

Fluoride concentrations in groundwater and impact on human health in Siloam Village, Limpopo Province, South Africa

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Abstract

Monitoring of fluoride concentrations in groundwater, identification of sources, and monitoring of the impact of fluoride on human health was undertaken in Siloam Village, Limpopo Province, South Africa. Most of the inhabitants of Siloam Village rely on groundwater for domestic use due to inadequate pipe-borne water supply. A preliminary survey showing that some community members in Siloam Village have mottled teeth motivated the study. Temperature and pH were measured in the field while fluoride and calcium in groundwater were analysed in the laboratory. A survey was conducted to obtain information on the impact of fluoride on human health. 40% of the households and 1 primary school in Siloam Village were interviewed. Fluoride concentrations in groundwater samples were found to be higher than the Department of Water Affairs and World Health Organization recommended values for domestic use of 1 mg/l and 1.5 mg/l, respectively. The results of paired two-tailed t-tests showed significant differences between mean values of pH, temperature, calcium and fluoride concentrations for all paired comparisons between 3 sites, with the exception of comparisons between sites GW1 (community borehole) and GW2 (artesian spring). Alkaline pH, low calcium concentrations, high groundwater temperatures and semi-arid climatic conditions of the study area may cause elevated fluoride concentrations in groundwater, by increasing the solubility of fluoride-bearing formations (fluorite). A survey revealed that 87% of the households use groundwater while 85% of these have family members with mottled teeth. 50% of children between the ages of 11 and 14 in Siloam Primary School also have mottled teeth. There is thus evidence suggesting negative human health impacts of high fluoride concentrations in groundwater in Siloam Village. The majority of the community was found to be aware of the fluorides in groundwater and the health impacts thereof making interventions easy to promote.

Keywords: Fluorides, groundwater, impacts, human health, Siloam Village