Dismantling the Helium Empire

The Bureau of Mines' helium production business is headed for the auction block; the cost could be higher prices for the military and for federally supported research

For the average American helium is merely a lighter-than-air gas that makes balloons and blimps float. The growing applications of helium in industry, medicine, and research largely go unnoticed. The U.S. government's role in stockpiling and producing helium for military and scientific needs is even more obscure.

The Bureau of Mines' helium operations are a tiny part of the Department of Interior's sprawling bureaucracy. But its Exell helium refining plant near Amarillo, Texas, is fast becoming a battleground for government policy-makers and private helium producers. The Office of Management and Budget (OMB) has targeted the helium operation as an enterprise that belongs in the private sector. So, Interior is considering selling Exell and may allow industry to tap the government's massive helium stockpile.

OMB's proposal has ramifications that are larger than ideological questions about whether government belongs in the business. The Department of Defense, the National Aeronautics and Space Administration (NASA), and other federal agencies may save money—or end up paying more for helium. The "privatization" of the government's helium operation could be worth millions of dollars to industry if the Administration goes ahead.

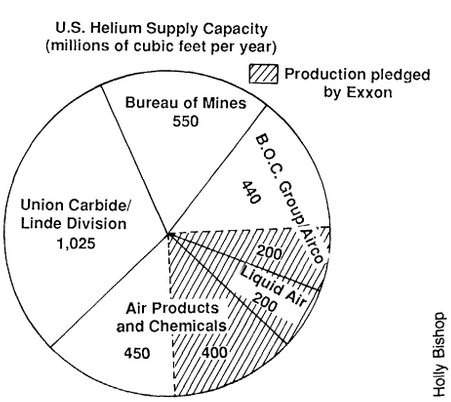
The proposal has intensified the rivalry between Union Carbide's Linde division, Air Products and Chemicals, Inc., the Airco Industrial Gases division of B.O.C. Group, Inc., and Exxon. The government's plan to sell off its purification plant poses both an opportunity and a threat to companies seeking to preserve or strengthen their positions in the market.

The call for privatization comes at a time when helium use is growing in industry and the federal sector. The gas is used in welding, creating inert atmospheres for growing crystals, leak detection, cryogenics, manufacturing fiber-optic cables, and other areas. The proliferation of magnetic resonance imaging machines in health care is one major growth area. This diagnostic tool, which relies on helium-cooled superconducting magnets, accounts for 10% of commercial helium sales, says George F. Diehl, manager for helium products at Air Products.

Overall federal demand for helium rose 2% between 1985 and 1986, a significant increase considering that the cancellation of space shuttle orbiter launches after the Challenger disaster cut sales to NASA from 120 million to only 70 million cubic feet. The decline in the space agency's consumption was offset by rising demand from the Strategic Defense Initiative, advanced weapons systems development programs, and other federal research activities. The resumption of space-shuttle flights, the Navy's plan for building a new fleet of blimps, and the proposed construction of the Superconducting Super Collider all point toward continued growth in federal helium use.

The House Appropriations Committee has blocked a sale of the helium plant in fiscal year 1988, but this action only defers the fight until next year. Meanwhile, the Interior Department is proceeding with an economic evaluation of its helium operations. That is expected to serve as the basis for the Administration next year to submit to Congress a concrete plan for reducing government involvement in helium production. It appears certain that the government would retain ownership of the stockpile (34.6 billion cubic feet of crude helium) and continue to manage it.

The appropriateness of allowing the Bureau of Mines to continue to be the government's sole supplier of refined helium is questioned by Linde and Airco. They claim that the government is in "direct competition with industry." In particular, commercial producers allege that the government helium enterprise is a drag on prices. Enough private helium production capacity currently exists—2.7 billion cubic feet—to meet all industry and federal needs, analysts note.



Helium capacity. *Two-thirds of the nation's helium production capacity is now in use. Exxon has contractual commitments to supply Air Products and Chemicals, Airco, and Liquid Air with the output from its plant.*

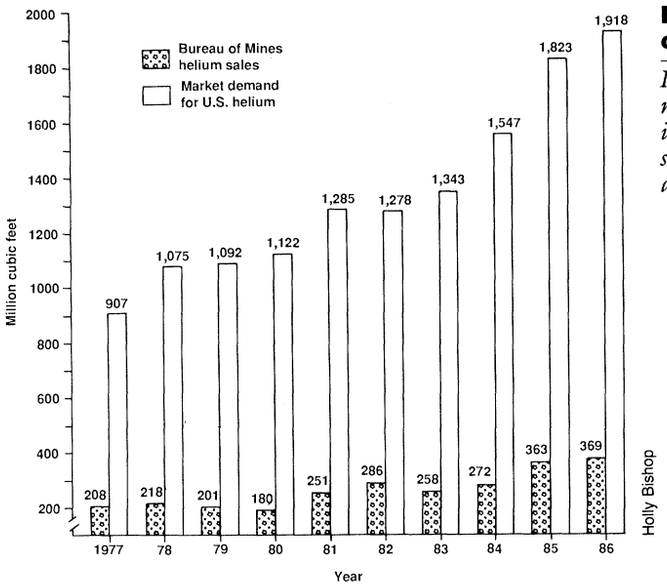
Federal agencies are required to buy helium from the Bureau of Mines under the Helium Act of 1960. In 1986 the Bureau of Mines supplied 369 million cubic feet of helium to government facilities and government contractors, 25% of the domestic market. Total world demand for U.S.-produced helium in 1986 was 1.92 billion cubic feet.

Built in 1943, the government's Exell plant can refine 550 million cubic feet of helium annually. But even though it has been upgraded recently, it is "inefficient," contends Roger Maddox, manager of helium operations for Exxon. He says the facility is "antiquated" and in need of an extensive overhaul. Phil S. Kornbluth, helium products manager at Airco, shares Maddox's assessment.

Interior officials, however, have repeatedly defended the government activity. "We are not in this business for the purpose of selling helium," says helium operations director Armond A. Sonnek. "We're in the business to serve federal agencies because at one time they expressed concern about having a secure supply of helium."

While Interior is laying the groundwork to sell Excell, it is not certain that it will be auctioned off. In testimony before the House subcommittee on mining and natural resources in February 1986, Robert Horton, director of the Bureau of Mines, said, "The sale of the operation, in my mind, would not result in any net gain to the federal government. I believe our operations are as efficient as any in private industry." Horton says the plant continues to operate efficiently today.

Even so, some federal purchasing agents, such as Gary Childers of Los Alamos National Laboratory, are not convinced it is always cheaper to buy through the government. Intersupplier competition, he says,



Rising consumption

Industry's share of the market has risen steadily in the last decade with the surge in private sector demand for helium.

might produce lower prices. Bill Reardon, purchasing manager for Fermi National Accelerator Laboratory, agrees. "All the bureau has meant to us is a higher price. The commercial guys could have sold us this stuff cheaper," he says.

In the late 1960s and 1970s the helium industry's prices were lower than those charged by the bureau. It is doubtful, however, that federal research agencies and the military can count on lower prices from industry in the future. The Bureau of Mines sells helium gas at $37.50 per 1000 cubic feet at the plant gate whereas industry prices range from $37 to $50. Similarly, the bureau charges $45 per 1000 cubic feet for liquid helium (gas equivalent) compared to a range of $50 to $65 in industry. Federal agencies, says Airco's Kornbluth, are unlikely to get any bargains from private suppliers.

Arthur Francis, a former Linde executive who continues to work for the company as a consultant, says the government and industry should be charging more for helium. "There are projects capable of paying four or five times the current price of helium," he says. Prices are somewhat depressed, industry officials argue, partly because a minute portion of government helium gas sales made to approved contractors ends up in the private market.

Francis, who contends that federal prices are artificially low, says the government is "at the crossroads" with respect to the future operation of the Bureau of Mines' helium plant. While there is enough crude helium in the bureau's Cliffside, Texas, stockpile to supply federal agencies for more than 20 years, the government's refining capacity could peak in 6 years, assuming a 7% rise in annual helium demand.

"Eventually they are going to have to expand the size of their plant," observes Francis. Industry officials estimate the cost at $10 million or more, depending on how much refining capacity the government chooses to add. That also would force the bureau to raise its helium prices. Alternatively, the agency could minimize any rise in federal helium prices by having industry supply just that portion of the government's needs that exceed the Exell plant's capacity.

The last thing commercial helium suppliers want is for the bureau to augment its refining capability. Industrial helium producers also will need to build new refining plants in the 1990s. Capital investment decisions could be made less risky if it were clear that the federal government would have to rely on the private sector to supply at least a part of its refined helium. At best, companies say, the government should be allowed to service perhaps 50% of federal agency needs. Surplus refining capacity in industry would be reduced and helium prices could increase as a result, Kornbluth admits.

The Bureau of Mines has produced helium since 1929, and until 1961 it was virtually the sole supplier. Concern then about a possible helium shortage in the future led Congress to pass the Helium Act of 1960, which established a national helium stockpile. The purpose was to capture a huge store of helium that would otherwise have been vented by natural gas producers working the Hugoton-Panhandle gas fields that run from the southwestern corner of Kansas, across Oklahoma and into northern Texas.

The legislation authorized the Secretary of Interior to contract with private companies to fill the stockpile with crude helium stripped from natural gas being produced in the Hugoton-Panhandle field. This, in turn, created the impetus for industry to expand helium production. A string of helium purification plants was built along the 450-mile pipeline that served the government's Cliffside, Texas, helium storage facility. The government purchased about 28 billion cubic feet from industry between 1961 and 1973.

But the concern about helium shortages (*Science*, 24 February 1984, p. 789) that existed through the 1970s has waned. The massive reserves found in the Riley Ridge area and the Madison Formation in Wyoming are thought to contain some 200 billion cubic feet of helium. This is enough to supply domestic and overseas markets well into the next century. Exxon, the first company to exploit this source of helium, began operating a 850-million-cubic-foot-per-year refining plant in September 1986.

This plant added substantially to the nation's refining capacity and has intensified industry's interest in taking over the federal helium supply market. Overnight, Exxon has become the largest player in the helium refining segment of the industry. The company wholesales its production to Air Products, Airco, and Liquid Air Corporation, rather than distributing the product itself. And with some firming of oil and gas prices, it could increase its output substantially in the early 1990s.

Although this added capacity has softened prices, in the long run, Linde's Francis says, helium costs must rise considerably so companies can justify tapping new helium-rich gas fields and building new refining plants. "It will not be generated under present economic conditions," he says. Costs for government-supplied helium could rise, too, if the bureau adds capacity. In theory, bureau price hikes could be smaller since the government would only need to recover its investment and cover operating costs.

The construction of new production plants is a matter of timing. Industry decisions will hinge on how rapidly the dwindling reserves in Hugoton-Panhandle fields are depleted. Adding capacity in these fields is unattractive because reserves there are being depleted rapidly. Future technological breakthroughs such as the application of new high-temperature superconductors in magnets, for example, also could dampen growth in helium demand. Its use in magnetic resonance imaging equipment, for example, could be cut dramatically, if not eliminated.

Natural gas leases held by Exxon, Mobil, and other companies on Riley Ridge are the most likely source for this helium. But the economics do not yet support exploiting these fields. Higher prices for natural gas and oil are needed, and demand for carbon

dioxide must rise before extracting helium there becomes attractive.

Regardless of these variables, Exxon's Maddox says, "There must be another major supply of helium production in the 1990s." Most analysts agree, but they are not yet predicting a helium supply shortage. One could occur if demand temporarily outstrips the industry's refinement capacity or its supply of crude helium. Access to at least a portion of the government's stockpile, they add, would protect helium distributors and helium users from a shortage in the 1990s.

The Bureau of Mines has not yet endorsed opening up the stockpile. So far, it is just looking at the feasibility of supplying one or more companies with helium in exchange for fulfilling government agency needs. The agency also is considering selling stockpiled crude helium on the open market to recoup the costs of buying purified helium from private companies.

Linde, Air Products, and other companies, however, want the government to look at the access issue more broadly. Given the investment and market uncertainties, Francis asserts that "the stockpile's most useful value is to smooth out irregularities between supply and demand—not saving it for the long-term future use of government agencies." Federal crude helium should be priced above market rates so that companies use the stockpile as their last source of supply, he says.

Kornbluth, however, says that stockpile helium ought to be priced at the market rather than sold at premium rates. Linde's proposal is "a self-serving statement," he says, noting that his competitor is "the most crude independent" of major helium distributors.

Edward Hammel, a consultant and former assistant director for energy at Los Alamos National Laboratory, says Linde could be "vulnerable" on the supply front. It does not have access to Riley Ridge reserves or to production from Exxon. "Linde is trying to stake out a position that will stabilize their supply situation for the 1990s," contends Hammel. Nevertheless, "it is not inappropriate" that part of the stockpile be made available to industry, say Hammel.

Whether Exxon would object to opening up the government stockpile is unclear at this time. Such a strategy, however, could be viewed as intrusion in the market. Exxon, for example, under unstable economic circumstances, has risked $34 million alone on its helium complex and an undisclosed amount to develop the natural gas fields at Riley Ridge from which helium is extracted. What puts the operation on the economic margin is soft natural gas prices and the fact that the resource is mostly carbon dioxide.

To make the venture viable, Exxon must sell its low–British thermal unit methane (22.5% by volume) and its helium (0.6% by volume), plus sulfur extracted from hydrogen sulfide (4.5% by volume) and carbon dioxide (65% of the gas stream). Making federal crude helium available to industry at this time could shelter competitors from the kind of financial risks that Exxon must cope with. It would allow them to defer making capital investments for new refining capacity and resources until market conditions are more predictable.

Market competition also is forcing companies to consider buying the government's "inefficient" helium plant—if for no other reason than to block a competitor from picking up more refining capacity. Comments one company marketing representative, "We don't want Union Carbide to get it." Linde's helium purification capacity, now at 1 billion cubic feet, would be increased 54% if it acquired the Exell plant.

Exxon is looking at the government plant as a way to obtain federal helium orders and to gain operating flexibility. The company's customers now must truck purified helium from Wyoming. But acquisition of the federal facility would give it access to a 450-mile helium pipeline that connects Linde, Airco, and Air Products helium facilities in Kansas and Texas with the Exell plant. It then conceivably could tap the stockpile to fill private orders and offset that drawdown with supplies shipped to federal users from its Wyoming helium reserves.

Linde also may bid on the Exell plant even though it has surplus production capacity. But Francis says Linde would just as soon see the Bureau of Mines facility remain in the government's hands and be operated at some minimal level. That would spare Linde the expense of paying perhaps $25 million for the facility (the government says it is worth $50 million) and deny competitors access to the facility.

But apart from his company's interest, Francis insists that such an approach has real merit. "It is not irrational for the government to own helium liquefying and purifying capacity," he says. "It is a normal function for government to provide for unforeseen events, such as having a major helium processing plant break down." This argument is consistent with the intention of Congress when it sought to ensure that the nation had an ample supply of helium to meet future military, government research, and industrial needs.

The White House, however, may not favor maintaining any vestige of the government's helium empire, except for the stockpile. Whether Congress endorses liquidating the government's helium plant may not be clear until next year. But the House Appropriations Committee's decision to await a report on the matter indicates a willingness to consider opening the federal helium market to private industry. ■

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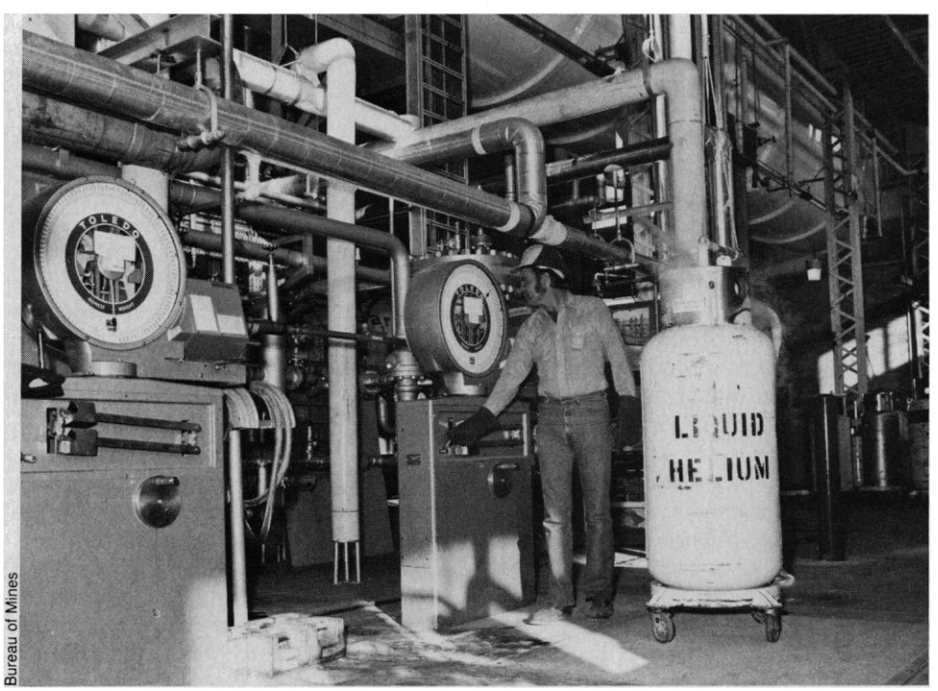

Bureau of Mines

Liquid helium. *A new 500-liter-per-hour refrigeration unit enables the Bureau of Mines to produce 100 million cubic feet of liquid helium a year.*