

# ASCO

All about CO<sub>2</sub>  
an interview with  
Thomas Trachsel



**China** - Accelerating growth  
**Helium** - Challenges of tight supply

# Helium



## Changing faces, technology shifts and tight supply - challenges facing our industry

For many years the US was the most important market for helium and the major source to the worldwide market. Over the past 11 years, others global sources have been developed and demand in other regions has taken off. Leading consultant John Raquet investigates what is happening in the global helium market.

While we are only just over halfway through 2006, this year will certainly be remembered as an important year in the helium business. Demand has outstretched supply. Two new sources have come on-stream, but with feed gas and operational problems limiting their output they are yet to have a major impact on the market. Helium became a major anti-trust issue for both the European Commission and the US Federal Trade Commission following the offer by Linde to acquire BOC, and Taiyo Nippon Sanso (TNSC) acquired a primary supply position to the global market.

So where do we begin? Firstly, we need to look at the demand and uses for helium and what has and will drive demand.

### Growth in helium use

Over the past 15 years, demand has mainly been driven by the development of Magnetic Resonance Imaging (MRI) and the need to cool the magnets to near absolute zero to become effective. MRI became and still remains the major use of liquid helium. Another driver of demand in the past was the use of helium as a heat transfer agent and carrier gas for fibre optic production. The other major uses include pipeline leak detection, the leisure industry, electronics, specialised welding and airships.

According to Spiritus Consulting, demand reached a peak in about 2001 when global consumption was 159 million Nm<sup>3</sup> or 5.9 billion SCF. Up until then helium use had been growing at about seven per cent per

annum. However, the slump in fibre optic production in 2002/03 and the slowdown in the electronics industry and major developed economies following 2001 caused a reduction in demand for helium (Figure 1).

Fibre optic manufacturing has not really rebounded, although some helium players believe that this may happen in the next few years - but with less impact than before.

A technology shift in the way MRI magnets are produced and maintained has had a significant impact on the amount of liquid helium used to cool them. The use of closed cycle systems in the magnet has generally resulted in liquid helium use being reduced by 75 per cent in new magnets. Manufacturers have also installed recovery systems, leading to more efficient use of liquid helium. The technology shift would be a major concern to helium producers and suppliers, but this decline in the use of helium per magnet is offset by the recent rapid rise in the production of MRIs to meet global demand - especially in the Far East. According to Phil Kornbluth, global helium VP for BOC, the overall demand for liquid helium in MRI applications will remain stable to slightly positive as a result of the technology shift.

Fibre optic production reached a peak in 2000/01 but severe over-production in countries such as India, and the slowdown in the electronics industry, resulted in several major production plants in Europe and the US closing down. While fibre optic demand is starting to pick up again, this is mainly in the Far East and so the expected rise in helium will be measured compared to historic trends.

### [www.HeliumOneSource.net](http://www.HeliumOneSource.net)

Nishi Associates is launching an interactive website [www.HeliumOneSource.net](http://www.HeliumOneSource.net), which will offer all types of high quality equipment and engineering support for helium processors and users. Offerings range from dewars and transfer lines to complete recovery and purification systems. The website is laid out in easy to use and follow, system modules. Orders are accepted and filled for global customers without the customers need to arrange shipping or tedious banking documents.

The site offers equipment from only carefully selected suppliers with proven experience in helium technology. HeliumOneSource offers the total solution for helium processors and users.

## Future demand

According to a number of gas companies, 2005 saw a strong rise in demand from the decline seen in 2002/03. Most companies witnessed a four to five per cent rise in demand – some experienced even higher sales due to market share penetration.

*What about the future?* The consensus amongst the major players is that they are expecting a four to five per cent per annum rise over the next few years. According to Spiritus, however, this is the top of its growth expectations over the long-term; it has a more conservative growth forecast of about 2.5-3% pa. The consultancy recognises the short-term boost driven by the high demand for helium in the electronics sector – especially in flat panel display manufacturing for LCD and plasma televisions. A number of major manufacturing plants have been established in China, Korea and Taiwan and will drive the demand for helium over the next few years.

Figure 2 shows that MRI accounts for about 20 per cent of the worldwide use of helium and is the largest end-use sector. This is expected to remain an important sector but future growth is very much related to the continued shift in technology as described above. Demand for MRI machines is still growing, although growth has slowed from the recent highs. MRI use is driven by strong growth in emerging nations investing in such technology and replacement of older units in the developed regions. Spiritus believes that in the short-term there will be stagnation in demand for liquid helium in MRI and that mid to long-term, demand will fall.

The use of helium in more sophisticated welding processes continues to grow strongly, especially as a shielding gas mixture in laser welding techniques. Around the world the use of helium in balloons continues to rise, due in part to the increase in domestic or leisure use but also in advertising blimps and airships. There has been increased interest in the use of dirigibles for military applications, primarily for surveillance.

The forecast is for positive growth and Spiritus expects demand to rise to 190 Nm<sup>3</sup> (c 7.0 Bn SCF) by 2010. There do not, however, appear to be any significant new end-uses that would have the impact that MRI did on global helium demand in the 1990s.

## New plant start-ups

We mentioned at the beginning that the US was the major supply source to the global market. This has started to change, beginning when Algeria (which has massive natural gas resources) built its first liquid helium recovery facility in Arzew in 1993, with the aid of Air Products and Air Liquide. 2006 has seen the start up of two major new liquid helium recovery units.

The first new plant that started production in 2006 (actually first deliveries occurred in September 2005) was the facility in Ras Laffan Industrial City, Qatar. This plant, which was supplied by Air Liquide, processes vent gas from the large LNG facilities at Ras Laffan in Qatar, owned by Qatargas and Rasgas and operated by EXXONMOBIL. The helium plant has a capacity of 600 million SCF per year. It has been commissioned but feed gas supply and refrigeration problems have limited output to around 40% of capacity at present. The output from this plant is divided between BOC and Air Liquide.

The second was in Skikda, Algeria by Helison Production (a joint venture between Linde Gas and Sonatrach). This started production in May, after

delays caused by the explosion in the LNG facilities in January 2005. According to Linde, the plant was fully commissioned in May of this year and produced liquid helium to specification and at the expected capacity. However, crude feed problems have limited output and the plant has been closed since the end of June for the summer break. It is believed that the plant will be up and running again in September or October but will only be operational at 40-50 per cent of nameplate capacity until the new LNG facilities are completed in 2009.

## Why the tight supply?

The global helium business is currently experiencing acute supply shortages and some consumers have been put on restricted volumes. This is due to a number of concurrent problems. By now, there should be 1.2bn SCF a year of new capacity on-stream in Algeria and Qatar, but the explosion in Algeria will result in a reduction of at least 300 million SCF a year until 2009. Arzew is currently down for a major maintenance break related to the LNG2 facility and is due to be offline for between four and six weeks. With Skikda offline and Qatar limited for now to roughly 40% of capacity there is a major supply restriction in

## TNSC buys Linde/BOC helium businesses

Following the recent offer by Linde to acquire BOC and subsequent referral to the European Commission and the FTC on possible anti-trust issues, Linde agreed to divest of certain helium assets and contracts in order to get approval from both authorities. TNSC and its subsidiary Matheson Tri-Gas have effectively agreed to acquire certain parts of the combined helium business (especially those sources formerly contracted to BOC).

## These include:

- In the US, one of the EXXON-MOBIL wholesale contracts BOC had at LaBarge in Wyoming will be divested to TNSC, together with 2 full trans-fill facilities located in Houston, Texas and Orlando, Florida.
- In Europe, Linde has agreed to divest the existing helium wholesale purchase agreements BOC had with the Polish State Gas company at Odolanów and also with Russian helium producer JSC Cryor in Orenburg. We also understand that a number of wholesale supply agreements in Europe and Turkey will have to be divested as well to TNSC – including the eventual acquirer of the Linde UK gases business.
- In Japan, TNSC has agreed to acquire BOC's stake (40% ownership) in its joint venture transfill facilities (7 in total) in Japan – Japan Helium Centre – together with associated Isotanks to supply these centres and other acquired business. There are some smaller investors in these centres but TNSC will be the majority owner of these trans-fills on completion.

As a result, TNSC will, for the first time enter the primary supply chain for helium around the world. The company will gain about 500 million SCF of helium sourcing contracts.

Figure 1

## Global helium demand, 1995-2010

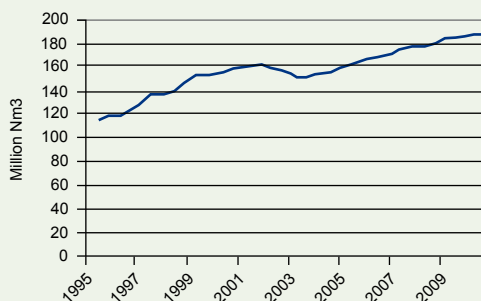
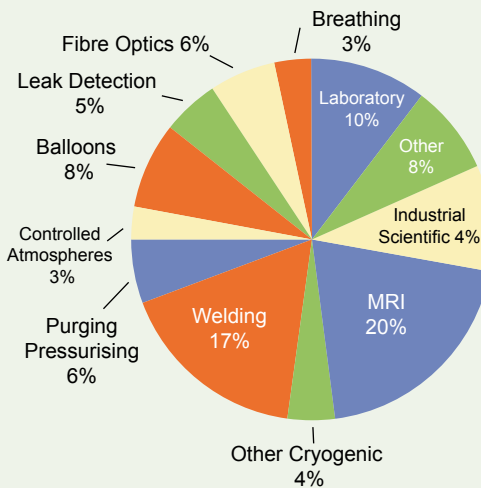


Figure 2

## Global helium market - by end user



▶ the European and Middle Eastern zone. Russia and Poland, however, are producing normally and near to capacity.

The supply position has been further worsened by supply restrictions in the US, where six helium refineries rely to varying degrees on the Bureau of Land Management (BLM) pipeline system in the Texas Panhandle (see Figure 3) for their supply of crude helium feed gas.

For a variety of reasons, including outages at natural gas processing facilities that inject crude helium into the BLM pipeline, problems with several wells at the Cliffside Field and high demand from the refiners caused by outages at sources not linked to the BLM, the BLM has had to restrict supply in order to maintain sufficient pressure and quality of product.

As a result, there is a tight squeeze even in the US. This will be compounded when EXXONMOBIL's Wyoming facility shuts down for maintenance in September.

Gas companies are hoping that the situation will ease somewhat by late October or November when the Algerian plants and EXXONMOBIL are back on-line.

### What about new sources?

There have been several announcements in the past 18 months of new capacity to be added. Firstly, BOC is going to build a 150 million SCF per year helium facility in northwest Australia. The plant is planned for July 2008 start-up and will be geared to supplying Australia and the Far East market.

There are also plans to expand output in the US by Air Products but details have not been announced. There have been plans to build a new facility in Ridgeway on the Arizona/New Mexico border. These plans have not progressed further and are dependent on the recovery and use of CO2 for enhanced oil recovery.

The Russian helium player Cryor announced plans

to build a new facility in the East Siberian area where additional natural gas reserves with contained helium can be exploited. However, gas companies do not expect this to come on-stream before 2009. It is interesting to note that because of its very remote location, liquid helium will be shipped in rail cars.

Spiritus believes that due to the current supply crunch gas companies will wait and observe the demand trends over the next few years, and ensure that the current plants and new facilities are up and running consistently before determining whether to invest in further production capacity.

### Where does that leave pricing?

The pricing structure for Helium is very much to do with the cost of crude helium before it is refined and liquefied rather than determined by market dynamics. Most helium is associated with natural gas fields and therefore the crude availability is not generally owned by industrial gas companies but by the oil and natural gas companies. These companies set the initial pricing structures by demanding value for the crude product before refining. It is worth noting that as new sources of helium are developed, the return the oil companies want for the crude continues to increase.

In addition, the US Government has huge strategic reserves of crude helium which are managed by the BLM. However, the price of the crude helium owned by the BLM continues to increase due to a formula linked to the consumer price index. At present 1000 SCF of BLM crude helium costs \$56.50 and this will increase to \$58.75 in October 2006.

So even if the current tight supply/demand position improves over the coming six months it is unlikely that there will be any downward movement in prices for the foreseeable future, despite the increase in competitive dynamics with the entry of TNSC in the primary supply market.



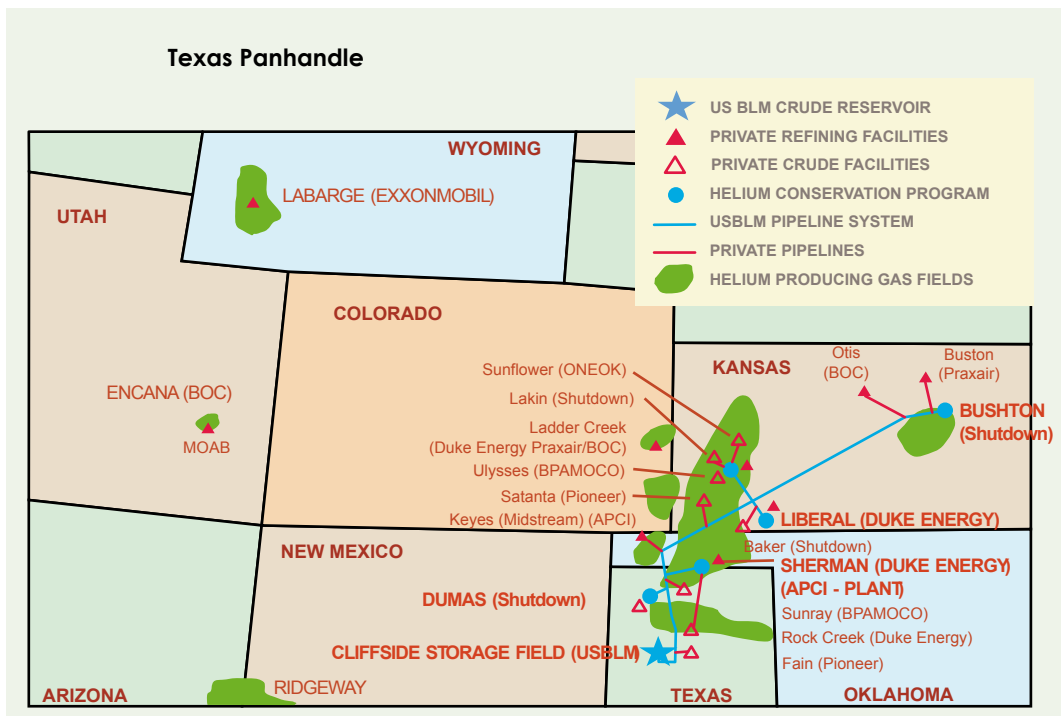
**Magnetic Resonance imaging (MRI)**

Most people are aware of doughnut shaped scanners that take 3-dimensional images in hospitals. These are in fact MRI units (see picture). In the manufacturing process liquid helium is used to cool the internal magnet down to almost absolute zero before testing and then shipping to the hospital.

At a liquid temperature of  $-270^{\circ}\text{C}$ , helium is the most effective coolant for this operation.

When the MRI is installed at the hospital, the temperature of the magnet must be maintained for continual operation. This is done with a top up of liquid helium. Older magnets need as much as 2000 litres of liquid helium a year to top up the magnet but more modern units need less than 500 litres a year due to their lower loss rate.

Producers are striving to improve MRI technology that can run at warmer temperatures, certainly at liquid nitrogen temperatures ( $-196^{\circ}\text{C}$ ) and possibly moving over to closed cycle mechanical refrigeration units. These MRI units are expected to be developed over the next five years.





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