

# System 800xA Simulator provides multiple benefits for LKAB



**At LKAB's new processing and pelletizing plant, a simulator for ABB's automation solution provides major capabilities for increasing operational reliability and quality in production. "On the simulator, we can train operators and test changes to control systems and processes, free of interference. It saves time and raises the quality of daily processing in the plant," says Mats Renfors at LKAB.**

The Swedish mineral company LKAB has in northern Sweden a number of iron ore mines and facilities for processing and pelletizing iron ore. In 2008, LKAB commissioned a new processing and pelletizing plant in Kiruna, KA3/KK4. It is an enormous facility with the capacity to produce five million tons of pellets each year.

"Ball-shaped pellets are used in our customers' blast furnaces and direct-reduction furnaces, and there are considerable quality requirements on the size of the balls, their roundness and quality," says Mats Renfors, automation engineer at LKAB Kiruna.

In the new plant, the iron ore is ground down to powder, cleaned of phosphorus in a flotation process, supplemented with a binding agent, drained and rolled into balls. The balls are transported in a 70-meter long grate furnace, followed by a 40-meter long kiln furnace where the balls are dried, the iron in them oxidized and the balls sintered to the desired hardness in up to 1250 degrees Celsius. The final process step is slow and careful cooling in a rotating cooler with a diameter of 28 meters. This is the world's largest sinter machine to date of the type grate-kiln-cooler.

Production in the processing and pelletizing plant is controlled and monitored by operators in a common control room. The automation system is ABB's System 800xA, including the operator environment. But LKAB wasn't satisfied with just a functional control system; there is a more exceptional element here in a room next to the control room – a simulator for the control system.

### **At the leading edge with simulator**

Simulators have traditionally been used for example by aviation, oil, gas and nuclear power industries, but when it comes to the mineral sector, LKAB is at the leading edge with its new simulator.

"We were early to realize the advantages of simulation as a part of our work with improving processes," says Mats Renfors. "At the beginning of the 2000s, we had for one thing problems with dosage of binding agent in another pelletizing plant, and a consultant helped us with a number of simulations of both dosage and the process. Based on the simulation results, we made changes to the mechanics and the control systems, and obtained good solutions."

Not long after, LKAB began the construction of the new processing and pelletizing plant KA3/KK4. The plant was formally opened with a grand ceremony in July 2008, and production started with the ABB 800xA control system. A few months later, the new simulator was in place, ready for a number of different tasks.



The new processing and pelletizing plant is an enormous facility with the capacity to produce five million tons of pellets each year.

## “We were early to realize the advantages of simulation as a part of our work with improving processes.”

The LKAB KA3/KK4 simulator uses ABB 800xA Simulator, which provides simulation functionalities for System 800xA. The control system is connected with process models built by the consulting firm Optimization. Optimization handled integration between control systems and process models, and all development was in collaboration between ABB, Optimization, LKAB and the system supplier Midroc.

Rikard Hansson, system developer for the ABB 800xA Simulator at ABB in Norway, explains that the simulator uses ABB's control systems and operator stations but runs the control system on standard Windows servers instead of ABB's controllers. The process models simulate the process' equipment, instrumentation, and actuators, and supply the control system with input data as similar to the actual process as possible.

“Simulation is really about solving equations,” says Rikard Hansson. “Once or a few times per second, process models compute enormous equations, and the process is recreated on the display in front of our eyes. Important parts of the process have advanced modeling with major calculations, while other parts manage with simpler modeling.”

### Benefits in testing

The simulator in LKAB's plant has been successfully used for a number of different tasks. It was most recently used to test upgrades of the control system.

“We've conducted large reviews, for instance improved reprogramming of controllers, and we've been able to test them in advance in the simulator. It has worked really well, primarily because it gives us the opportunity to quality-assure the process against uncontrolled machinery or other system faults,” says Mats Renfors.

New code for the control system has also been tested in the simulator before it is transferred to the actual control system. “Changes to the control philosophy can be tested and checked, under calm and safe conditions.

Other usage areas for the simulator are tests in conjunction with planning and configuration, and test-runs prior to process changes. The tests also provide improved data for the company's decision-making process by clarifying planned changes and their results in flow and quality. Moreover, there are opportunities for solving problems with pellet quality and other product problems through implementation of suitable quality parameters in the simulator.”

## Benefits in training

Perhaps the most extensive application area for the simulator is in education and training. Newly employed operators receive training on the simulator, and further education of experienced operators includes a more extensive training program. Relevant training scenarios are developed in the program where operators are trained in a safe environment to handle unusual events.

The benefits of the KA3/KK4 simulator were apparent fairly soon and there is a current interest in LKAB to obtain more simulators.

“There are many application areas that can provide major benefits. Above all, an investment in ample time prior to commissioning of a process can pay for itself in a very short time,” says Mats Renfors.

“Being able to run a flow in advance on the simulator, before actual operation, can greatly improve planning. Faults are detected beforehand and it can definitely shorten the start-up period. Moreover, one can simulate programming of the control system and test parameters, such as interlocks and alarms, and entire sequences in advance. This is also a comprehensive assurance of quality.”

In LKAB’s constant efforts to improve the processes, the simulator has a significant role. The goal is an even flow of high quality iron ore pellets in filling orders from customers, primarily in Northern Europe but also in the rest of the world.

## LKAB

LKAB is an international high-tech minerals group, specializing in the production of refined iron ore products for the steel industry. Sales are primarily to European steel works. Other important markets are North Africa, the Middle East and Southeast Asia.

Iron ore mines, refining plants and ore harbors are located in northern Sweden and Norway. LKAB operates several refining plants in Kiruna. The new pelletizing plant, KK4, and the associated processing plant, KA3 – along with other investments in various facilities – entail that LKAB is increasing its yearly overall production from 24 to 28 million tons of iron ore pellets.

## KA3/KK4 Simulator

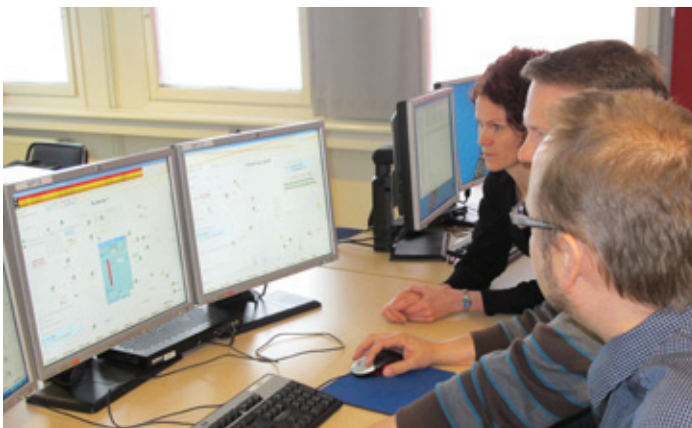
The simulator consists of:

- 800xA Simulator with AC 800M.
- Control applications and operator displays from the plant’s 800xA control system.
- 800xA Simulator interface for communication between model and control system.
- Process model and integration from Optimization AB.

The control room with its System 800xA operator workplaces.



Mats Renfors, automation engineer at LKAB, describes the function of the 800xA Simulator.



Training session at the 800xA Simulator.



The 40-meter long kiln furnace.

For more information please contact:

**ABB AS**

**Process Automation Division**

Oslo, Norway

Phone: +47 22 87 20 00

Fax: +47 22 87 29 00

E-mail: [simulator.sales@no.abb.com](mailto:simulator.sales@no.abb.com)

**[www.abb.no/controlsystems](http://www.abb.no/controlsystems)**

**Note:**

We reserve the right to make technical changes or modify the contents of this document without prior notice. With regard to purchase orders, the agreed particulars shall prevail. ABB does not accept any responsibility whatsoever for potential errors or possible lack of information in this document.

We reserve all rights in this document and in the subject matter and illustrations contained therein. Any reproduction, disclosure to third parties or utilization of its contents - in whole or in parts - is forbidden without prior written consent of ABB.

The IndustrialIT wordmark, Aspect Objects, and all above mentioned names in the form xxxxxx<sup>IT</sup> are registered or pending trademarks of ABB. All rights to other trademarks reside with their respective owners.

© Copyright 2010 ABB.  
All rights reserved.