Hot topic

The CO2 crisis: One year on, could history repeat itself anytime soon?

By Rob Cockerill

By the time this issue of **gas**world goes to press and is in your hands, it'll be one year since the biggest carbon dioxide (CO_2) shortage of recent years erupted. The CO_2 crisis of 2018 sent shockwaves through Europe and Mexico alike, bringing mainstream media and public attention to an industrial gas supply chain like only helium has previously demonstrated.

CO_2 shortages are almost an annual occurrence, but last summer the CO_2 paradox became more evident than ever before: plenty of it in the atmosphere, and yet not enough of it to carbonate our beer. So what happened?

Europe's CO_2 supply position had tightened in April, driven by the usual turnaround of maintenance procedures in ammonia plants, but this position became critical when other plants associated with bio-ethanol and chemical production were also shut down for maintenance or other technical issues. Ammonia plants have traditionally been one of the largest sources of food-grade CO_2 in Europe and while in the past decade other sources of CO_2 have been invested in, including those raw gas streams from chemical operations and bio-ethanol plants, ammonia still remains one of the largest sources – especially in Western Europe.

However, this is very much a seasonal feedstock and leaves Europe, which is more vulnerable to this source than other regions around the world, at annual risk of supply chain challenges; ammonia is used in fertiliser production and the peak production output for fertilisers is generally from August to March or winter months. Fertiliser companies then plan maintenance or shutdowns in April through to June on a regular basis – but this is coincidently the peak time for production of soft and alcoholic drinks.

What compounded the situation last year was not only the timing of all the maintenance procedures, but that ammonia market prices had fallen to a low and imports were available from outside of Western Europe, leading to European producers prolonging the downtime of the ammonia plants within the region. The margins in the ammonia business had not been particularly attractive either, due to the higher pricing of natural gas – a major raw material for ammonia production.

Jennifer Willis-Jones, *Fertiliser Week* Senior Markets Editor, affirmed the importance of natural gas pricing when speaking at **gas**world's CO_2 Summit in Innsbruck, Austria in March 2019. "The major feedgas is natural gas and that's certainly the case in Europe," she said. "European producers are reliant on natural gas and it has a huge impact on price."

"In 2017, China said it wanted to use less coal as a feedstock, so the plants switched to natural gas and what happened was prices went through the roof. CO_2 is a by-product of ammonia production, it does not drive ammonia production at all, but natural gas prices do. Natural gas prices are a big factor in ammonia output."

What transpired was a perfect storm of supply chain conditions that were largely beyond the control of the CO_2 business itself, and created a lack of raw gas sourcing for CO_2. This was further compounded by the extreme heatwave that hit Northern Europe in May – creating an unprecedented demand for CO_2 from the food and beverage sector. It was described as the "worst supply situation to hit the European CO_2 business in decades" and left many consumers of CO_2 desperate for supplies of the product. All major suppliers of liquid CO_2 were affected by the raw gas sourcing issues – including Praxair, Messer, Linde and Air Liquide.

Is another crisis on the cards?

So the question is, one year on, are we likely to see history repeat itself anytime soon? As **gas**world understands it, the market is still tight but not yet crunched.

Just a few months after the peak of the European CO_2 crisis, much of the capacity in question had returned to the market and a sense of stability had returned. As 2018 drew to a close, there were still concerns over the tight position the market found itself in and little had changed by the time **gas**world hosted its CO_2 Summit in March. The feeling in the room then was still one of caution.

We are far from seeing a glut of supply in Europe, and the situation is not significantly different in North America either. The start-up of plants in 2016 and 2017 alleviated some of the tightness that had been experienced in the merchant CO_2 market, but the same factors (though not as ammonia-dependent) of demand growth, seasonality of that demand and supply, and reliability of sourcing mean there is always a desire to broaden the sourcing spectrum. At the same time, the demand for CO_2 in its various forms continues to grow.

The good news is that the market is not yet crunched, for the time being at least, and Willis-Jones described the lower prices ($6/MMBtu versus $8/MMBtu) in the ammonia market this year during her talk in Austria. She added, "Even with a weak ammonia market it still makes sense to produce ammonia in Europe. It's only likely to be in quarter four (2019) that prices will go up because of winter."

"Considerably lower natural gas prices is good news for ammonia producers and it's because of record high US production, ample Russian natural gas output, and a relatively mild European winter. Better news for CO_2 consumers is the ammonia industry faces a significant downward price pressure due to a new 891,000/year Russian merchant plant."

At the time of writing, Nippon Gases (the former Praxair Europe business acquired by TNSC in December 2018) has also just announced plans to build a £9.5m ($12.1m) CO_2 import and distribution terminal at Warrenpoint Port, Northern Ireland. The 2,500 tonnes capacity facility will store liquid CO_2 for the food and drinks industry across Ireland and aims to 'significantly improve' security of supply for the gas on both sides of the border.

The UK market appeared the hardest hit at the peak of 2018's shortages, with only one major CO_2 plant operating at one point. Very reliant on imports from Scandinavia and also the Netherlands, the UK was doubly impacted in that there were limited movements across the Channel due to plant shutdowns in the Benelux and France limiting product to ship. A response to those shortages, the new terminal is therefore welcome news in terms of CO_2 storage capacity and with work commencing this summer, the facility is expected to be operational in Q2 2020.

Gerard Dore, Nippon Gases' Commercial Manager, explained that with no significant native source of liquid carbon dioxide on the island of Ireland, supply is currently imported by industrial gas companies daily into Ireland via road tankers coming across the Irish Sea. "Nippon Gases already own a number of CO_2 terminals and ships in North West Europe. With this investment in Ireland, Nippon are changing the supply chain radically for their Irish customers by importing via ship rather than road tanker," he said. "It is worth noting that one ship will be the equivalent of 90 road tankers coming across the Irish Sea." gw

MEXICO: CO_2 SUPPLY UPDATE

By Sam A. Rushing, President of Advanced Cryogenics, Ltd

Within just 48 hours of the news of a CO_2 crisis breaking in Europe, it emerged that Mexico had become the latest country to be affected. The problem was in part borne out of similar issues being experienced in Europe – a problem with the ammonia plants and production reliability.

The difficulties maintaining adequate supplies to fulfill the nameplate capabilities of Mexican CO_2 plants has grown ever more difficult, at the time of writing. When I began reporting on the shortfall of raw gas supplies to existing CO_2 plants in Mexico, there was a hope of resolution over the months ahead.

Now, in the spring of 2019, it has become apparent to me that the lion's share of raw gas supply has become unavailable. I am told the supply of raw gas from ethylene oxide has also developed into a difficult proposition.

Most CO_2 raw gas sources borne from natural gas as a feedstock have been curtailed. Officially, it is said the natural gas is unavailable to these plants and, therefore, ammonia is not produced. When examining the natural gas supply issues and CO_2 shortages, however, the true reasons are more complex than the official version.

The ammonia plants are operated by Pemex, the state-owned agency which controls the production of hydrocarbon-based chemicals as well as the oil and gas business, and natural gas supplies in Mexico. Part of the reason for the sheer lack of supply of natural gas to the ammonia plants is a shift over to urea production. One year ago, in the spring, there was some CO_2 production available from the ammonia-based raw gas, where at that time urea production was being tested and was then intermittent; so some CO_2 was available to the merchant sector. However, since August 2018, the ammonia plants which serve the merchant CO_2 plants with raw gas, are essentially shut down. I am told the CO_2 industry is constantly monitoring the situation with the government weekly, hoping for a near term resolution.

Some of the merchant gas companies in Mexico are then looking further afield for supplies, where I am told in one situation a whole week of additional travel is required for the supply of CO_2 within the country – making it essential to pass along significant surcharges to the customer, assuming the product is even available.

All of which leaves the merchant CO_2 business in Mexico struggling. Further still, there is not a biofuels industry in Mexico as we have in the US, which could supplement this shortfall. There simply exists a sheer lack of concentrated raw gas sources and supply chain diversification.

The situation in Mexico could probably be considered more unstable than what it was in the spring of 2018. In looking for some positivity, some say the ammonia plants may start up in 2019 and as mentioned earlier, the gas companies are monitoring this situation continuously.