

## GORO KEY TO FUTURE OF PAL

In the halcyon days of the mid nineties, it seemed as if scarcely a day went by without the announcement of a new PAL project. However, the pendulum swung dramatically in the opposite direction when the three WA PAL projects came on stream and experienced technical and economic difficulties. As a result, In the midst of all the gloom and doom, there has been a growing interest in leaching at atmospheric pressure (AL), as a way of alleviating the harsh PAL operating conditions and reducing capital cost. AL technology can be considered either as a replacement for PAL or as a supplemental operation. Organizations with reported interest in AL technology include BHP/Billiton, Preston Resources, Weda Bay, and Jervois Mining (with technology developer TTS).

### ***Goro and Rio Tuba Sticking with PAL***

However, Inco's giant Goro project in New Caledonia is bucking the trend, not only sticking with PAL, but pushing the envelope further by increasing the autoclave operating condition temperature from the commonly used 250°C up to about the 270°C level. This involves a much higher operating pressure, and the adoption of indirect feed heaters, which have so far not been used for a commercial PAL plant. Goro also involves innovative technology for downstream processing, yielding nickel oxide and cobalt carbonate as products. Goro is now under a cloud with Inco announcing a major review because of a projected capital overrun of 30-45%. The increases are stated to be due to site geotechnical conditions and evolving design and infrastructure requirements. The outcome will undoubtedly have a significant bearing on the future of the PAL process.

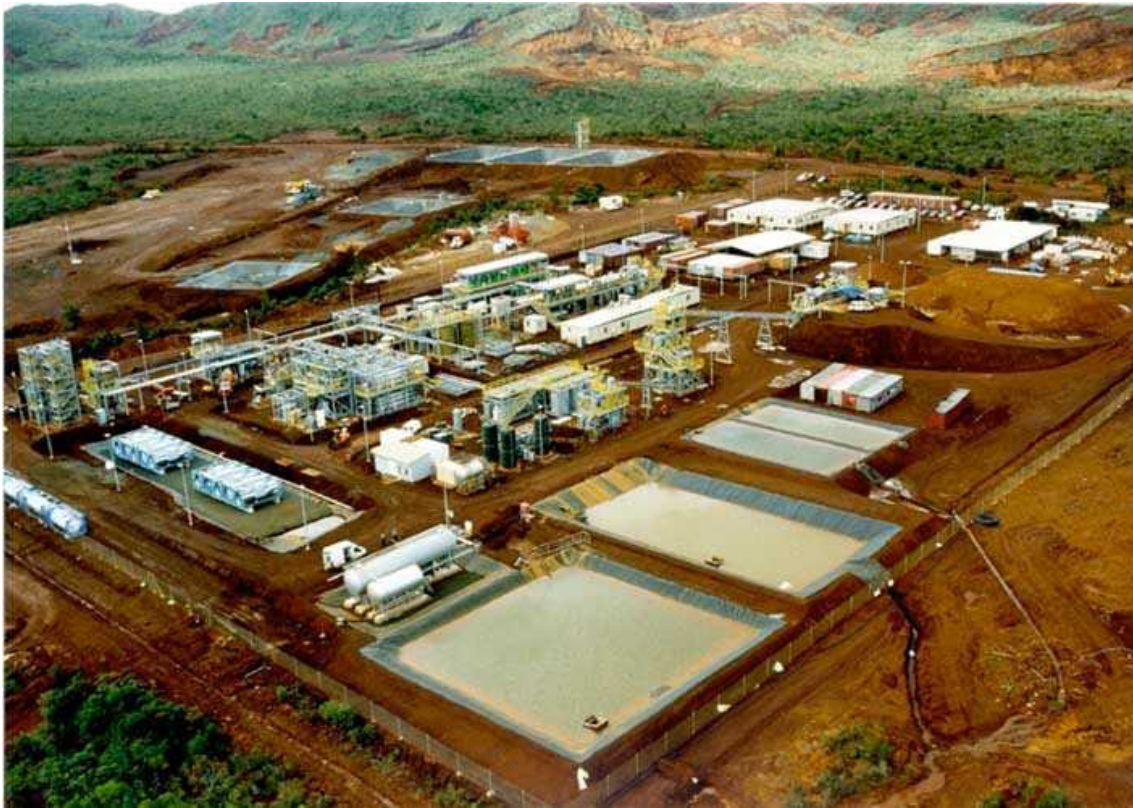
Sumitomo are also placing their confidence in PAL for the Rio Tuba project located in the Philippines. Rio Tuba, much smaller than Goro, is comparable in scale to Bulong and Cawse with a single autoclave, though will produce an intermediate mixed sulphide product. In addition, Sumitomo are heading a Japanese consortium with a view to acquiring a 25% stake in Goro, though this presumably could be affected by the current review.

The Nakety Project in New Caledonia was also to use PAL when it was being actively developed by Argosy and Norilsk.

### ***Factors in Favour of PAL for Goro***

Factors favouring PAL for Goro include:

- Being able to draw on the experiences of the recent WA PAL projects.
- Inco's access to the access to the technical data from the extensive Amax PAL testwork programs in the 1970s, which included leaching at around 270°C and the use of indirect feed heaters.
- Operation of a large scale pilot plant at the Goro site.
- A large high grade resource.



*Goro Demonstration PAL Plant in New Caledonia*

### ***Downstream Processing a Key Issue***

Operation of the autoclaves and associated front-end facilities has largely been sorted out at the three WA operations, and many of the remaining issues in fact involve downstream processing, which is different in each case. Interestingly, Inco has adopted yet another downstream flowsheet for Goro. Each of the processes have advantages and disadvantages in terms of capital and operating costs, efficiency, technical risk and product value. Furthermore, the forms of the products have important marketing implications, which require very careful assessment for each project.

### ***Considerations for Future projects***

Considerations in the selection of the treatment process for future projects will likely include include:

- For large projects, with a good ore grade, which can carry the capex, PAL could still make sense. With the experience of three recent projects to draw on it should now be feasible to undertake realistic economic project evaluations, and to engineer and build reliable plants.
- Production of an intermediate product such as mixed sulphide or mixed hydroxide offers a way to reduce capital cost and minimise risk, provided a good off-take agreement can be obtained.
- For smaller projects and lower grade ores, where capex is a significant issue, it makes sense to pursue potentially lower cost options such as AL.



- A combination of PAL and AL may be a potentially attractive approach for deposits that contain significant zones of both limonitic and saprolitic material.
- AL is still at the development stage, and no commercial plant has been built as yet.

The Goro Project is obviously a key consideration, and its success or otherwise will likely have a major impact on whether PAL is adopted for other future projects.

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