# Helium — A Gas Facing Extinction



### THE PERIODIC TABLE'S ENDANGERED ELEMENTS

1 H Hydrogen 3 Li Lithium 11 Na	4 Bee Beryllium		Lim Risi Ser	ited ng th ious	avail nreat threa	abilit from at in t	:y, fu incr :he n	ture i ease ext 1	risk t d use 00 ye	o sup e ears	oply	5 B Boron 13	6 C Carbon 14 Si	7 N Nitrogen 15 P	8 O 0xygen 16 S	9 F Fluorine 17 CI	2 Heium 10 Neon 18 Ar	2
Sodium 19 K Potassium	Aagnesium 20 Caa Calcium	21 Sc Scandium	22 <b>Ti</b> Titanium	23 V Vanadium	24 Cr Chromium	25 Mn Manganese	26 Fe	27 Co Cobalt	28 <b>Ni</b> <sup>Nickel</sup>	29 Cu Copper	30 Zn <sub>Zinc</sub>	Aluminum 31 Gaa Gallium	silicon 32 Gee Germanium	Phosphorus 33 <b>AS</b> Arsenic	Sulfur 34 <b>Se</b> Selenium	Chlorine 35 <b>Br</b> Bromine	Argon 36 <b>Kr</b> Krypton	He
37 <b>Rb</b> Rubidium	38 <b>Sr</b> Strontium	39 Y Yttrium	40 <b>Zr</b> Zirconium	41 Nb Niobium	42 Mo Molybdenum	43 <b>TC</b> Technetium	44 Ru Ruthenium	45 <b>Rh</b> Rhodium	46 <b>Pd</b> Palladium	47 Ag Silver	48 Cd Cadmium	49 In Indium	50 <b>Sn</b> ĭii	51 <b>Sb</b> Antimony	52 <b>Te</b> Tellurium	53 Iodine	54 Xe Xenon	Helium
55 Cs Cesium	56 Ba Barium	<b>*</b> 57 - 71	72 <b>Hf</b> Hafnium	73 Ta Tantalum	74 W Tungsten	75 <b>Re</b> Rhenium	76 Os Osmium	77 <b>Ir</b> Iridium	78 Pt Platinum	79 Au <sub>Gold</sub>	80 Hg Mercury	81 Tallium	82 Pb Lead	83 <b>Bi</b> Bismuth	84 Po Polonium	85 At Astatine	86 <b>Rn</b> Radon	Incirum
87 <b>Fr</b> Francium	88 Ra Radium	<b>* *</b> 89 - 103	104 <b>Rf</b> Rutherfordium	105 Db Dubnium	106 <b>Sg</b> Seaborgium	107 <b>Bh</b> Bohrium	108 Hs Hassium	109 Mt Meitnerium	110 <b>DS</b> Darmstadtium	111 <b>Rg</b> Roentgenium	112 <b>Cn</b> Copernicium	113 <b>Nh</b> Nihonium	114 Fl Flerovium	115 Mc Moscovium	116 Lv Livermorium	117 <b>TS</b> Tennessine	118 Og Oganesson	
*Lanthanide series		57 La Lanthanum	58 Ce Cerium	59 <b>Pr</b> Praseodymium	60 Nd Neodymium	61 <b>Pm</b> Promethium	62 <b>Sm</b> Samarium	63 Eu Europium	64 <b>Gd</b> Gadolinium	65 <b>Tb</b> Terbium	66 Dy Dysprosium	67 Ho Holmium	68 <b>Er</b> Erbium	69 <b>Tm</b> Thulium	70 Yb Ytterbium	71 Lu Lutetium		
**Actir series	ide S	89 AC Actinium	90 <b>Th</b> Thorium	91 Pa Protactinium	92 U Uranium	93 Np Neptunium	94 Pu Plutonium	95 <b>Am</b> Americium	96 <b>Cm</b> Curium	97 <b>Bk</b> Berkelium	98 <b>Cf</b> Californium	99 <b>ES</b> Einsteinium	100 <b>Fm</b> Fermium	101 Md Mendelevium	102 No Nobelium	103 Lr Lawrencium	So	ource: Chemistry Innovation Knowledge Transfer Networl

# Helium

Helium is named after the Greek word for the sun, helios, as it was first identified in the sun's corona (the sun is composed of 25% helium).<sup>1</sup> The second most abundant element in the universe, helium is scarce on Earth. A product of nuclear fusion and radioactive decay, it is the lightest noble gas, colorless, odorless, and inert with a low boiling point.



As an irreplaceable element used in medical diagnostic equipment, a secure supply of helium relates to U.N. Sustainable Development Goal #3: Good Health & Well-Being.

# Where is it from?

On the Earth, most helium is a radioactive decay product of uranium and thorium. It is found under the Earth's crust with other natural gases. Commercial helium is extracted from natural gas when the helium concentration is above 0.3%.<sup>2</sup>



# TEXAS PANHANDLE 30% OF WORLD'S SUPPLY

### **U.S. Helium Reserve** slated to shut down by 2021

The U.S., Qatar and Algeria have the world's major helium reserves, while the U.S., Russia and Algeria are the top suppliers. In the U.S., helium is found primarily in the Texas panhandle and Kansas.<sup>2</sup>

The U.S. Helium Reserve, located deep underground Amarillo, Texas, is slated to be shut down by 2021; it has provided 30% of the world's supply for many years.<sup>3</sup> Uncertainty about how private markets will distribute and price helium is a concern, especially to scientific researchers using small amounts of helium.

A recent discovery of helium beneath Tanzania may provide a short-term boost in future helium supply if development challenges can be overcome.<sup>4</sup>

# How is it used?

While the general public might be most familiar with helium's buoyancy—which makes it ideal for filling birthday balloons, Macy's Day Parade figures and blimps—helium has many other irreplaceable uses:







- Liquid helium is unique among all elements in that it can reach ultra-cold temperatures, approaching absolute zero (-273.15°C). Research conducted at these low temperatures has led to discoveries in superconductivity that have led to many applications, including the Maglev high-speed train.<sup>2</sup>
- Helium's cooling properties are indispensable to scientific research and medical diagnostic equipment including magnetic resonance imaging (MRI) machines, NMR spectrometers and even the Large Hadron Collider.<sup>1,2</sup>
- Helium is used to cool nuclear reactors and keeps rocket fuel cool during lift-off.<sup>5</sup>
- Due to its unreactive nature, helium provides a protective atmosphere for making fiber optics, semiconductors, and in arc welding.<sup>1</sup>
- Deep-sea divers breathe a mixture of helium and oxygen, which helps them avoid the dangers of "the bends."<sup>2</sup>

# Why is it a critical element?

## ATMOSPHERIC RECOVERY IS NEARLY IMPOSSIBLE

Liquid helium boils off and can be captured and recycled by re-liquefying it. In the U.S., only a small amount of recycling infrastructure is in place.<sup>2</sup>

Once helium is released in the atmosphere, it will continue rising until it escapes into space, making it the only truly unrecoverable element.



Helium in recoverable quantities is found in only a few locations around the world, and these sources are being rapidly depleted. Accordingly, the U.S. has important economic and national security interests in ensuring a reliable supply of helium.<sup>5</sup>



## PRICE SHOCKS ARE FREQUENT

The cost of helium has increased 250% over the last five years, making scientific research more expensive.<sup>2</sup>

The helium market is subject to frequent price shocks. In 2017, the blockade of Qatar suddenly removed 30% of the world's helium supply from the market, causing prices to temporarily skyrocket.<sup>4</sup>

# What can we do about it?







#### CHEMISTS

- Work to increase recycling infrastructure in laboratories; capture and reuse helium that is used for instrument cooling, or in cryopumps, etc.<sup>2</sup>
- Explore alternatives such as using hydrogen for buoyancy applications (where flammability is not objectionable).<sup>6</sup>
- Explore the use of hydrogen to replace helium as a carrier gas in gas chromatography.

### INDIVIDUALS

 Opt not to buy helium balloons.



#### INSTITUTIONS

- Establish price controls and market stabilization measures for scientific research use.<sup>2</sup>
- Fund research labs to implement small-scale recycling technology and other methods of reducing helium usage.<sup>2</sup>

## Find out more about Critical and Endangered Elements: acs.org/endangered-elements

#### SOURCES

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