

Survey of disinfection efficiency of small drinking water treatment plants: Challenges facing small water treatment plants in South Africa

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Abstract

A survey involving 181 water treatment plants across 7 provinces of South Africa: Mpumalanga, Limpopo, North West, Free State, KwaZulu-Natal, Eastern Cape and Western Cape was undertaken to identify the challenges facing small water treatment plants (SWTPs) in South Africa. Information gathered included ownership and design capacity of the plants, water sources, and various methods of disinfection, equipment currently employed and performance of the treatment plants. In general, the majority (over 80%) of the SWTPs surveyed in the designated provinces were owned by the district municipalities. The designed capacities of these plants varied between 1 and 60 Mℓ/d; the smallest capacity was 100 m³/d and the largest 120 Mℓ/d. The small water treatment plants abstracted their raw water from either surface or groundwater or a combination of both water sources with greater preponderance for surface water sources (over 86%). Water treatment practices were noted to be the conventional types mainly coagulation, flocculation, sedimentation, filtration and disinfection. Two types of coagulants namely polyelectrolyte (66%) and alum (18%) were commonly used by the water treatment plants across the provinces studied. Rapid gravity filtration, pressure filter and slow sand filtration systems accounted for 60%, 23% and 9% of the filtration systems across the provinces, respectively. The predominant types of disinfectants employed were chlorine gas (69%) followed by sodium (15%) and calcium (14%) hypochlorite. Over 50% of the various SWTPs did not comply with the SANS 241 Class I (< 1 NTU) and Class II (1 to 5 NTU) recommended turbidity values. The recommended target range of 0.3 to 0.6 mg/ℓ free chlorine residual concentrations at the point of use was not always met by 40% of the plants. Seventy percent of the SWTPs complied with the SANS 241 criteria of microbiological safety of drinking water vis-à-vis total and faecal coliforms. Operational problems affecting the efficiency of small water treatment plants included: inability to appropriately determine the flow rate, chemical dosage and turbidity, lack of chlorine residual at the point of use and lack of water quality monitoring. To produce safe drinking water, appropriate operational practices must be implemented in all small water treatment plants.

Keywords: disinfection, efficiency, drinking water, small water treatment plants, challenges