

# Uranium pollution of the Wonderfonteinspruit, 1997-2008

## Part 2: Uranium in water – concentrations, loads and associated risks

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### Abstract

Uranium (U) pollution of the surface water and groundwater of the Wonderfonteinspruit (WFS) catchment caused by gold mining over more than a century has been an ongoing concern for several decades. Triggered by a recent increase in media attention, political pressure on governmental authorities has mounted to assess the associated health risks and implement appropriate mitigation measures. However, owing to the complexity of the catchment arising from the presence of a multitude of dischargers, a complex karst hydrology and large-scale modifications thereof by deep-level gold mining, most attempts to address the issue to date have been limited to uncoordinated *ad hoc* studies generally suffering from a lack of temporal and spatial representivity of the underlying data. Part 2 of a series of 2 papers aimed at quantifying the extent of mining-related U pollution in the WFS catchment, this paper addresses the pollution of surface water, groundwater, as well as mine effluent. Based on close to 3 400 measured U concentrations (mostly unpublished) of water samples gathered between 1997 and 2008, an overview of U levels and associated loads in the WFS catchment is provided. Results indicate that U levels in water resources of the whole catchment have increased markedly, even though U loads emitted by some large gold mines in the Far West Rand have been significantly reduced. A major contributing factor is highly polluted water decanting from the flooded mine void in the West Rand, which was diverted to the WFS. Over the reference period, an average of some 3.5 t of dissolved U has been released into the fluvial system from monitored discharge points alone. However, since the WFS dries up well before it joins the Mooi River this U load does not usually impact on the water supply system of downstream Potchefstroom directly. It may, however, indirectly reach Potchefstroom since much of the water from the WFS recharges the underlying karst aquifer of the Boskop Turffontein Compartment (BTC), the single most important water resource for Potchefstroom. Compared to 1997, groundwater in the BTC showed the highest relative increase in U levels of the whole WFS catchment, resulting in some 800 kg/a of U flowing into Boskop Dam, Potchefstroom's main water reservoir. Of particular concern is the fact that U levels in the WFS are comparable to those detected in the Northern Cape (South Africa), which have been linked geostatistically to abnormal haematological values related to increased incidences of leukaemia observed in residents of the area.

**Keywords:** uranium, water pollution, load, deep level gold mining, karst, dolomite, risks, leukaemia, Wonderfonteinspruit, West Rand, Far West Rand