

WITNESS Refines Processes at INCO



WITNESS has helped precious metals refiner INCO to streamline its processes and improve yields. Simulation has also helped reduce the need for capital expenditure and supported the business case for new investment at INCO's Acton, West London refinery. The nickel and copper ores mined by INCO in Ontario, Canada contain precious platinum group metals (PGMs). After local processing to remove the main constituents, PGM bearing residues are shipped to the Acton Refinery, which is one of the few in the world equipped to purify these metals. Built in 1925, the refinery is widely recognised for the efficiency of its extraction and purity of its product. For the last 20 years, the refinery has also processed concentrates, residues and industrial scraps for other mining and refining companies.



"WITNESS has become so accepted in the Acton refinery that any new capital investment option that isn't a simple replacement decision will be modeled in WITNESS before it's approved."

- Richard Lea, Technology Manager, INCO

Precious metal refining is a multi-stage process in which batches of material pass through a series of chemical treatment circuits. Material completing one stage may have to wait until a suitable batch size has accumulated, or the appropriate reaction vessels become available, before further processing can take place. The overall efficiency of the refinery relies on the size of each circuit being optimised to handle a wide range of raw material inputs. The selection of refining campaigns is determined by the supply of raw materials and demand for pure PGMs. It is vital that managers understand the inter-dependencies between different circuits so that the effect of implementing different refining campaigns can be predicted.

Company	● INCO
Industry	● Mineral Refinery
Application	● Refining Operation Improvement
Benefit	● Capital Expenditure Reduction

INCO's management team started using WITNESS in 1997 as part of an effort to improve operations at the refinery. Two of INCO's most experienced managers were trained to use WITNESS on the basis that their knowledge and understanding of the business would enable them to develop accurate and pragmatic models. Richard Lea, technology and development manager, and Melanie Murray, supervisor metallurgical accounting, have subsequently created a number of models with assistance from Lanner consultants.

One of the early WITNESS models investigated the proposed investment plans to upgrade a chemical treatment circuit. The simulation showed that the required capacity increase could be achieved simply by adjusting the shift patterns and by using a different chemical with a greater capacity for extracting impurities in one piece of equipment. The necessary changes were made and the increase in capacity was achieved with no need for capital expenditure.

WITNESS was also used to investigate a planned upgrade of the ignition furnaces that provide one of the final treatments in the refinery. A simulation model proved that replacing one large furnace with two smaller furnaces would increase processing flexibility and result in a more streamlined flow of material through the area. The model also predicted improvements to yield and energy efficiency with a reduction in emissions, an important consideration as INCO is certified to the ISO14001 environmental management standard.

One of the most significant improvements in the refinery has been achieved by using simulation to study the impact of altering the flow of materials through a pair of non-identical reaction vessels. The company had already recognised that difficulties in two chemical treatment circuits were resulting in the irregular flow of materials through the refinery but the dynamic nature of the workload made it difficult to identify the root cause of the problem.

A WITNESS model of both circuits narrowed suspicion to two adjacent pairs of reaction vessels. One of the four vessels involved processed material travelling through both circuits, suggesting that this was a possible bottleneck, but after flow patterns were simulated using a variety of load conditions it was apparent that the problem lay within the other pair of vessels. The use of different specialist linings in these two vessels meant limiting operational flexibility. Smooth flow was further compromised because processing time in both vessels varied between one and five days.

The capacity limitation in this part of the refinery was restricting INCO's ability to accept certain materials for refining. It was vital that the company find the most effective solution. A WITNESS model of the existing situation showed that if nothing was done the problem was likely to get worse. The same model was used to examine several possible upgrades to the infrastructure around the vessels although little improvement was predicted. The most expensive option, replacing both vessels with new units capable of treating all material, was also simulated and it was predicted that this would resolve the problem.

The new vessels were installed after INCO accepted the recommendations supported by the simulation and a new charging schedule was implemented based upon the required output from the refinery. Flow through the area improved in line with the modelled prediction and the number of charges processed each week has been increased to meet the projected targets.

"The simulation model helped identify the root cause of the problem," says Richard Lea. "WITNESS provided an objective means of measuring the benefits to be expected from the capital investment option."

INCO's most recent simulation project has been to model the entire Acton refining operation at a high level. An in-depth knowledge of the business has been invaluable in striking the right balance between trivial and



excessive detail. The model covers the arrival of material into the refinery and simulates its flow through relevant treatment circuits until pure precious metal is shipped out. The company plans to use this model as a predictive tool to examine the effect on the refinery of possible future business and to assess the relative sizing of circuits.

WITNESS has now been used to identify the bottlenecks within and between circuits, the conditions under which they occur and to evaluate alternative strategies for overcoming them. It has also been used in a variety of projects within the refinery to assess the potential benefits of proposed new capital investment options.

"The use of WITNESS has now become so accepted in the Acton refinery that any new capital investment option that does not constitute a simple replacement decision will be modelled in WITNESS before any major capital investment is approved," says Richard Lea.

