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ISSUES AND EVENTS

Helium shortage hampers research and industry

If new sources of helium aren't developed, the world's supply of the gas will dwindle and prices will soar.

Drained budgets and postponed projects are widespread these days among the physics labs, manufacturers, and other businesses that depend on helium for their work, direct consequences of a worldwide shortage of the element, which ironically is one of the most abundant on Earth.

For the last 10 years, groups around the US, including the American Physical Society, have been predicting that a severe shortage of the gas—which has many more valuable applications than filling party balloons—would emerge early in the 21st century. Pointing to a 1996 federal law that mandates sale of the federal helium reserve by 2015, they've warned that once the reserve—which supplies some 40% of domestic needs and 35% of worldwide requirements—is sold off, it can never be replaced.

The prophecies are already coming true, but for a different reason. The supply crimp that arose last year is the result of production glitches around the world that gas industry experts say underscore the need to develop new helium sources. If supply is tight now, they say, it's likely to be far more constricted once the reserve is depleted.

A byproduct of radioactive decay within Earth, helium is often a component of natural gas. Helium refiners extract natural gas from gas fields—in the US, the fields are mostly in Texas and Kansas—and cool it to below 90 K. At that point, everything except helium liquefies; the helium is distilled and compressed or further cooled to liquid form. In addition to the federal reserve, which is in a gas field near Amarillo,

Texas, several sources worldwide supply helium: a handful of other US gas fields, and plants in other countries including Algeria, Qatar, Poland, and Russia.

The current shortage has several causes. A new production plant in Algeria and an existing plant in Qatar still aren't up to full speed, while through the second half of last year, several shutdowns and slowdowns plagued two US facilities and another Algerian plant. Meanwhile, low pressure stalled a US pipeline; then this spring, a second US plant was slowed down for maintenance.

No one can say when all the snags will be untangled, but Phil Kornbluth, for one, executive vice president of Matheson Tri-Gas, an industrial and specialty gas provider, forecasts improvement by next year if the Qatar plant reaches full capacity. Meanwhile, the shortage has led to financial woes and research headaches.

Rising prices

Thanks to higher costs than budgeted for liquid helium, Robert Hallock, a physicist at the University of Massachusetts at Amherst, may have to do without the work-study student he hoped to bring in this summer as a lab helper. To save on delivery charges, Hallock's department orders large quantities of liquid helium each week, but inevitably winds up paying more anyway because the liquid helium boils off as it sits around in Dewar flasks.

"It costs us more to do our work," says Hallock, who adds that his department uses the liquefied gas to cool magnets for experiments on superconductivity, conduct research in nanoscience, and investigate the behavior of helium. "The bottom line is, you can do less work for the money. Somebody doesn't get hired, or you go without something else."

Janis Research Co of Wilmington, Massachusetts, which manufactures low-temperature cooling equipment, has also been forced to dig more deeply into its pockets. The company's liquid helium supplier, UK-

based BOC Gases, imposed a quota last year and Zuyu Zhao, Janis's vice president and principal scientist, says their allocated amount isn't enough. To make up for the shortfall, Janis contracted with another supplier, who has no quota but whose prices are higher than BOC's. "We're absorbing [the higher cost], but it's cutting into our profit margin," Zhao says.

BOC has been forced to impose quotas because of the "supply–demand imbalance," according to spokeswoman Kristina Schurr, who says medical users such as magnetic resonance imaging facilities aren't rationed as much as nonmedical accounts. She adds that the company has been juggling the needs of all its customers while dealing with a limited supply of helium. Making matters worse was the US Federal Trade Commission's requirement that BOC divest some of its helium sources as a condition of being acquired recently by another company.

NASA's John F. Kennedy Space Center in Florida is also feeling the pinch. The center, which goes through a million standard cubic feet of gaseous helium per shuttle launch, uses it primarily to purge oxygen from shuttle engines and external tanks. "We've had to work a lot closer with our suppliers so that we can get product when we need it," says Tom Elam, propellants engineer at the center. Right now, the center is trying to conserve helium use; on a longer term, it's looking into ways to cut its helium dependence as well as to recapture helium that's lost to the air, he adds.

Growing demand

The situation is likely to become even more dire in the near future. Kornbluth and Leslie Theiss, field office manager at the US Bureau of Land Management's helium operations in Amarillo, say the worldwide demand for helium is growing, fueled at least in part by the growth of high-tech manufacturing in China, Japan, Taiwan, and South Korea. Companies in those countries use helium in the production of semiconductors, flat-panel displays, and optical fibers.

Meanwhile, the tightened supply and higher costs are prompting efforts in both academia and industry to convert to dry cryostats, or closed-cycle refrigerant units, which eliminate the need to replenish helium. But the systems don't suit everyone. They're costly—up to $50 000 apiece, according to Allen Goldman, a physicist at the University of Minnesota. And some units' base temperatures are limited, able to bring helium down to only 2.7 K, not cold enough for all types of research.

Until other sources are developed, industry officials warn, the worldwide helium supply will continue to be squeezed. "We're producing everything we can here but it just isn't enough," says Theiss.

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