, when deciding the details of the programme, must be aware of the context in which the national plan will operate. In particular:

- The sophistication of the programme must match the capabilities, funding sources, facilities, and level of expertise available in that country.
- The programme should be flexible enough for expansion as resources increase, and be dynamic in nature. Money raised by international fundraising, or grants, should be sought if any elements of the programme prove to be unaffordable.
- A central referral laboratory for pollutant analysis is crucial. Similarly, sampling requirements and analysis should be based on populations served by the water system, with minimum requirements as specified by WHO guidelines.¹

In developing countries, the launch of a programme to ensure safe drinking-water will uncover many deficiencies in the old system, which will require substantial financial expenditure to ameliorate. Common problems include: old pipelines, overproduction in water plants, and a shortage of trained personnel. It is important, therefore, to develop co-operative arrangements with water authorities and agencies, so that these systems can be improved over time, rather than adopt-



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The ever-increasing levels of pollution make water analysis in a central laboratory an imperative.

ing a punitive stance through legislation.

Adequate residual disinfectant must be available throughout the distribution system to prevent the spread of water-borne diseases. This stage should involve the use of cheap field-screening, and analytical instruments for measuring residual chlorine, the pH, and bacteriological and other chemical parameters. The confirmation of screened samples can be completed in the central referral laboratory. Screening equipment should be standardized throughout the country, and operated by trained personnel. This is important in ensuring consistency when data are compared from region to region, or from system to system.

The Malaysian experience

Since 1985, Malaysia has operated a National Drinking-Water-Quality Sur-

veillance Programme (NDWQSP) to guarantee the quality of drinking-water. The NDWQSP has been successful in improving the bacteriological quality, and has reduced the incidence of water-borne diseases linked directly to poor drinking-water quality.²

Before the introduction of the NDWQSP, a monitoring programme, run by the Waterworks Agency, was already in operation. Following a 1982 outbreak of gastroenteritis, linked directly to poor drinking-water quality, the Ministry of Health redesigned the monitoring programme to form what is now the NDWQSP. The NDWQSP requires the co-operation of various government agencies, as the responsibility for water supply, protection of water sources, and water-sample analysis rests, with the Waterworks Agency, the State Government, and the Department of Chemistry respectively.



Water samples must be taken at designated points by properly trained personnel.

Other problems indirectly affecting the quality of drinking-water need further co-operation between other government agencies. To enable nationwide implementation, the NDWQSP was designed to work with the previously established organizational structure, as well as with whatever financial and manpower resources were available; with a view to increased capacity and resources in the future.

Despite significant gains, the objectives and targets of Malaysia's NDWQSP have not yet been fully realized. In particular, only 5 out of the 10 programme criteria (monitoring; sanitary survey; data processing and evaluation; remedial action; and institutional inspection) have been identified in the NDWQSP.

Many problems arose from the absence of a comprehensive action plan to cover all aspects of the programme, especially personnel and financial needs. It was for this reason that, while the pace of development in many sectors has advanced rapidly, the NDWQSP continues to face difficulties in its implementation. This problem is felt acutely because of increased water-supply coverage, and a rise in the level of contamination and water-source pollution. This, in turn, calls for improvements in analytical capacity, still at this time limited.

Progress

Recognition of these constraints, however, has resulted in the adoption of various strategies. Plans are underway to upgrade the facilities of the Department of Chemistry, the analytical agency for the NDWQSP, through a World Bank loan. In the meantime, bacteriological and chemical field-test kits have been procured to allow for

on-site testing by Ministry of Health personnel. This not only allows for quick analysis of results, but reduces the Department's workload. The manpower and financial constraints are being addressed by a recruitment drive for extra health inspectors, more intensive training for health and waterworks personnel, and through the privatization of treatment-plant operations.

Despite these limitations, Malaysia's NDWQSP has achieved a significant improvement in inter- and intra-co-ordination and co-operation between agencies, which has resulted in the following benefits:³

- A comprehensive picture of the status of drinking-water quality and water-supply systems in Malaysia, obtained through the proper acquisition and documentation of data.
- Poor treatment-plant management was identified as a cause of inadequate treated-water quality, resulting in the establishment of training



programmes for waterworks personnel at all levels.

- Various research needs were identified and addressed.
- Savings in operating costs, through the identification and upgrading of operation and maintenance practices in treatment plants.
- The transfer of technology and expertise was made possible through a series of seminars and workshops. More recently, the Quality Assurance Programme (QAP) was launched. By identifying indicators, and setting moving targets, it is hoped that the quality of drinking-water will be further improved in the near future.

With the privatization of treatment-plant operations, Malaysia's Ministry of Health recognizes that the future success of the NDWQSP cannot continue to rely on the existing strength of inter- and intra-agency co-operation. As a result, a Safe Drinking Water Act has been drafted and circulated for comments, before being tabled at Parliament.

Conclusion

Every country should have a drinking-water quality monitoring and surveillance programme, with a firm commitment from government to achieve successful implementation; failure to do so can lead to public-health risks with the attendant costs of controlling and treating disease. Such a programme should be seen as an important preventative health programme, forming a part of the public health measures implemented by any country. Drinking-water quality problems are becoming progressively more complex in developing countries, and increased emphasis needs to be directed towards refining and adapting such programmes to suit the local conditions. ●

References

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