



**Helium**



*Praxair's helium production plant in Bushton, KS, is one of our three world-scale facilities in the U.S.A.*

## **A Unique Resource For Unique Applications**

Just as helium is unique among our natural resources, customers who need it require a supplier with unique capabilities, including:

- Reliable, long-term supply
- Stringent quality assurance
- Global supply and distribution resources
- Technical support in applications and conservation technologies

Praxair meets all these requirements with sourcing, and production and distribution facilities to supply a wide range of industries worldwide — today and tomorrow.

Praxair has more in-depth, hands-on experience in helium supply, and related technologies and services than any other company in the world. Since 1917, we have been a leader in helium supply, distribution and processing technology. Today, Praxair is also among the leaders in helium refining. Our long-term supply of crude helium is supplemented by stored reserves, so our customers enjoy the security of knowing we can meet their helium needs both short- and long-term without depending on third-party wholesale suppliers. But our helium production capabilities are just the beginning.

- Our technical capabilities include extensive experience both in helium conservation strategies for a wide range of industries and in the design of safe, reliable and economic recovery processes, including proprietary membrane and adsorption systems. In fact, Praxair's patented Helium Recovery Technology and Systems (HRTS) offer a conservation alternative that can make it economically feasible to replace another product with helium to improve production efficiency.
- All our helium production facilities are ISO certified, proof of our commitment to quality.
- Praxair's distribution centers are strategically located to serve customers 24/7, worldwide.
- Praxair operates a worldwide network of transfill stations to meet all our customers' needs, no matter where they are located.

*All our helium production facilities are ISO certified.*





Praxair is an industrial gases industry leader in helium refining.

**Only Helium Has All These Properties:**

- Chemically inert
- Nonflammable
- High thermal conductivity
- Lowest boiling point
- Low molecular weight
- Small molecular size
- Nontoxic

**Praxair: A World Leader In Helium Resources And Supply**

A reliable, long-term supply of helium for our customers requires the global resources necessary to obtain crude helium from the limited number of helium-rich natural gas deposits around the world.

Praxair has established long-term contracts and sourcing arrangements with many of the world's leading natural gas producers. Together, we evaluate and develop new global sources of helium so we will have the product our customers need, when and where they need it.

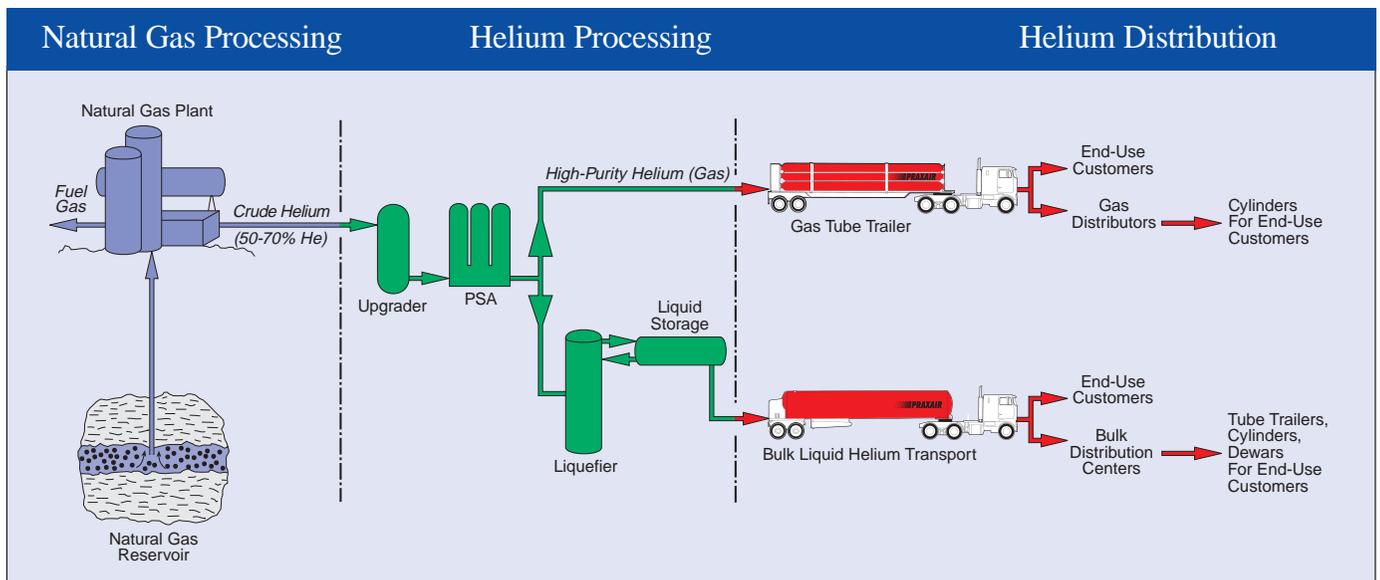
**Gaseous Helium: Multiple Options**

For gaseous helium users, Praxair works closely with its customers to optimize helium use in their processes and products. Through customer relationships, Praxair has developed systems that enable customers to gain an important edge on their competition — everything from ultra-high-purity delivery systems, to proprietary heat exchange technology, to exclusive helium recovery programs.

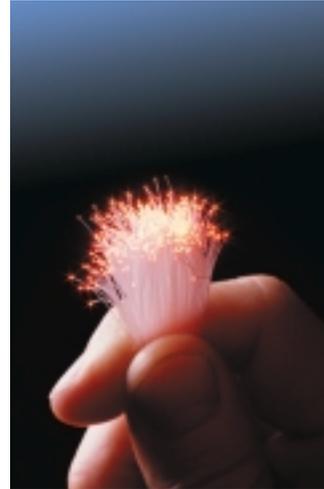
Praxair's supply options include gaseous helium delivered in tube trailers, receivers or modules. Helium in cylinders is also available through our extensive distributor network.

Tube trailers, which come in a wide range of capacities, can be parked at your site and connected directly into your system. Receivers can be permanently installed at your site and filled as you need them. Skid-mounted modules are available for diving support vessels and for transporting gaseous helium on container ships.

**Praxair's Helium Supply And Recovery**



*Gaseous helium is critical for producing optical fibers for telecommunication cables.*



## **Endless Application Possibilities**

Helium's ability to provide a protective atmosphere coupled with Praxair's helium recovery capabilities make it possible to cost-effectively produce optical fibers used in telecommunication cables, a key component of "information highways" which carry vast amounts of data. Gaseous helium also allows manufacturers to grow specialized crystals needed for electronic semiconductors or crystals with the optical properties required to produce masers and lasers.

Another role for helium's inertness is creating controlled environments for manufacturing semiconducting devices that are so critical in electronics, as well as for providing enhanced thermal conductivity.



*Helium's ability to create controlled environments makes it essential for manufacturing semiconductors.*

Its high arc temperature and high heat transfer combined with helium's inertness enable metallurgists to extract, smelt and refine such advanced materials as niobium and tantalum, which are used to manufacture superconductor wire, as well as zirconium and titanium.

Helium is also an ideal refrigerant for cryogenic research. Its ability to remain fluid at temperatures near absolute zero is invaluable in magnetic resonance imaging (MRI) and nuclear magnetic resonance (NMR) spectroscopy where liquid helium helps cool metal alloys below their critical temperatures, creating superconductors.

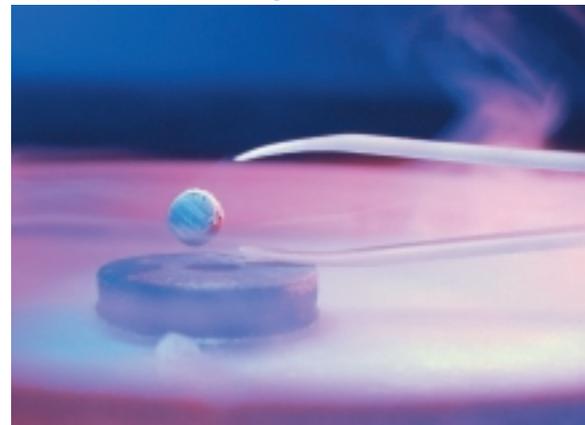
Other applications for these superconducting magnets include research in advanced physics, experimental treatment of various cancers, and the properties of materials at extremely low temperatures, which can lead to new and better products.

Because its molecules are so small, helium is superb for detecting and locating minute leaks in pressure and vacuum systems or the absence of leaks. Its leak detection capability is invaluable to the aerospace, semiconductor, nuclear, cryogenic vacuum, refrigeration, food and automotive industries.



*Helium is invaluable in magnetic resonance imaging.*

*Liquid helium helps create superconductors by cooling metal alloys below critical temperatures.*





*Helium is used to purge and pressurize liquid hydrogen fuel systems in rockets and spacecraft (photo courtesy of NASA).*

Helium's low solubility and low boiling point (-452°F, or 4.2°K) combine with its inertness to purge and pressurize the liquid hydrogen fuel systems of rockets and spacecraft. It is the only inert substance that remains a gas in such low-temperature environments.

Deep sea divers use gaseous helium as a carrier gas for oxygen in the gas mixtures they breathe. This makes possible pioneering undersea scientific investigation, as well as the exploration and development of offshore oil and gas resources.

Helium plays an important role in various instrument applications. In chromatography, helium is used as a carrier gas to reliably analyze the purity and composition of virtually any chemical substance.

Helium in balloons also lifts important cargos ranging from weather forecasting instruments, television equipment and radar stations, to communications relays, blimps and aerostats. And it helps generate magic, reflected in the eyes of a child whose birthday party is brimming with brightly colored, helium-filled balloons.

Of course, gaseous helium is critical for welding. Helium's inertness, high arc temperature and high heat transfer rate make it an ideal shielding gas to weld stainless steel, aluminum, copper, nickel, titanium and many alloys.

Just as important, laser cutting applications benefit from helium used inside the resonator, where the laser beam is generated, to cool laser gases.



*Helium is a carrier gas for the oxygen deep sea divers breathe.*



*Gaseous helium is an ideal shielding gas for welding stainless steel, aluminum and other metals.*



*Helium gives a lift to everything from party balloons to aerostats (71M® aerostat photo courtesy of TCOM, L.P.).*

*Small-volume users receive their liquid helium in high-performance, superinsulated dewars.*



## **Raising Profits With Praxair's Helium Recovery Systems**

Optical fiber manufacturing...Metal processing furnaces...Leak testing...Airships...These are some of the many applications where Praxair's patented Helium Recovery Technology and Systems (HRTS) make it economically feasible to replace other gases in a customer's commercial process.

To demonstrate the effectiveness of our HRTS units, Praxair operates a customer demonstration recovery facility.

Customers see first-hand how capturing and recycling source helium using Praxair's HRTS can dramatically reduce overall manufacturing costs, improve production efficiency and/or address environmental concerns while conserving this unique, non-renewable resource.

Each system begins with an in-depth review of a customer's on-site operation. This ensures that Praxair's technical team designs, fabricates and installs the optimum system to meet their needs. The customized system they receive factors in operating an open or closed system, volume and flow, types and quantities of impurities, as well as site-specific concerns. The result is a system that captures helium cost-effectively, purifies it when necessary, and recycles helium to the process.

The specific technology used for purification depends on the recycled impurities and required cleanup. Technology can range from simple filtration to Pressure Swing Adsorption (PSA), membrane modules and cryo-adsorption. All, however, significantly reduce high-value helium waste, while the quality and integrity of the process and end-product(s) are maintained, ensuring helium recovery and purity.

### **HRTS customers benefit from...**

*Reduced production costs* — Up to 99 percent of potentially wasted helium can be recycled, nearly eliminating the entire replacement/supply costs.

*Increased production options* — Praxair customers can potentially increase production rates by replacing less-effective alternatives with helium's preferred heat transfer and inert properties — all made cost-efficient with Praxair's HRTS.

*Increased helium flow rates* — Savings are maximized by economically increasing helium flow rates, which in turn allows for faster processing rates.

*Customization* — Praxair specializes in developing conservation technologies and our engineers have the expertise and field experience to design a custom-fit, site-specific HRTS.

## **Praxair has developed solutions for...**

*Optical fiber manufacturing* — More than 100 installed HRTS units are helping fiber optic companies worldwide recover, purify and recycle helium.

*Metal processing furnaces* — For more than a decade, a major producer of niobium and tantalum has been relying on an HRTS unit for its furnace operations.

*Leak testing* — A leading industrial company relies on a patented HRTS unit from Praxair to cost-effectively recycle previously vented helium.

*Airships* — An independent, skid-mounted HRTS unit customized to meet a customer's needs for tethered aerostats is also easily adaptable for a variety of industrial applications.

## **Liquid Helium: From Dewars To On-Site Storage**

As with gaseous helium, Praxair's liquid helium customers also benefit from our vast experience across the entire spectrum, from production to application. Here too, a range of supply options enables customers to select the method that best meets their needs.

For small-volume users, Praxair offers high performance, superinsulated liquid helium dewars in capacities from 60 to 1,000 liters. High-volume users can take advantage of our bulk supply containers, ranging from 1,000 to 15,000 gallons (3,785 to 56,775 liters).

In short, we have the equipment and design capabilities to provide customers with the right kind of liquid supply system for their specific needs, and we can also incorporate our recovery technology to reclaim evaporated gas.



*The helium recovery rate for a specialty coatings customer is over 95 percent with a membrane purification system (right).*

*This PSA system allows an exotic-metals producer to recover more than 99 percent of the helium it uses (left).*

*Liquid helium cools superconducting magnets in MRI equipment for diagnosing health problems.*

## **High-Tech Applications And More**

Liquid helium has become one of the most important materials in science, dramatically increasing demand for this unique product. Application of the principles of superconductivity — the ability to flow electricity through a material with zero resistance — has led to the development of some of the most remarkable diagnostic and research equipment ever created.

Liquid helium helps cool certain metal alloys below their critical temperature, where they become superconducting. These superconductors are used to make magnets essential in magnetic resonance imaging (MRI) equipment, which produce detailed images of body tissues and allow accurate diagnosis of many health problems without surgery. Using similar technology, researchers can probe the structure and properties of almost any compound using nuclear magnetic resonance (NMR) spectroscopy.

Superconducting magnets are vital to research in advanced physics, where they help particle accelerators reveal the building blocks of matter. These devices are also used in experimental treatment of various cancers.



You will find superconducting materials in power generation and transmission, fusion research, magnetohydrodynamic (MHD) propulsion systems for ships, superconducting magnetic energy storage (SMES), electronics and magnetically levitated (Maglev) transportation systems. Using liquid helium, scientists can conduct research into the properties of materials at very low temperatures, lending new insight into how these materials can be used to create new and better products.

## **Worldwide Distribution**

To provide the helium supply our customers need, Praxair operates a worldwide distribution network — one of the most sophisticated and extensive in the industry. It reaches from North and South America, through Europe and the Pacific region. We are also focused

on the future, constantly exploring new possibilities to stay ahead of the growing demand.

We use our present locations and hundreds of affiliated distributors to ship helium to every part of the world — by land, sea and air. So, no matter what quantity our customers require or where they are located, we have the unique capability to deliver helium when they need it.

## **Working With The Leader**

High product quality. Reliable delivery. Long-term global supply. Hands-on expertise. Customer service 24 hours a day. These are the reasons why increasing numbers of industries worldwide rely on Praxair for their helium needs.

These industries know that our helium supply is just the beginning. They have experienced firsthand the value-added service and support that have made a difference for their operations.

See for yourself. Contact your nearby Praxair office or representative today, then experience the difference Praxair helium can make for you.



*Praxair's trained customer service specialists assist NMR researchers in safe and efficient management of their helium supplies.*



© Copyright 1996, 2002  
Praxair Technology, Inc.  
All rights reserved

Praxair, Inc.  
39 Old Ridgebury Road  
Danbury, CT 06810-5113  
USA

[www.praxair.com](http://www.praxair.com)  
[info@praxair.com](mailto:info@praxair.com)

*Telephone:*  
1-800-PRAXAIR  
(1-800-772-9247)

*Fax:*  
1-800-772-9985

*Praxair* and the *Flowing Airstream* design are trademarks or registered trademarks of Praxair Technology, Inc. in the United States and/or other countries.

The information contained herein is offered for use by technically qualified personnel at their discretion and risk. All statements, technical information and recommendations contained herein are based on tests and data which we believe to be reliable, but the accuracy or completeness thereof is not guaranteed and no warranty of any kind is made with respect thereto.

Printed in the United States of America  
5-02

P-7827B 1M