

## EXECUTIVE SUMMARY

The mining industry is involved in a major initiative to reclaim defunct tailings facilities containing recoverable quantities of gold. Once the tailings material has been removed, the land has a certain potential for land development. The extent of contamination contained in the unsaturated and saturated zone beneath these deposits formed the topic of an investigation completed in 1998. It was concluded from this investigation that the soils underneath reclaimed tailings dams are in general contaminated with pollutants that typically originate from acid mine drainage (AMD) seeping from tailings dams. This investigation also showed that some of the metals are highly mobile, particularly in the surface soil units. Limited groundwater data were available, but it was evident that groundwater in close proximity to tailings dams was being affected by salt loads.

The follow-on investigation conducted over the period 1999 to 2001 had as its primary objective the development of guidance for the rehabilitation of the footprint of these reclaimed gold mine tailings facilities. In general, the outcome of this investigation recommends a change in the technical approach to evaluating and remediating contaminated land. The introduction of a risk assessment approach, a phased and chemically orientated approach to site investigation, and the selection of remediating strategies from a number of technologies are all intrinsic components in the rehabilitation of these areas. Furthermore, the complexity of evaluating the degree and extent of contamination became evident, demonstrating that a simplistic approach is inadequate. Identifying the most appropriate rehabilitation method for a given site is a difficult process and requires consideration of a number of factors, including process applicability, effectiveness, cost, process development status and availability and operational requirements. Additional factors to be considered are process limitations, monitoring needs, potential environmental impact, health and safety needs and post-management requirements. The amount of information required for an effective appraisal of available options is considerable and may not be available. During the rehabilitation process, adequate quality control measures are needed to ensure that the methodology conforms to specification or that treatment targets have been achieved. By implication, this requires environmental monitoring while rehabilitation is in progress. In addition, on completion of the rehabilitation, additional monitoring and management activities may be necessary if contamination sources remain on the site.

Radionuclides were not specifically focused on during this investigation. Given their long radiological half-lives, the relevant uranium and lead isotopes can be treated as heavy metals with known toxicities for the purposes of assessing their potential environmental/health impacts. Further work on the mobility and transport pathways of uranium and lead-210 in the footprint environment, as with any other heavy metals, would most likely need to be site-specific. Because of its low mobility, radium-226 may however remain on site where it may potentially give rise to increased radon exposure in homes built on the site.

The generic case studies on the Witwatersrand Supergroup and Karoo Supergroup has shown that there is adequate reason to believe that the underlying geology plays a major role in the behaviour of contaminants in the vadose zone, and that sites overlying the same geological environment may show significant differences. Further generic research in this regard may therefore not yield additional information. It is therefore recommended that any additional work should be on a site-specific basis, for the specific purpose of identifying the most appropriate rehabilitation option for the individual sites. The basic methodology to do so is outlined in this document.