

# Performance of a water defluoridation plant in a rural area in South Africa

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## Abstract

The fluoride concentration of a borehole water supply in a rural area (Madibeng Local Municipality, North West Province, South Africa) varies between 5 and 6 mg/l. This water is therefore not suitable for potable purposes because the high fluoride concentration may cause mottling of tooth enamel in children and fluorosis in adults. Therefore, the fluoride concentration should be reduced to less than 1.5 mg/l to make the water suitable for potable purposes. The activated alumina and reverse osmosis processes are both processes that can be very effectively applied for water defluoridation. The activated alumina process, however, is considered to be a more simple and robust process for water defluoridation, especially in a rural area. Therefore, the activated alumina process was selected for water defluoridation. An activated alumina plant was designed, constructed and commissioned in the rural area. Fluoride in the feed water is removed from 6 to 8 mg/l to less than 1.5 mg/l. No reduction in plant output was experienced over 6 service cycles. Therefore, it appears that fouling of the activated alumina should not be a problem. Plant output varied between 940 and 1 296 m<sup>3</sup> to a fluoride breakthrough of approximately 2.0 mg/l. No significant operational problems were experienced during commissioning and the plant is performing satisfactorily. Spent regenerant is disposed of into evaporation ponds. It was demonstrated that a 1<sup>st</sup> world technology could be effectively applied in a rural area with proper training and supervision of the operators. The capital and operational costs of the 200 m<sup>3</sup>/d defluoridation plant are estimated at approximately R1.2m. and R0.7/m<sup>3</sup> treated water.

**Keywords:** water defluoridation, activated alumina, plant performance, costs