

January 26, 2022

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U.S. Geological Survey, Department of the Interior
Draft List of Critical Minerals
MS-102
U.S. Geological Survey
12201 Sunrise Valley Dr.
Reston, VA 20192

RE: 2021 Draft List of Critical Minerals - Helium

To Whom It May Concern:

This letter is a response from James R. Weaver, P.E. to the request for public comments on the **2021 Draft List of Critical Materials**.

I, James R. Weaver, P.E., a Professional Engineer registered in the states of Texas and Oklahoma have been working in the petroleum industry for over 40 years. For most of my career, I have been involved in the estimation of reserves and resources of oil, gas, helium, and carbon dioxide. During that time, I have estimated reserves on nearly every helium-producing field in the USA. Additionally, I have been involved in the exploration for helium resources and as a result have evaluated the potential of helium discovery for every gas test with a helium content of 0.3% or greater (the limit of economic separation of helium from indigenous gas). During the past 12 years I have been an estimator of reserves and resources in several helium-producing fields where helium is the primary product.

I was quite surprised to see that Helium, which was included on the 2018 List of Critical Materials, was omitted from the 2021 draft list and strongly suggest that the Department of the Interior reconsider this omission.

According to the Energy Act of 2020, critical minerals are defined as those which:

1. are essential to the economic or national security of the United States;
2. the supply chain of which is vulnerable to disruption (including restrictions associated with foreign political risk, abrupt demand growth, military conflict, violent unrest, anti-competitive or protectionist behaviors, and other risks throughout the supply chain); and
3. serve an essential function in the manufacturing of a product (including energy technology-, defense-, currency-, agriculture-, consumer electronics-, and healthcare-related applications), the absence of which would have significant consequences for the economic or national security of the United States.

It is quite clear to anyone familiar with the many important applications for helium that it meets the three criteria outlined above. I would highlight, however, that helium is critical to the semiconductor chip manufacturing process and the aerospace industry, which are the two fastest growing helium applications, as well as other important applications including MRI scanning, optical fiber manufacturing and nuclear power generation. Moreover, the helium supply chain has experienced three periods of prolonged shortage during the last 16 years, and has experienced disruption due to geopolitical events such as the Saudi-led embargo of Qatar between 2017 and 2021 and the current shipping bottlenecks related to the COVID pandemic.

While I do not find fault in the quantitative evaluation which determined that the U.S. is not currently dependent on helium from foreign sources and is actually a net exporter of helium, I am concerned that the gradual decline of U.S. production could lead to U.S. dependence on foreign sources of helium within a relatively short period of time. During my career, I have observed the U.S. share of global helium production decline from well over 90% in the early 1980's to less than 50% at present. By 2026, my estimate is that the U.S. share of world helium supply will decline to around 35%. By that time, supply from Qatar and Russia will account for 25 – 30% of world supply each, with Algeria providing an additional 8%. While Qatar is a U.S. ally, it is located in a part of the world that is subject to military risk and supply chain disruption, as evidenced by the Saudi-led embargo. Russia, which is just emerging as a major supplier as they bring their Amur Project into production, has shown a propensity to leverage energy supply for political gain and could do the same with helium. Algeria is a politically unstable country that could experience an upheaval at any time.

It should be noted that no new helium discoveries have been made in the 21st Century. In fact, all discoveries of helium being produced today were made as a result of exploring for oil and gas. Although exploration for helium is ongoing, the models used by most companies have not been successful in finding any new domestic sources of helium. At present, the three major helium-producing areas in the USA are:

- Hugoton-Panhandle Fields
- Shute Creek Field
- Dineh-Bi-Keyah Field

The Hugoton-Panhandle Field is located in southwestern Kansas, and the Oklahoma and Texas panhandles. These fields have been producing for over 70 years and are declining between 5% and 7% per year. Many areas of these fields are producing on vacuum, which means the pressure in the reservoirs are so low that the compressors are acting as vacuum cleaners and sucking the gas from the reservoirs. This is the final stage of production and also quite expensive. It won't be long before most of these wells are at the end of their lives.

The Shute Creek Field is located in Sublette County, Wyoming. The production from the field is fairly flat as the reservoir is under a water drive. While a water drive reservoir is beneficial to an oil reservoir, it is not beneficial to a gas reservoir. This is because the water eventually invades the gas-saturated part of the reservoir and shuts off the production of gas. However, because water moves into that area of the reservoir to replace gas that has been produced, the production remains flat up to the time water begins to be produced. The main constituent of the gas at Shute Creek is carbon dioxide at approximately 88%. The helium content is about 0.7% and the remainder is natural gas. In recent years, it has been reported that some of the wells have begun

to produce water, indicating the water has moved into some of the gas-saturated areas. It is unknown how long it will be before the reservoir waters out. This is operated by Exxon and since Exxon does not use third parties to evaluate their properties, the severity of the problem is unknown.

The Dineh-Bi-Keyah Field is located in Apache County, Arizona on the Navajo Nation. Although discovered in the late 1960's when exploring for oil, the helium reservoirs in the field did not produce until 2014. The field is currently producing at a stable rate, but is expected to begin declining in mid-2028.

One thing that needs to be mentioned is the fact that helium production is limited by the helium refining capacity for each field. Most oil and gas wells are produced at or near the maximum rate available based on the reservoir and production equipment. Helium fields, however, are produced at curtailed rates based on the volumes contracted to midstream and end users. The plants refining helium are designed to operate at these curtailed rates. As a result, it is not possible to increase helium production in times when additional helium may be needed. An example of this is the helium shortage created in 2017 when Saudi Arabia and the UAE denied Qatar access to ports for export. To help make up for the loss of Qatar helium, the fields in the USA were only able to increase production by 3%.

The fact that helium production is limited by refining plants also indicates that a loss of any helium-producing area in the USA cannot be made up by the remaining producing areas. In years past there was the ability to produce additional helium from the Federal Helium Reserve located near Amarillo, Texas. However, excess helium stored in the reserve has been sold, leaving about 3 billion cubic feet of helium in the reserve. This remaining helium is specified for use by the Federal government and approved research projects. As a result, there is no cushion of helium available to supplant any shortages of helium that may occur.

While the U.S. is not yet dependent on helium supply from Qatar, Russia or Algeria, it seems very shortsighted on the part of the U.S. DOI to remove helium from the List of Critical Minerals, when the ongoing decline of domestic production puts us on a path toward reliance on foreign sources and the primary alternatives to U.S. production will be located in countries that are all subject to either geopolitical risk or supply chain disruption.

In summary, James R. Weaver, P.E. strongly recommends that helium be included on the 2021 List of Critical Minerals to highlight its importance to critical U.S. industries, to continue to encourage development of new U.S. sources and to avoid future dependence on unreliable foreign sources.

Very Truly Yours,

James R. Weaver, P.E.