

Helium Designated as a Critical Material by the U.S.

Prelims: *Current events of national and international importance | International Relations*

Why in News?

Recently, the U.S. Department of Energy (DOE) has classified helium as a critical material in accordance with the Energy Act of 2020.

- **Aim** - To enhance domestic manufacturing, decrease reliance on foreign sources, and increase supply-chain security.
- Helium plays a vital role in semiconductor manufacturing and is indispensable for various advanced technologies.

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Key Facts		
	Parameter	Details
	Material designated	Helium
	Country	United States
	Designating authority	U.S. Department of Energy
	Legislation	Energy Act of 2020
	Secretary of Energy	Chris Wright
	Major objective	Strengthen domestic manufacturing and supply-chain security
	Key applications	Semiconductor production and advanced technologies



Helium: Basic Properties

	Symbol	He
	Atomic number	2
	Periodic table	Group 18, Period 1
	Element category	Noble gas
	Atomic mass	Approximately 4 u
	Nature	Colourless, odourless, tasteless and chemically inert under ordinary conditions.
	Density	Less dense than air.
	Boiling point	Approximately -268.9°C at atmospheric pressure; the lowest boiling point of any element.

Physical Properties

- **Chemically inert** - The filled electron shell of helium renders it highly unreactive.
- **Low boiling point** - This property makes liquid helium valuable for cryogenic cooling applications.
- **Non-flammable** - In contrast to hydrogen, helium does not combust.

- **Lightweight** - Helium is utilised in balloons and other lighter-than-air technologies.
- **Cryogenic properties** - Liquid helium facilitates cooling to temperatures necessary for achieving superconductivity.

Major Uses

Sector	Application
Semiconductors	Manufacturing processes and controlled production environments
Medical technology	Cooling superconducting magnets in MRI scanners
Scientific research	Cryogenics and low-temperature experiments
Nuclear and advanced energy technologies	Cooling and specialised industrial applications
Aerospace	Pressurising and purging rocket fuel systems
Leak detection	Detecting leaks in vacuum systems and industrial equipment
Electronics	Specialised manufacturing and fabrication processes

Justification for the U.S. Classification of Helium as a Critical Material

- **Strategic importance** - Helium is indispensable for semiconductor manufacturing and the development of advanced technologies.
- **Supply-chain vulnerability** - Global demand for helium is increasing at a rate that exceeds current production capacity.
- **Limited substitutes** - Many critical applications lack viable alternatives to helium.
- **Domestic production constraints** - Although the United States possesses significant helium-rich natural gas resources, domestic refining capacity remains limited.
- **Regulatory delays** - Prolonged permitting processes hinder the expansion of domestic helium production.
- **National security** - Ensuring reliable access to critical materials such as helium is essential for maintaining industrial capacity and technological leadership.

Helium: Sources and Production
• Helium is primarily produced commercially by processing helium-rich natural gas deposits. • Helium forms naturally from the radioactive decay of heavier elements in Earth's crust and accumulates in underground gas reservoirs. • Due to its low chemical reactivity, helium does not readily form chemical compounds. • Because helium is very light, it gradually escapes from the atmosphere into space. This makes recoverable terrestrial deposits especially valuable. Note - Helium is not typically extracted directly from the atmosphere on a commercial scale. Natural gas processing remains the primary source.

Reference

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