Plant Services

WHEN LIGHTNING STRIKES TWICE

"What are the odds?" After an incident, SABIC turns to data modeling to find out

by Christine LaFave Grace, managing editor

On paper, at least, it seemed like sufficient redundancy. Global chemicals company SABIC (www.sabic.com), headquartered in Riyadh, Saudi Arabia, has a Saudi Arabian affiliate that produces industrial gases for a large number of SABIC businesses and other companies in the region. To avoid the wide-ranging impacts that unplanned downtime would have on customers, the affiliate has a backup power feed and eight production units operating in parallel.

"We have all kinds of redundancies; it looked very robust," says John Bruijnooge, director of technical services at SABIC. The affiliate hadn't suffered a major outage in its 30 years of production, and there was a "high level of confidence" in its ability to stay online, come what may, Bruijnooge says.

But then in May 2017, what came was a major electrical storm. Lightning struck the main power feed; the feed went out. Within a second, another strike hit the backup feed. "And then it became dark," Bruijnooge says.

Gas production was stopped, and subsequently, many of the plant's customers had to stop their operations. "We restored (operations) fortunately in a day-and-a-half," says Bruijnooge, "but then the damage was done, of course."

It was a highly unlikely occurrence, to be sure. But it happened. And in the wake of it, SABIC executives and reliability engineers alike wanted to know: What were the odds that it (or a similarly debilitating event) could happen again?

To answer the question, Bruijnooge and his team turned to reliability, availability, and maintainability (RAM) modeling using AspenTech's (www.aspentech.com) Aspen Fidelis Reliability software. The software maintains a listing of all critical assets in the system and – crucially – their relationship to one another as it pertains to keeping operations up and running. Then, explains Bruijnooge, "You provide the actual failure rates, repair procedures, and all the work that needs to be done, and then you ask, 'What is the probability that I will reach a situation where one or more of the units will go out?' "

It's about more than looking for "bad actor" assets, Bruijnooge indicates; it's about examining how the current health of your assets affects the likelihood that an event such as a bad storm will take production offline and putting actual probabilities behind such an event occurring. So after running the numbers, what a facility winds up with is a more-contextual view of its top 10 (or 20, or 30) contributors to unavailability.

"(You look at) which are the components that have shown in the past to have the most vulnerability?" Bruijnooge says. "And then it becomes a probability calculation that one or more of those events will occur at the same time. And then that leads to the answer to, 'In the next 20 years or the next 10 years, how often can this happen to us again?' "

For the SABIC affiliate, after modeling was conducted in July, the probability of a recurrence "was not zero," says Bruijnooge. To mitigate that risk, the facility made the big, costly decision to – for now – run with an extra unit operating at all times.
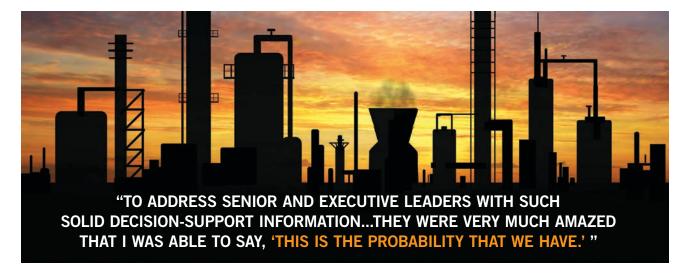
"In theory, that should not be necessary, but the calculations we did scared us so much," Bruijnooge says, that the facility opted to shoulder the extra costs at least until several identified maintenance priorities can be addressed. "We are

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now executing and processing and trying to improve," he says. "Somewhere in the next few months, I would like to redo the modeling and then feed into the data the improved assets and see where the probabilities of failure are at that moment and see if we reach the confidence level to start operating at a more-efficient mode again."

Confidence in the face of uncertainties is a big part of what simulation modeling – a vital aspect of prescriptive maintenance (RxM) – aims to offer, says AspenTech's Mike Strobel. "We give them that ability to quantify, what does the future look like if I make this decision rather than that decision?" says Strobel, an engineer by training and long-time reliability pro who helped develop the Fidelis software. (AspenTech acquired the Fidelis offering in 2016.) Equipment health is one part of a larger picture that also includes weather, personnel factors, and geopolitical issues when it comes to setting expectations for production, Strobel notes;

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the Aspen Fidelis Reliability tool lets SABIC run through different possible scenarios based on calculated probabilities rather than just "averaging away" variables.

"You're trying to produce more product; you're trying to be more efficient with your production; you're trying to spend less money on maintenance; you're trying to react to changing markets or logistics," Strobel says. "(Modeling) just allows you to squeeze the most money out of any facility ... it allows you to play the what-if scenarios of, 'How can I improve that, that event that's stealing money from me?' If a piece of equipment fails too often, it's robbing money from me. If a ship is showing up late, it's robbing money from me. If a spare part is missing, it's robbing money from me."

Attaching dollars to different scenarios run through the modeling software has been enormously valuable in getting buy-in from leadership for taking specific action, Bruijnooge says. "Having the ability to quantify and to estimate risk and to estimate and quantify vulnerability ... here in Saudi Arabia, I think I've blown my colleagues out of the water, more or less," he says.

"This is what I have learned," Bruijnooge continues: "To address senior and executive leaders with such solid decision support information ... they were very much amazed that I was able to say, 'This is the probability that we have.' "

In addition, simulation modeling offers Bruijnooge and his team the opportunity to present worst-case and best-case outcomes – again, with probabilities behind different scenarios, rather than hunches. "It's very easy once you have the model to play with it," he says. "You have fantastic output opportunities in the tool to show the confidence around the answer that you're giving."

Strobel, for his part, notes that it remains a hurdle in many organizations to get stakeholders on board with purely data-driven decision-making.

"These are big multinational multibillion-dollar companies that we deal with, and I was surprised that even today they make decisions based on emotion," he says. "Even when data is available, nobody wants to do the dirty work of collecting that data, cleaning that data, and then finally putting that data into a smart tool that will do something with it." When it comes to backing up your arguments for major equipment purchases or revisions to asset management processes, modeling "forces you to do your homework," he says.

Bruijnooge is quick to point out that reliability modeling isn't necessary for addressing each and every reliability issue or supporting every asset management decision in a plant. Decision-support technology such as reliability modeling software is "always in my backpack, as I would call it," he says. "Depending on the problem statements that arrive on my path, I take a grab in my backpack and try to use the right tools."

Modeling and the discussions it can lead to takes time and thus personnel resources, so it's best applied when making major CapEx or OpEx decisions, Bruijnooge suggests. "It is important that use of this tool is applied when it provides the most value," he says. "It's like a carpenter has a hammer, but he also has other tools."

When designing and opening a new facility, RAM modeling has the potential to save millions, Bruijnooge says. "I'm now pulling the tool again ... because we are building a new plant, which is designed on paper, and I said, 'Look, before we throw the money over the fence and build it, I want to see, on paper and in the reliability model, how reliable is this plant really going to be?' Even before we pour one kilogram of concrete or before we erect one meter of steel, I can already predict to you how this plant will perform in the next 25 years based on how it's designed and what types of components are used. There are great opportunities." ⊗