



## WorldSpotlight

# Electrolytically Active Water:

*Using Chemical-Free Technology to Clean Up Wells*

# in Botswana

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**Summary:** *Electrochemically activated water (EAW) technology is allowing Botswana residents greater access to drinking water from their wells. By using anolyte, EAW is gaining wider acceptance because of its simplicity, efficiency and relatively low costs.*

Botswana is a dry country with an annual average rainfall of 400 millimeters (15.7 inches). Lack of surface water in most parts of the country means that wells are required to cover domestic and industrial water needs. Currently, there are more than 10,000 water wells in operation, covering the needs of rural communities and agriculture and including 29 major wellfields.

Many wells show a marked and continuous decline in yield from inception. In 2001, the government of Botswana through the Department of Water Affairs (DWA) started to investigate the causes of well deterioration and identify and test appropriate technologies to improve the maintenance of borehole infrastructure.

Historically, the declined yield was attributed to corrosion and scaling, caused by unfavorable chemical characteristics of

groundwater. Corrosion is so severe in some wells that pumping equipment and rising mains have to be regularly replaced, often at intervals of less than 12 months.

### Avoiding the 'slime'

The "sliming" or biofilm growth of wells is another major concern. Because aquifers aren't sterile, they often contain a rich and diverse microbial flora,<sup>1</sup> as is the case in Botswana. Waterborne bacteria rapidly attach themselves to the surface. Red slime found on pumps and discharge lines is an indication of iron-reducing bacteria, while black slime—mainly observed in deeper boreholes with stagnant water below the deepest inflow zone—indicates sulfate-reducing bacteria.

Many methods for successful treatment of wells affected by bacteriological growth have been documented, such as treatment with hydrochloric acid or other strong chemicals. These methods necessitate using chemicals, however, which are hazardous to the semi-skilled staff involved at the DWA.

To minimize these problems, the DWA along with a company developing electrolytically active water (EAW) treatment technology (see Principles of EAW Technology)

initiated a water well rehabilitation program using anolyte. Anolyte, a super-oxidant solution, has proven to be at least as effective as hypochlorite, and completely safe and non-polluting.

### Well problems in Botswana

The significance of microbial fouling on well and pump equipment deterioration has been described in various studies.<sup>1</sup> Investigations by the DWA have revealed the presence of iron and sulfate related bacteria in nearly all affected wells.

Groundwater in Botswana occurs mainly in sedimentary aquifers and is restricted to semi-confined conditions and some basement aquifers. Wellfields most affected by yield and corrosion problems are within sedimentary environments.

Explosive bacteriological growth is likely caused by widespread organic layers such as coal—containing organic carbon as the prime source of energy—and allowing microorganisms to flourish within the porous structures of the aquifer. With time, the flow conditions within the system deteriorate. It's not yet understood why a sudden burst of biofilm growth affects the well and pumping gear. It's believed that short