

Up, Up, and Away...

WHERE HAS ALL THE HELIUM GONE?

By Maura D. Garvey

Helium continues to become tighter in the worldwide market through 2007 with allocations and price increases in the US becoming a major issue for many distributors and customers.

What makes helium different from major air gases like oxygen and nitrogen is that helium is the by-product of natural gas (NG) processing. This makes helium a limited resource with its supply based on:

- The overall availability of natural gas
- The availability of natural gas that contains a high enough level of helium for extraction
- The amount of processing of NG for Natural Gas Liquids (NGLs) and Liquid Natural Gas (LNG) being done. Helium is a by-product of NGL and LNG processes.

An important point to remember is that industrial gas companies do not make the investment in the raw material — crude helium; that investment is made by either the LNG companies or NGL processors. The temporary helium shortage of the past few years appears to be with us for at least the next three years because worldwide supply of crude helium has not been keeping up with the natural demand for crude to feed pure/liquid production. LNG companies and natural gas processors must make the investment to recover more crude to alleviate the tightness in supplying the pure/liquid helium market.

There were a number of problems that occurred this past year affecting crude feedstock supply in the US and worldwide. Supply interruptions were due to normal plant maintenance and operations shutdowns or to severe weather conditions. Also, helium markets had anticipated supply from two new sources of crude in Algeria and Qatar, both of which experienced technical problems and continue to be slow to reach planned capacity utilization. These problems brought to the forefront just how tight world supply of helium is in the face of fast growing worldwide demand. There has been some improvement in European production, but those gains are offset by the current and long-term decline in the US mid-continent supply of crude helium (Hugoton). Unless there are new investments in crude supply sources, supply will be capped. There is plenty of purification and liquefaction capacity, it is the crude feedstock where the world is short.

The capital required to add new crude helium supply makes the decision to invest difficult because a natural gas company not only invests in the production facility for the crude helium product, they must also invest in the operations to extract the primary LNG or NGL. The Linde Group is involved with a small project in Australia, scheduled to come on line at the end 2009. The Australian crude production represents only three percent of worldwide demand, however, so it only

begins to make a dent in the overall supply problem. Larger crude and pure/liquid helium investments are being considered for Qatar and Algeria.

Concern about limited supply and increasing worldwide demand has driven the major gas producers to actively promote and develop technology for helium conservation and recovery for their customers. Since helium use is capped by supply, part of the difference between natural demand and the real use of helium molecules will be made up through helium conservation and recovery techniques. For example, annual growth in the US helium natural demand over the past several years has been around 2-3 percent. However, helium use continues to be relatively flat through helium recycle and substitution efforts. (*See CGI February 2003, "Helium Recovery Systems: Instrumental in Coping with Short Supply."*)

Completion of The Linde Group buyout of BOC brought changes in worldwide player market shares. Linde, a smaller helium player, became a big player with the acquisition of BOC's helium production sources. Also, Taiyo Nippon Sanso became a new worldwide player when that company purchased the contract assets spun out of the Linde – BOC deal under the direction of the US Federal Trade Commission and the European Union.

HELIUM DEMAND/MARKETS AND PRICE

Over the past ten years, US and non-US regional growth in helium demand has shifted. From 1996 to 1999, there was rapid growth in worldwide demand for helium, which put pressure on US resources. Between 2000 and 2004, growth outside the US remained relatively strong but within the US demand shrank from 3.2 billion cubic feet per year (bcf) to 3.0 bcf/yr, an overall reduction of 200 million cf/yr. This fall in demand was reflective of the overall weakness in the US economy at that time, and specifically of the serious stalling of the US fiber optics industry and the movement of electronics fabs over-

seas. Since 2004, fiber optics production has been recovering worldwide and Corning announced earlier this year the partial reopening of its Concord, NC optical fiber manufacturing facility. It is interesting to note, that Corning's NC facility has Praxair helium recycle units, which reduce the consumption of helium.

Currently, the US comprises about 45 percent of worldwide helium demand, as shown in Figure 1. From 2004 to the present, natural demand growth has been about 2-3 percent. This rate of growth is expected to continue for the next five years.

Growth in Europe has tended to be slightly higher than the US because helium applications like MRI are far less saturated than in

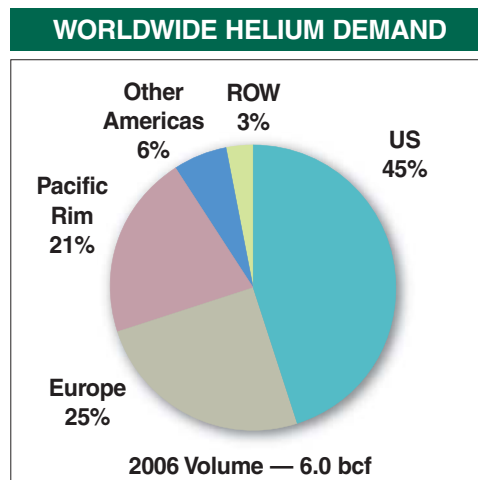


Figure 1
Source: Cryogas International Estimates and BLM

the US. According to Dan Baciu, Head of Business Development — Global Helium for The Linde Group, “Penetration of MRI in hospitals is still happening in the UK, France and Germany. Also, we have seen a migration of the older liquid helium consuming MRI units from Western into Eastern European facilities. The older units are not as efficient as the newer units and the helium volume consumption is higher.” In addition, Europe has a lot of heavy manufacturing (especially related to the automotive industry) using welding and cutting or manufacturing processes that are big consumers of helium. Europe is the second largest market for helium behind the US and comprises about 25 percent, or 1.5 bcf/yr, of worldwide helium demand. *Cryogas International* estimates that European demand will grow at about 3-5 %/year over the next five years, greater than in the US.

The Pacific Rim represents the third largest market at 21 percent of worldwide helium demand, or about 1.2 bcf/yr, not far behind Europe. The US is the primary supplier for the PacRim with the remainder of the supply coming from the new Qatar plant in the Middle East. The Pacific Rim has experienced mid to high single digit demand growth. The future of helium demand growth in specific regional markets depends on each area’s mix of technology and industrial production. Much of the electronics industry and manufacturing facilities that require large amounts of helium are located in the Pacific Rim. For example, according to Dan Baciu, “We expect the Korean helium market to experience sustained growth of 20 – 25 percent per year over the next five years due to the growth of the electronics industry. Use of helium in chip processing and in the manufacture of flat panel displays and photovoltaic cells, are examples of the types of electronics manufacturing that are using increasing volumes of helium as units

produced increase. As those markets grow, the consumption of helium goes up as well.” China’s sheer size and increasing industrialization will cause helium demand to grow there, potentially into double digit growth rates. Recent reports have shown that helium consumption in Japan, an established PacRim economy, could grow about 20 percent this year alone. Overall, the demand for helium in the Pacific Rim is expected to grow at 8-10 percent per year.

Other Americas and The Rest of the World (ROW), including the Middle East, together represent about nine percent of the global market. These regions have contributed to strong demand growth, about 8-10 percent per year, driven by emerging industrial economies in these areas. This rate of growth is likely to continue, given adequate supply, over the next five years.

For the most part, the worldwide wholesale price of crude helium is tied to the US Bureau of Land Management (BLM) price. (See a complete explanation of the BLM’s role in world helium markets “The Government’s Role in Providing Helium to Worldwide Markets”, on page 32 of this issue.) The BLM is the major source of crude helium worldwide and global helium producers have used the BLM price as their baseline. Increases in the BLM’s Open Market Sales price for helium are based on the change in the US Consumer Price Index. Price increases by major helium producers of late have been greater than this increase, due to increased production, feedstock and distribution costs. In the US, the cost to retrieve mid-continent crude helium is going up because of the acceleration of natural gas depletion in the US mid-continent. This has caused an increase in the price of crude helium and ultimately led to significant increases in wholesale and retail helium pricing.

HELIUM CONSERVATION AND RECOVERY

The recent growth in demand for helium has not been driven by new applications for helium (like MRI) as in the past, but by the increased use of helium in existing markets that are experiencing rapid growth. Helium use in electronics manufacturing, as discussed, is one such example. Growth in basic industry and infrastructure in countries like China have driven demand for helium used in more traditional applications like cutting and welding. The tight helium market, has led major industrial gas companies, their secondary distributor channels, and major customers to focus more on helium conservation and recycle as there are not the new helium molecules available to spur new applications.

As a technology company, The Linde Group has been focusing on helium substitution, recovery and recycling, all intended to conserve precious helium molecules. Dan Baciu said, "We are in the process of developing systems to allow people to use mechanical refrigeration instead of liquid helium in deep cryogenics applications. This requires capital and electric power, so it is not cheap. But the helium molecules are also scarce and expensive." Another approach to conserve helium is the "substitution of pure helium still used in some welding and cutting applications with less helium-intensive mixtures," according to Dan Baciu. In the US, where helium used to be relatively abundant and inexpensive, pure helium has been used for such applications. However, in Europe where helium has not been as plentiful and typically more expensive than in the US, effective helium mixtures have been used in welding & cutting for quite some time. The Linde Group has been working to bring their gas mix technologies to the US as a way to conserve helium there. Praxair focuses

on smaller applications that were formerly not economically feasible for recovery and recycling. Recovery not only preserves the molecules but also helps to mitigate the effects of supply disruptions to the customers' processes.

Helium recovery is also on the increase to minimize helium losses during the MRI manufacturing process as well as at helium transfer facilities. Gas companies, like The Linde Group, are actively improving operating practices at their transfer facilities to reduce helium losses.

WORLD HELIUM RESERVES AND CRUDE AND PRODUCTION

According to data published in the United States Geological Survey (USGS) Mineral Commodity Summaries (US data originates from the US BLM helium group) of January 2007, the United States represents 21 percent of the world's known helium reserves. It produces 71 percent of the world's helium and is the single largest consumer of helium. Helium produced in Algeria, Poland and Russia is sold almost exclusively into European markets, and helium produced in Qatar is sold exclusively into Asian markets. These countries combined own 79 percent of the worldwide helium reserves yet produce only 29 percent of the world's helium.

According to the USGS, world production of helium grew about 17 percent between 2005 and 2006 while US production increased 4.2 percent. US helium production from natural gas is now producing at maximum capacity. Potential for shortages of helium in the US remain as demand continues to outpace supply, the US experiences continued depletion of its mid-continent gas fields, and production

EFFECTS OF THE US HELIUM SHORTAGE ON THE BALLOON INDUSTRY

When people think of balloons, they recall special occasions like a child's multi-colored birthday party, a wedding full of white floating centerpieces, or perhaps a large cloud of black balloons delivered to a co-worker on his 40th birthday! Parties are important to everyone and those in the balloon industry will tell you, "Balloons make the party!" There are not many industries like the balloon and party goods business where the products manufactured are centered on fun and entertainment. For the balloon industry, however, this fun depends largely on the use of the lighter-than-air properties of helium and no one in the business likes to entertain thoughts of the effects of a long-term helium shortage.

At the core of the US balloon market are a handful of balloon manufacturers who utilize a system of distributors to market and wholesale their balloons and balloon accessory products to the retailer. Balloon retailers consist of party stores, grocery stores, independent balloon decorators, entertainers, florists, and mass merchandisers to name a few. Included in the balloon industry are sub-industries, like national helium brokers who supply helium for the balloon industry. (There are many distributors and retailers who have large helium rental businesses as well.) Others in this category include a manufacturer of a product used to extend the floating life of helium-filled latex balloons, manufacturers of balloon inflation equipment, and manufacturers of balloon weights.

In the early stages of the helium pipeline disruption and plant shutdowns, reports of shortages were spotty and regional. Today the repercussions are being felt everywhere with reported price increases of 40-70 percent and inconsistent, and in some regions nonexistent, helium supply to the balloon industry. Party stores are suspending helium rental to the public, decorators are moving their customers to air-filled decor, and distributors are rationing existing customers while turning down new accounts every day. Helium balloon suppliers are working overtime and absorbing most of the price increases in an attempt to hold down price to their clientele. So far the impact of the shortage has been felt mostly at the retail level but as helium becomes more and more limited for fill use, it won't be long before the effects are felt all the way to the top.

The balloon industry has faced adversity before. In fact, the International Balloon Association (IBA) was founded because of such adversity and the IBA will work to help the industry adapt during this time of shortage with product recommendations and ideas for air-filled alternatives at the retail level. IBA will also lobby producers to continue supplying helium for fill use as we believe our industry should not be swept under the rug and treated as a casualty of the helium shortage problems. Creativity and forward thinking are the foundation of the balloon industry and we will continue to work to supply the balloon loving public with floating fun.

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interruptions. The mid-continent gas fields are experiencing a depletion of about 6-7 percent per year. If we assume that mid-continent extraction of crude helium is 1,400 mmcf/yr in 2007, at current depletion rates, this will reduce supply to about 700 mmcf/yr in ten years, half of today's crude supply. This decline exceeds the crude required to feed the currently typical two-train 600 mmcf/yr pure liquid plant installed by Arzew or Duke Energy. Last year the pipeline managed by the US Bureau of Land Management (BLM) experienced pressure problems which made it difficult for companies hooked into the line to draw crude helium. (*See BLM feature on page 32 in this issue.*) That problem was resolved, but new problems like frozen well heads due to a severe winter in the mid-West reduced crude supply. These supply interruptions are a normal occurrence and will continue as they are the nature of plant operations. BLM is producing at maximum capacity. Helium will remain tight and prices will continue to increase until new investments in crude helium supply are made.

WORLDWIDE SUPPLY AND DEMAND BALANCE

While US consumption of helium remained relatively flat from 2004 to 2007, helium exports have been increasing at a far greater rate. Helium exports increased over 20 percent per year from 2005 to 2006, absorbing practically all available crude and effectively capping supply. European consumption grew four percent from 2005 to 2006 while their production increased at 20 percent during the same period, decreasing demand for US exports to Europe. Europe needs to increase this supply pace to keep up with overall worldwide demand since the US is already at maximum capacity utilization.

Future supply sources must be developed to meet future supply needs, for example, from Algeria and Qatar.

FUTURE SUPPLY

While the world has plenty of helium refining and liquefaction capacity, future production of crude helium hinges upon additional natural gas processing (or other processing), where the natural gas contains a critical amount of helium. Investment in this type of processing typically takes three years to establish. The Linde Group's project in Australia will produce 150 – 175 mmcf/year when it comes fully on line by end 2009. New potential sources of helium exist in Algeria, Qatar, and Wyoming, and Kovytko in Eastern Russia. But, wherever raw helium exists, it is likely to take at least three years to produce crude and then pure/liquid.

CONCLUSIONS

We can expect increasingly tight crude helium supply for at least three years, and therefore, a likely shortfall in wholesale and retail pure/liquid. With the US mid-continent and other US sources producing at maximum capacity, new production from Algeria and Qatar will be needed to alleviate the anticipated shortfall in helium supply and to offset current tight supplies, these new investment plans need to be accelerated. Otherwise, the shortfalls will continue beyond 2010. In this event, we will all continue to experience healthy increases in wholesale and retail helium prices.

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