Comment on the paper 'Neutralization of bioleach liquors' by B.M. Nyombolo, J.W. Neale, and P.J. van Staden

in the *Journal* of SAIMM, vol. 100. no. 7. pp. 403–408

by J.M. Schaekers* and D.W. Dew*

In the first part of the article, the authors give a broad overview of the chemistry and some engineering aspects of bioleach processes, eventually leading to the important and critical issue of the stability of arsenic-containing residues, especially those derived from bioleaching of sulphidic gold ores.

In the section 'Factors affecting arsenic stability' they give an excellent summary of the factors normally affecting the stability of such residues. This is followed by some valid comments on the suitability of a single leach test to evaluate the long-term stability of solid waste streams. However, they fail to mention that, up till now, no tests procedure has been accepted by either environmentalists or the mining/processing industry as a valid method to test the long-term stability of solid wastes. Their own method is no exception, although, like many others, it is useful to identify potential problems with solid wastes considered for disposal.

The authors also fail to mention that a single leach test, such as the TCLP procedure, is invalid for materials, which change chemically during the leach test or over time, including a few weeks or months after the solid waste was produced. The results given by the authors indicate that the samples tested probably fall in this category. It is therefore very unfortunate and unjustified that the authors use these results to claim that arsenic-bearing precipitates of hydrated ferric oxides, normally referred to as 'arsenical ferrihydrites', with a Fe:As ratio (molar) of ~3:1 tend to be unstable and unsuitable for disposal on sites typical for the mining industry.

BILLITON (and formerly GENCOR) are very much aware of these problems and have done extensive tests, over the past 13 years, to find suitable conditions to produce stable precipitates even at a Fe:As ratio of 3:1. Some of these results have been published in the open literature[1–4]. In these publications, stability claims were based mainly on single leach tests (such as TCLP) and occasionally on repetitive leach tests. BILLITON is also aware of the importance of long term stability and is addressing this problem in co-operation with the MIRO Arsenic Research Group (Imperial College, London) using a combination of repetitive batch leaching or washing, simulation of dehydration/hydration cycles and column leach tests.

Some early results (46 weeks) were presented at a conference in February 2000, indicating that both, laboratory-prepared precipitates and neutralization residues produced at commercial plants, were stable, even with a Fe:As ratio of 3:1, and did not show any of the unusual characteristics of the samples tested by MINTEK[5]. Column leach tests are continuing and, even after ~150 weeks, no change in the leachability of arsenic, or any of the other minor elements, from the residue samples has been observed.

In summary it can be said that the results presented by MINTEK were indeed suitable to highlight the potential problems associated with single leach tests. However, due to the unusual relation between arsenic leachability and solution pH or contact time for these samples, it is unjustifiable to use the results for any conclusions with respect of waste materials routinely produced at operating plants. Obviously, BILLITON, with a declared commitment to environmentally acceptable operating practices, will continue to monitor the stability of arsenic-containing wastes produced and disposed at operating plants, in order to improve its understanding of the influence of precipitation and disposal conditions on the long-term stability of these wastes. These results will be reported in due time if appropriate.

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* *Billiton Process Research, 200 Hans Strydom Drive, Randburg 2194, South Africa.*

 SA ISSN 0038–223X/3.00 + 0.00. Originally published in Nov./Dec. 2000. Comments received Jan. 2001.