# Optimization of the Xstrata Copper-Horne smelter operation using discrete event simulation



This paper presents a new model that focuses on the plant logistics and scheduling aspects of the smelting, converting, fire refining and casting operations at the Horne smelter. As part of a program to further optimize plant operations at Horne, both in terms of copper production and overall plant performance, a number of new plant models were recently developed and implemented. This paper describes the development and initial applications of a new tool developed using the ARENA software to model the plant logistics and scheduling, referred to here as "discrete event simulation."

A schematic illustration of the main units at the Horne smelter considered in the logistic model is shown in the figure below, taken from the main screen of the ARENA model. The diagram includes the Noranda Process reactor and the Noranda Converter shown in the upper part of the diagram, with the PRV units and anode furnaces shown along the middle-lower part of the diagram; the two converter cranes, which can traverse the length of the converter aisle, are shown in the lower part of the diagram. A number of data boxes presenting numerical data related to matte, metal and slag parameters are also shown. These include, for example, the actual quantity and melt levels in the Noranda reactor and the NCV. The display also includes data pertaining to plant conditions when throughput may be lowered on account of local ambient air conditions (the "SCI" label in the upper middle part of the figure).

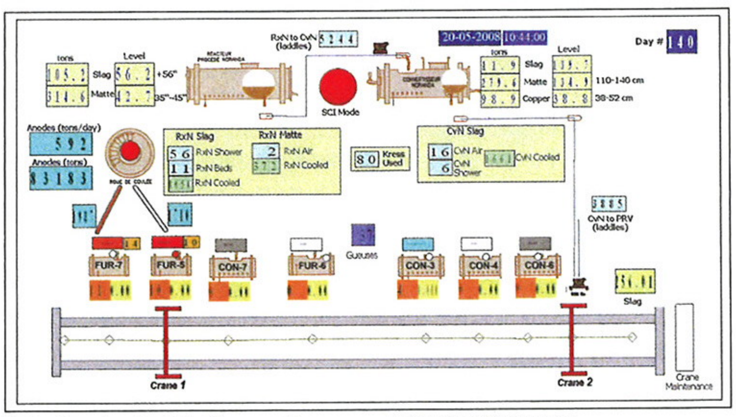


**Illustration of units of the Horne smelter as presented in the ARENA model.**

The model is set up to handle a variety of complex strategies with the objective of the optimum utilization of available resources. For example, the crane logic coded in ARENA includes operation with one crane, two cranes and tandem movements, the objective being to minimize congestion and provide for rapid transfer from a PRV unit to an anode furnace.

The model was used to examine the impact of a number of plant parameters. For example, a feed high in copper content may potentially pose a processing constraint downstream of the NCV, while treating higher quantities of lower grade feed and recyclables may potentially pose a smelting bottleneck in order to maintain a given copper throughput rate. Particular attention was given in the model development to the cycles between the PRVs, the anode furnaces, the anode casting operation and the crane logic. For anode casting, it was confirmed that increasing the actual anode casting rate alone could potentially be counterproductive since a given amount of wheel maintenance and preparation time is required between extended casts of several anode furnace charges. Hence, it was found beneficial to slow down the casting rate to "catch" the next charge of anode-ready copper that is ready for casting rather than continue at full casting rate. This approach has been practiced for several years at the Horne smelter, but the value of the model is that the productivity gain of this practice can now be quantified. Alternatively, the gain of other potential strategies intended to improve plant productivity can also be quantified. In another simulation scenario and for a given feed mix, the feed rate to the Noranda Reactor was gradually increased and the processing capability of the downstream units was observed, with a view to identifying potential bottlenecks in different sections of the converter aisle and casting wheel.

The model was developed and put into service in early 2008 and already has proven valuable in evaluating potential operating scenarios.

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