VisSim™

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INEOS Chlor

VisSim case study

TEST DRIVING

INEOS Chlor, one of the major chlor-alkali producers in Europe and a global leader in chlorine derivatives, is using VisSim to train operators in readiness for the company's new membrane chlorine plant

Chlorine and its derivatives are used in a variety of industrial applications ranging from the manufacture of paints, plastics, textiles and technology through to pharmaceuticals, industrial and domestic cleaning products, water treatment, food processing and personal care.

The most common way of producing chlorine is the electrolysis of brine, a process that also produces caustic soda.

Clearly, with so many uses for chlorine and its derivatives, production is best done on an industrial scale, and a world-leader in the production of these essential chemicals is INEOS Chlor, headquartered in Runcorn, Cheshire.

Philip Masding, Process Control Manager at Runcorn, comments: **"Chlorine production is essentially a three stage process – purification and treatment of the brine, electrolysis (done in our electrolysers) and then gas treatment and liquefaction."**

INEOS Chlor is undertaking a major investment in a new chlorine production facility that will use improved membrane cell technology. The company plans to have the new plant in production by early 2006. The new plant will underpin the future of the site and significantly improve its cost base.

Role model

Masding continues: **"Building a new plant is a major investment. However, you're typically caught between a rock and hard place because on one hand you want to have the plant working as soon as possible and on the other hand, you can't afford to rush and make mistakes with any process that involves the bulk handling of chemicals."**

When designing a new process, INEOS Chlor traditionally builds dynamic models (or virtual prototypes) as a crucial part of its design strategy. The models allow the company to perform top-level control studies. Masding comments: **"Where we think parts of the plant might be difficult to control, we use a dynamic model to help us design a sound control scheme."**

INEOS Chlor builds its models in VisSim, and has been using the tool for more than ten years. VisSim is a visual and interactive environment for simulating dynamic systems. It has an intuitive user interface and users simply drag-and-drop block diagram elements to build system models.

VisSim is developed by Visual Solutions, Inc., Westford, Massachusetts, and supplied and supported in the UK by Adept Scientific plc details are at **http://vissim.adeptscience.co.uk**.

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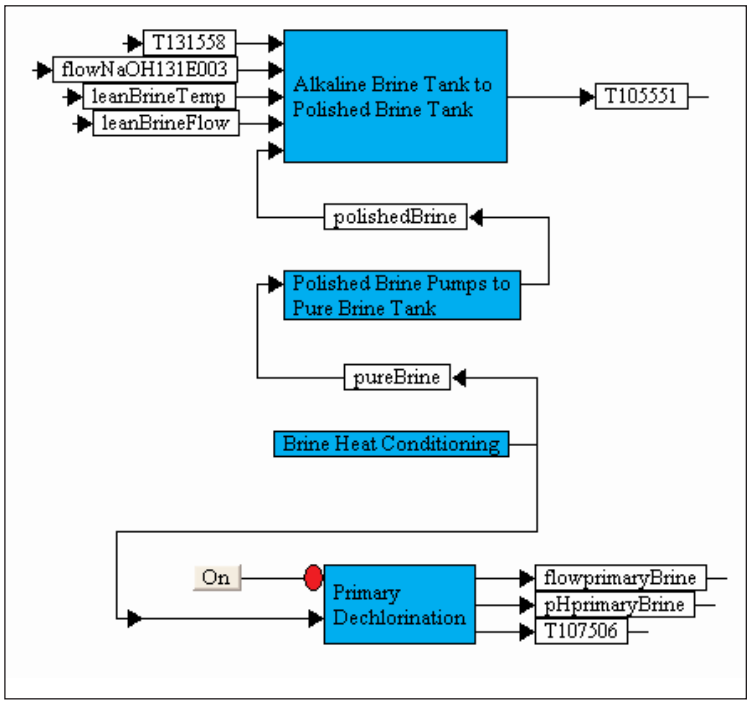
For INEOS Chlor's application, VisSim is being used to model: the chemistry, heat and mass balance of the brine treatment; the chemistry taking place in the membrane electrolysers; the cooling, drying and liquefaction of the chlorine; and the de-chlorination and treatment of waste brine.

Figure 1 below shows part of the top-level block diagram of the planned cell.



◀ **FIGURE 1:** *Shown opposite is part of the top-level block diagram of INEOS Chlor's chlorine plant training simulator: as modelled in VisSim.*

The top 3 compounds (blue boxes) in this section of the model represent the purification and temperature control of the brine prior to electrolysis. During this process heat is exchanged with other hot streams that have already passed through the electrolysers. The 4 inputs to the top compound represent the flows and temperatures of these hot streams.

In the fourth compound the spent brine is treated to remove dissolved chlorine.

Operator training began in August 2005 and, even when the real plant is up and running, the VisSim model will still be used to train new operators. Also, the model will be used to rehearse scenarios that crop up infrequently. Masding: "So this plant model, perhaps more than any other plant model, is of use before, during and after the completion of the plant it models."

However, with the development of the new plant INEOS Chlor is building the model for more than just a control study. Masding explains: **"We'd heard there were plans for VisSim to soon have OPC, an interface protocol supported by our distributed control system, so thought it would be extremely useful to interface the model with the controllers – thus enabling us to train the operators whilst the new cell is still being built."**

Industrial flight simulator

INEOS Chlor was one of the earliest adopters of VisSim/OPC and, being such a large application, was an excellent proving ground for the simulator. Further, Masding's team worked closely with the software manufacturer and was, in mid-2004, able to get an advance copy of VisSim/OPC.

"We tried to build a training simulator a few years ago," Masding recalls, **"but had to use analogue I/O cards to establish a 10-signal link between the controller and the model. Now that VisSim has OPC, we've got close on 200 signals."**

The distributed control system (DCS) in use at Runcorn is a Delta V machine from Emerson. These have been linked to Masding's training simulator model, which has upwards of 12,000 blocks and a five-layer hierarchy. The company plans to use the model in much the same way pilots use flight simulators.

"We're going to get the operators familiar with the controls and even throw in a few faults," Masding explains. **"A pump failure here, a valve stuck there. Basically, to get things right in the simulator so that there are no surprises when it comes to using the real thing."**

Model behaviour

Masding continues: **"At 12,000 blocks the key skill in writing a dynamic model of this size and complexity is that if you try to model it too rigorously it will take too long to run."** Thankfully, VisSim allows users to split models into individual modules or compounds and integration step lengths can be set independently, so available computing power is used efficiently.

"One of VisSim's main attributes is that it is an easy program to pick up and use," Masding says, **"and it's easy to get more sophisticated the longer you use it. Now, because we have such a detailed, scaleable and dynamic model, the new plant may achieve full rates earlier than would have otherwise been possible. And for an operation like INEOS Chlor, saving a few days alone will justify the spend on the simulator software."**

In conclusion, Masding says that many of the advantages of building a dynamic model can, and will, never been known. **"If we were not to have a training model, would it make any difference to the vital commissioning phase of the project? You just don't know. All we can say is that by extensive use of the simulator we're maximising our chances of a quick, safe and efficient start to production."**

For further information or to discuss your application with a VisSim specialist please contact Adept Scientific:

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