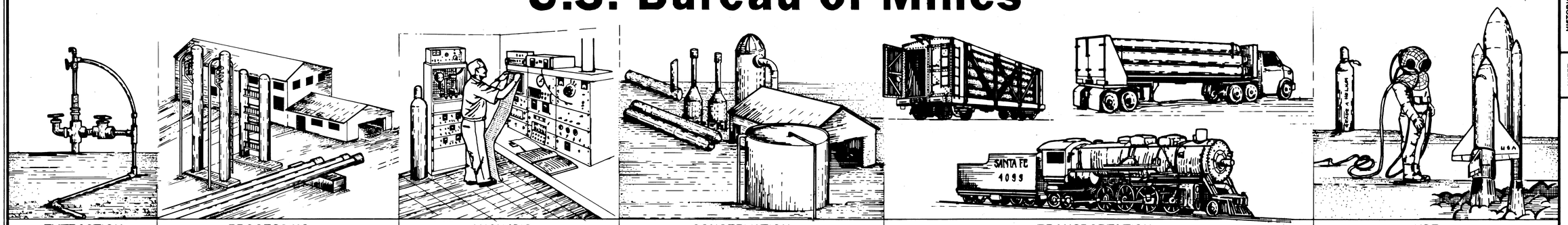
HELIUM PRODUCTION AND USE

U.S. Bureau of Mines



EXTRACTION → PROCESSING → ANALYSIS → CONSERVATION → TRANSPORTATION → USE

1868 Helium discovered in the sun's chromosphere by J. Norman Lockyer.

1895 Helium, found on Earth, obtained from the mineral "Cleveite" by Sir William Ramsey.

1905 Helium found in natural gas by Dr. H.P. Cady.

1908 Ferdinand Von Zeppelin of Germany developed the hydrogen-filled rigid airship. Helium first liquefied by Dutch physicist, Kamerlingh Onnes.

1918 Three experimental Helium plants constructed in the United States two at Fort Worth, Texas, and one at Petrolia, Texas.

1921 First full-scale Helium production plant constructed at Fort Worth, Texas.

1925 Act of U.S. Congress placed Government Helium program under the U.S. Bureau of Mines.

1927 Kentucky Oxygen-Hydrogen Company, first private industry helium plant built at Dexter, Kansas.

1927-29 Depletion of gas supply forced shutdown of Fort Worth helium plant. U.S. Government acquired gas rights to Cliffside Field, near Amarillo Texas. New Helium plant built in Amarillo.

1933-37 Loss of American Dirigibles- the Akron in 1933 and the Macon in 1935 – and the German hydrogen filled Hindenberg in 1937 ended the Dirigible program.

1937 Helium Act amended to authorize commercial sale of helium. Government bought assets of the private helium producer.

1940 During World War II, Navy blimps patrolled the open seas. Use of helium in welding of metals was developed. Helium used in the manufacture of the atomic bomb.

1942 Amarillo Helium Plant expanded to meet the World War II demand for helium.

1943-44 Bureau of Mines built helium plants located at Exell, Texas, Otis and Cunningham, Kansas, and Shiprock, New Mexico.

1945 First delivery of helium from Exell helium plant to Cliffside Field for underground storage. Cunningham plant ceased operation and was dismantled.

1949-50 Bureau of Mines developed Grade-A helium (99.995% pure). Helium used in development and operation of intercontinental ballistic missiles.

1954-59 To meet rising helium demands, Congress appropriated $6million to expand the plant at Exell, and $12million for a new plant at Keyes, Oklahoma. First liquid helium bulk transport trailer was constructed.

1960 Helium Act amended to provide the basis for long term conservation program.

1961 Kerr-McGee Oil Industries built first private industry helium plant in 35 years. Four contracts signed for Government purchase of crude helium for conservation.

1962 First helium delivered for storage under conservation program.

1966-67 Kansas Refined Helium Company and Alamo Chemical Company completed private commercial plants in Kansas.

1968 About 18 billion cubic feet of helium was in conservation storage at Year-end. Bureau of Mines shutdown Navajo and Otis helium plants.

1970 Amarillo Helium Plant ceased production of helium from Cliffside gas and continued to operate as a shipping terminal.

1973 Purchase of private helium for storage in Cliffside Field terminated.

1977 First commercial shipment of liquid helium from Amarillo plant.

1979-81 Installation of cryogenic and non-cryogenic Pressure Swing Adsorbtion purification units, and helium liquefaction unit at Exell. Exell begins large scale production and shipment of liquid helium.

1989 Legislation introduced in June to privatize Federal helium program.

1992 General Accounting Office recommended that Congress cancel the helium debt.

1993 Bureau personnel participated in opening 25-year leg of the Helium Time Column Monument.

1996 Helium Privatization Act of 1996 signed by president Clinton. Bureau of Mines abolished and Helium Field Operations transferred to Bureau of Land Management.

1998 Federal production of helium terminated. Last shipment of Federally refined helium delivered to NASA.

The U.S. Bureau of Mines completed construction of the Amarillo Helium Plant in 1929. Designed to produced 24 million cubic feet of helium a year, the Amarillo plant imported natural gas, with approximately three percent helium content, into its facility. Once at Amarillo, the natural gas was fed into the two carbon dioxide (CO_2) removal units placed into operation in 1929.

At the CO_2 removal units, flows of caustic chemicals removed the CO_2. The remaining gas was then, through heat exchangers, cryogenically processed. During this process of super cooling unwanted gases, such as methane, nitrogen, hydrogen, and oxygen, were liquefied and drained away from the vaporized helium, which remained in gas form until -452° Fahrenheit (seven degrees above absolute zero). This process produced 97 to 98 percent pure helium.

In the 1940s, chemists discovered that charcoal filtering produced a 99.995 percent grade of helium, a Grade A purity that satisfied new demands such as heliarc welding. When the Bureau of Mines built three new plants, the Amarillo plant served as the principal research center for the Helium Activities for the remainder of the federal program's history.

Initially, producers stored helium in small, high pressure tanks and railroad tank cars. By the early 1940s, they added a manifolded, high pressure tank facility to each plant. Until the 1960s, most of the helium was shipped via railroad tank cars to Cape Canaveral, Washington, D.C., and other research stations across the U.S.

The Helium Activity first stored helium in negligible amounts underground in the Cliffside reservoir during World War II. The Helium Conservation Act of 1960, however, established Cliffside as the nation's permanent underground storage facility for crude helium. Although not needed to meet immediate demands, millions of cubic feet of crude helium normally lost burning natural gas could now be saved. The resulting helium reserve could be tapped in cases of national emergency. In the late 1950s the Helium Activity investigated the possibility of producing liquid helium in an effort to reduce shipping costs. By the mid-1960s, the bureau adopted new processing and shipping technology-cryogenic dewars that were used to transport liquid helium to both federal and private consumers.

The earliest manufactured helium was for use in naval dirigibles. These high-flying aircraft proved invaluable in naval reconnaissance and warfare from the 1920s through World War II. During the interwar years, medical experts discovered practical applications for helium in treating asthmatics. The Navy also relied on helium for deep sea divers and in later decades, its Sealab program. The inert gas protected the divers from the bends during their ascent to the surface. When too much nitrogen enters the blood stream, it can be life threatening; helium greatly reduced that risk.

The most popular use for helium was heliarc welding, a specially designed technique using helium to produce an inert atmosphere that protected the weld from contamination. Devised in the 1940s, the new technique enabled stronger welds when applied to titanium and zirconium, lightweight metals employed in construction of fuselages for high-flying aircraft, spaceships, and nuclear rockets. As post-World War II demands for helium soared, most federal production sites enjoyed a massive expansion program in 1956-57. In subsequent years, the U.S. Air Force used helium in developing the Atlas missile, as did NASA in its space program, especially as a fuel propulsion agent for the first lunar spacecraft. More recent applications include the successful Challenger space shuttle.

The U.S. Weather Service requires helium to launch its weather balloons. Meanwhile, medical experts use helium for Magnetic Resonance Imagery (MRI). Laser research and superconductivity research also require helium. The multiple uses for helium guaranteed not only the survival but the unprecedented success of the federal program until its closure in 1996.

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U.S. BUREAU OF MINES, HELIUM PLANTS
TEXAS
POTTER COUNTY
AMARILLO

HELIUM ACTIVITIES RECORDING PROJECT
NATIONAL PARK SERVICE
UNITED STATES DEPARTMENT OF THE INTERIOR

DELINEATED BY: DOMINGUS PALLILING & TODD DELYEA 2001

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