BMS NF Facility at Langer Heinrich
(Ref: BMS Engineers/Paladin Energy presentation, ALTA 2016)

ALTA 2016 Membranes in Uranium Ore Processing Panel Discussion

May 2016

Panel Chair: Alan Taylor (AT), ALTA Metallurgical Services, Australia

Panel Participants: Darryl Butcher (DB), Paladin Energy, Australia; Marl Peacock (MP), BMS Engineers, Australia; Erik Hanson (EH), GE Water and Process Technologies, USA; Adrian Manis, ANSTO Minerals, Australia

AT noted that the panel represented the whole spectrum of the membrane field: operations, design/construction, suppliers, and research and development.

The discussions covered the pros and cons of membranes in the hydrometallurgical field and uranium ore processing in particular, including Paladin's operating experience at Kayelekera in Malawi, and Langer Heinrich in Namibia. Many of the delegates participated with questions and comments. Some of the key points included:

- DB said that the nano-filtration (NF) membrane installations at both Kayelekera and Langer Heinrich were successful and have resulted in opex savings of US$3 and US$6 per lb of U_3O_8 respectively, corresponding to payback periods of three and seven months.

- The surface plant C1 costs at Langer were low, about $6/lb. Overall mining adds $15-17 making a total of $22-23/lb.

- MP said that the nano-filtration technology has been developed by Paladin and BMS, and Paladin has recently been granted a patent. BMS hold commercial exploitation rights and have developed proprietary membranes.

- DB stated that the technology has led to a dramatic reduction in processing costs and represents a new paradigm for uranium processing plants. The NF step could be moved upstream of CIX as in the case of Langer, where potentially it would be able as a building block to achieve greater cost savings than downstream of the CIX where it is at the moment

- In response to questions, MP said that membrane life for acid applications depended on membrane type selected and acid concentration. Replacement membrane cost is not a relatively significant item (compared to reagent savings) and is not expected to be prohibitive for higher acid solutions. He also said that the nano-filtration membranes at Kayelekera do not require cleaning as the acid resistant type did not have any significant scaling before being replaced.

- MP said that a majority of the technical achievement is in the pre-treatment step prior to NF so that the membrane is not blinded by particulates or precipitates that form on the retentate side of the membrane.

- MP said that membranes have to be carefully selected for each particular application.

- Considerable discussion was centred on the issues involved in extending nano-filtration from IX eluates (as at Kayelekera and Langer Heinrich) to leach solutions which typically contain fine particulates and tend to form scale such as gypsum, so that some form of pre-treatment may be necessary.

The topic for the ALTA 2017 Uranium-REE Forum and Panel is Lithium Processing, which will be held 25-26 May in Perth, Australia.

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For more information, see *ALTA 2016 Uranium-REE Proceedings* and ALTA Short Course *Uranium Ore Processing* available from Publications

MetBytes are metallurgical commentary and insights written by Alan Taylor who has 40+ years' experience in the metallurgical, mineral and chemical processing industries. He has worked in metallurgical consulting, project development, engineering/construction, plant operations, plant start-up and technology development. Projects and studies have involved copper, gold/silver, nickel/cobalt, uranium, base metals, phosphates and alumina.

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