Executive Summary

A number of recent studies and surveys (Swartz, 2000; Mackintosh and Colvin, 2002; Momba *et al*., 2004a; 2004b; Momba and Brouckaert, 2005; Obi *et al.*, 2007) conducted in South Africa have confirmed that about 50% of small treatment plants are not producing the desired water quantity or quality. The primary reasons for the failure of these plants have been well documented and include inappropriate technology, poor operation, lack of training, municipal financial constraints, lack of motivation of operators and lack of knowledge of basic water treatment operations.

Seventy eight percent (78%) of the operators lacked the ability to calculate chlorine dosages, determine flow rate, estimate the free chlorine residual concentrations, undertake readings of turbidity and pH values, or repair basic process equipment. In addition, there appears to be a lack of understanding of process selection, design, techniques of chlorination, process quality monitoring and evaluation. Poor working conditions, depletion of chemicals, the lack of a maintenance culture, the lack of emergency preparedness and poor communication were also found to be major contributors to the failure of these systems. The remoteness of many of the sites results in limited technical support and this often leads to total/absence of disinfection or dysfunctional disinfection systems.

These guidelines have been formulated to serve as a reference document on ways and means of addressing the array of problems facing small water treatment plants in order to mitigate the disastrous effects of unsafe water supplies. Application of the recommendations in these guidelines will ensure that appropriate disinfection systems are selected and installed.

The guidelines include the multiple barrier approach to optimizing disinfection, which highlights the importance of source selection and protection as the primary barrier for the prevention of contamination of the raw water. The importance of appropriate planning and design and unit process selection is highlighted. The technical properties of the various disinfection practices employed in South Africa are reviewed and criteria for the selection of disinfectants are included in the guidelines.

In compiling the guide document, emphasis was placed on chlorination as the primary disinfection protocol practiced in South Africa. Various chlorination techniques include gaseous chlorination, liquid hypochlorination and granular hypochlorination. The advantages and disadvantages of the various disinfectants are discussed in detail. Details for the design and maintenance of gaseous chlorine systems are highlighted to ensure that proper maintenance practices are implemented. Capital and operating costs for a typical plant sized at 2.5 Ml/d are included as a guide to assist in budgeting and planning.

A description of a typical gravity dosing system available commercially in South Africa is included as an option for use where frequent power failure is experienced. The minimum requirements for operator training and development are included. A summary of roles and responsibilities of the various role players involved in the management and operation of this system. The guidelines also emphasize the need for regular water quality and process monitoring and provide a contact list of various reference laboratories that can assist in this area.

These guidelines outline practical steps for improving the efficiency of disinfection at small rural water treatment plants and are intended to be used by plant supervisors, plant operators, plants technical managers, design engineers, plant owners, consultants and Local Authorities for ultimate service efficiency and improved welfare.