

Helium on the Rise

THE GLOBAL HELIUM SHORTAGE — MANAGING TIGHT SUPPLY, STRONG DEMAND AND RISING COSTS

An Air Products Special Report

■ Helium Transfill
● Helium Production Plant



For any company that requires helium for its operation, especially those that value helium as an essential ingredient, ongoing difficulty in acquiring supply and increased prices attached to that supply are well-known issues. How we have arrived at this point and, more importantly, what we as an industry are doing to address these issues make for interesting and much needed discussions.

NEW FIELDS AND CAPACITY NEEDED

The current industry supply and demand imbalance is the direct result of the industry's dependence on just 16 worldwide helium sources, of which only six, operating at or near capacity today, account for nearly 80 percent of worldwide supply. This dynamic has made the industry highly vulnerable to both planned and unplanned production outages.

The United States, which contributes over 70 percent of worldwide helium supply, has long been the locomotive powering the worldwide helium train. However, US capacity is stretched thin these days, as its source fields, many of which date back to the 1950s, are in decline. Furthermore, new global sources of supply that were to come on-stream in Algeria and Qatar in 2006 failed to materialize on time, or at the production rates anticipated. This has caused a general global shortage of product supply that's resulted in market prices rising faster than underlying costs. While helium markets are in need of new fields and capacity, new sourcing opportunities around the world are both scarce and slow to develop.

PRICING PRESSURE

The US government, with about 700 million nm³ of helium reserves remaining from its stockpiling efforts in the 1960s and 1970s, has helped mitigate market tightness by selling these reserves through a program managed by the Bureau of Land Management (BLM), which oversees US helium reserves. BLM sales currently supply about 30 percent of global demand for helium feedstock. Without access to BLM reserves, worldwide helium production capacity today would satisfy only 70 percent of demand and prices would be even higher.

Helium price increases in recent years have initially resulted from new benchmark costs for crude helium established by the BLM, and then by tightness in supply to meet demand growth. Helium pricing pressure can also be linked to US market pricing catching up with

Asia and Europe and general increased costs in the system relating to feedstock, production and distribution. (For more on the BLM, see "The US Government's Role in Providing Helium to Worldwide Markets," *CryoGas International*, October, 2007.)

The global helium market will continue to be tight for at least three to four years, as the industry awaits the development of significant new sources of supply in Qatar, Algeria and Russia. It is expected that projects will be executed globally in the 2008 to 2009 timeframe to bring existing plants to full capacity and add incremental volume to the system.

A GLOBAL LEADER

With nearly 60 million nm³ per year in production capacity and a 32 percent market share, Air Products is the global leader in helium supply. Through diligent management of its global supply chain, Air Products has maintained reliability of supply and avoided product cut-offs. It has not had to declare force majeure in this helium market where shortages are becoming a reality. The company credits this success to a business practice of not over-committing its resources and an advanced distribution system.

Air Products has also pioneered many of the helium extraction, production, distribution and storage technologies that are relied on by the industry today. In fact, liquefied natural gas (LNG) technology, in which Air Products is also a global leader, reduces the costs to recover helium by as much as 50 percent. Today the company maintains the world's largest helium production and distribution system and operates numerous facilities around the world.

VALUE ADDED SERVICES

Air Products offers a host of value-added services to its customers including a helium consulting service, which offers technical advice regarding minimizing waste and improving efficiency. Air Products is also active in identifying opportunities for recovery and recycling of product. For example, in the case of magnetic resonance imaging (MRI) equipment, which uses liquid helium as a coolant for superconductivity, Air Products has technology for recovering vaporized helium that was traditionally vented while filling, cooling down, and testing the equipment's magnets. This technology allows Air Products to recover and reprocess this helium. In addition, in industries where

WORLDWIDE HELIUM PRODUCTION

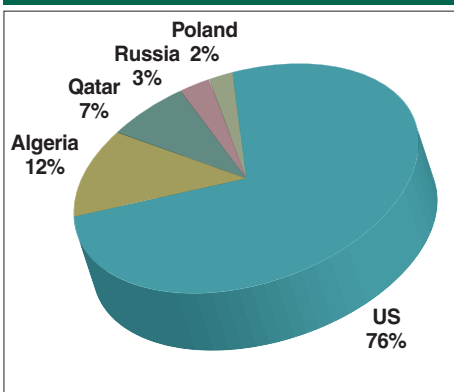


Figure 1 Source: Air Products and Chemicals

Air Products supplies multiple products, such as the electronics industry, it has been helpful to customers to work with a supplier that will reliably service a multitude of their needs.

AIR PRODUCTS' HELIUM JV WITH MATHESON TRI-GAS

In October 2007, Air Products announced plans for a joint venture with Matheson Tri-Gas to jointly build and operate a liquid helium production plant near Big Piney, Wyoming. This production facility would process helium recovered from natural gas in the Riley Ridge Field in Wyoming. The Riley Ridge Field is the second largest helium-rich natural gas field in the United States and is believed to contain sufficient helium reserves to support production for decades.

Production at this new plant is anticipated to commence in 2009. The plant is designed to produce five million nm³ per year at start-up, with expectations for future capacity expansion. It would process crude helium produced by a natural gas processing facility that would be owned by Cimarex Energy Co. and its partner, Riley Ridge LLC.

Air Products is also actively pursuing further new sources of supply across the world.

SAFEGUARDING THE FUTURE

Despite the current helium shortage, sufficient global helium reserves are believed to exist to satisfy demand for the foreseeable future. However, because the world's helium supply is finite and irreplaceable, we must work to protect this invaluable resource by focusing on three initiatives: conservation, recovery and recycling.

- **Conservation** — maximizing the extraction of helium from all natural gas production facilities around the world, regardless of whether it is needed to satisfy current demand, and minimizing losses in the distribution supply chain through the final points of use.
- **Recovery** — capturing effluent helium from given processes and reprocessing it for eventual reuse.
- **Recycling** — capturing effluent helium from a given process and returning it to the same process at the same location (after on-site reprocessing, as necessary).

Air Products is dedicated to developing and implementing efficiency improvements to minimize helium product loss at our facilities and assets, as well as developing new helium recovery and recycling technologies. Further, Air Products is dedicated to helping our customers do the same and is ready to assist helium end-users by providing facility reviews to ascertain whether new or updated helium recovery and recycle systems can help the end-user reduce its helium consumption.

THE SKINNY ON HELIUM

Helium exhibits a number of extreme physical and chemical properties that lead to its use in a broad range of industrial and commercial applications. The principal markets for helium today are for cooling superconductors, such as MRI equipment in hospitals, welding, pro-

ducing fiber optic, semiconductor, flat panel and solar material, and inflating balloons.

Total market demand in 2006 was 160 million nm³. Historical growth rates have been substantially higher than global GDP, but have been steadily declining and are expected to continue only slightly above GDP rates. Liquefied helium is distributed in bulk containers, each carrying over 25,000 nm³. Helium is the only industrial gas distributed in such large quantities on a global basis. (See *CryoGas International's* helium market update, "Up, Up, and Away," October 2007 Issue, for more details on the helium market.)

OUTLOOK FOR THE FUTURE

Total worldwide reserves of helium are estimated at 40 billion nm³ (1,400 billion scf), according to the US Geological Survey, *Mineral Commodity Summaries*, January 2007. This estimate, which indicates that reserves theoretically could provide approximately 240 years of supply at current consumption rates, includes those resources that are currently regarded as economic, as well as those that are considered marginally economic, and some that are classified as subeconomic.

Although several exploratory projects are underway around the world to develop new sources of helium supply, the best prospects near term are in the Middle East and North Africa. These regions have many large, helium-rich (up to 0.5 percent) natural gas fields that are already producing natural gas for export, either as a gas by pipeline to Europe or as LNG by ship. For example, it is estimated that helium levels in Algerian natural gas exceed 150 million nm³ per year. By these estimates, Algeria alone has the capability of fulfilling more than 90 percent of today's worldwide helium demand.

However, less than 25 million nm³ per year of this helium, under 20 percent, is actually being recovered in Algeria today.

LONG TERM

Although hydrogen is more abundant on earth, helium is the most common element in the universe. The radioactive decay of heavy metals continuously forms helium in the earth's crust.

The vast majority of this helium gradually permeates through the earth's surface. Being much lighter than air, the helium rises through the atmosphere and eventually dissipates into outer space. The earth's atmosphere contains less than 0.001 percent helium.

Given today's technology, the extraction of helium from the atmosphere is unlikely ever to be considered economically attractive, and the only commercially viable sources of helium are the limited number of natural gas fields around the world. However, the practical life of these reserves will be reduced through failure to capture all of the helium that is flowing through natural gas processing plants, and by the possibility that some of the helium-containing natural gas fields will not be developed within the foreseeable future. Nevertheless, it is not anticipated that availability of viable helium reserves will become a limitation to continued helium demand growth until sometime around 2050.

For more information on helium, visit www.airproducts.com. □

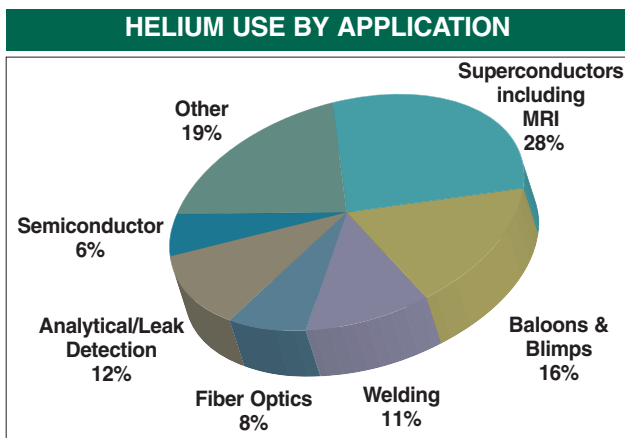


Figure 2

Source: Air Products and Chemicals