

Gallium Resources and Processing Method



US CRITICAL MATERIALS

Security of Supply



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GALLIUM: A STRATEGIC MINERAL FOR U.S. TECHNOLOGY AND NATIONAL SECURITY

Gallium plays a crucial role in a broad array of U.S. consumer, industrial, and government technologies. The United States Geological Survey (USGS) has consistently identified gallium as a critical mineral supply risk, emphasizing its significance for national security and defense.

Demand for gallium is particularly acute in the production of gallium nitride (GaN) and gallium arsenide (GaAs) high-performance chips, which are foundational to semiconductors, 5G technology, smartphones, satellite systems, medical diagnostics and therapeutics, and next-generation defense platforms. As advancements in artificial intelligence (AI) and telecommunications drive a surge in semiconductor demand, the need for gallium is projected to grow substantially.

Despite its criticality, the United States remains entirely dependent on imported gallium, with no emergency reserves in the Department of Defense (DOD) National Defense Stockpile. Gallium is a scarce resource, with most global production concentrated in China. A November 2024 USGS report estimated that a total cessation of China's gallium exports could result in a \$3.1 billion dollar reduction in U.S. GDP, underscoring the vulnerability of supply chains. This concern materialized in December 2024 when the Chinese government implemented an embargo on gallium exports to the United States, heightening tensions over access to critical minerals.

On January 20, 2025, the first day of President Trump's new administration, the White House declared a National Energy Emergency, highlighting the severe risks associated with restricted access to critical minerals. Gallium is consistently ranked among the most strategically important minerals. The following day, President Trump announced The Stargate Project, a \$500 billion AI initiative, underscoring gallium's indispensable role in advancing AI technologies.

US Critical Materials' Sheep Creek deposit in Montana offers the only economically viable domestic source of gallium, with an average grade of 300 parts per million (ppm)—far exceeding the 50 ppm typically found in Chinese production. This unique deposit positions the United States to establish an independent and secure gallium supply chain. To this end, US Critical Materials is collaborating with the Idaho National Laboratory to develop environmentally sustainable methods for processing and separating gallium. Unlike most global sources, where gallium is a byproduct of bauxite processing, Sheep Creek's gallium is contained within rare earth minerals, simplifying extraction and refining processes.

The Trump administration has also focused on Greenland, a region of significant global competition involving China and Russia, due to its reserves of rare earth elements and critical minerals. However, based on reports from Geological Survey of Denmark and Greenland, Greenland's gallium concentrations, which range from 66 ppm in North Greenland to 81–117 ppm in Southern East Greenland, are significantly lower than those at Sheep Creek, further highlighting the strategic value of the Montana deposit.

In conclusion, US Critical Materials' Sheep Creek project represents the nation's only viable domestic gallium initiative, providing a pivotal opportunity to secure and stabilize the U.S. supply of this essential mineral. Developing Sheep Creek's gallium resources will not only bolster national security but also support the continued growth of key technologies vital to America's economic and strategic interests.

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4190 S Highland Dr. Suite #230
SLC, UT 84124 | 801-322-3401

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Rare earths and critical minerals are indispensable to U.S. consumer, industrial, and government technologies. These materials serve as the foundation for emerging and future technologies, playing a vital role in manufacturing, clean energy production, semiconductor fabrication, and the defense and aerospace industries.

The United States Geological Survey (USGS) consistently ranks critical minerals among the top supply risks impacting national security and defense. The absence of a domestic rare earth mining and processing capability poses a direct threat to U.S. national security. Rare earth elements (REEs) are essential for semiconductors, 5G technology, smartphones, satellite systems, fiber-optic networks, medical diagnostics, and healthcare therapeutics. They are also critical components in next-generation defense systems, including lasers, radar, sonar, night vision, missile guidance systems, jet engines, and armored vehicle alloys.

Some analysts have dubbed rare earths “the new oil” due to their indispensable role in powering modern and future technologies. With the increasing demand for semiconductors driven by advancements in artificial intelligence (AI) and 5G telecommunications, the global necessity for rare earths is projected to grow exponentially.

U.S. DEPENDENCE ON IMPORTED RARE EARTHS

The U.S. remains heavily dependent on imports for rare earth elements and lacks an emergency stockpile for many critical minerals. According to the Congressional Research Service, The National Defense Stockpile (NDS) has a \$13.5 billion gap between the current stockpile minerals and current stockpile requirements. This lack of preparedness places the U.S. at significant national security risk, especially as China dominates the global production and processing of rare earths. China's near monopoly on rare earths grants it the ability to influence global markets and make decisions with far-reaching national security and economic implications. In December 2024, China imposed an embargo on exporting certain critical minerals to the United States, intensifying the ongoing geopolitical tensions. This restriction has highlighted the U.S. military's reliance on rare earths for critical technologies and weapon systems, further underscoring the urgent need for a domestic supply chain.

EXECUTIVE ACTIONS TO RESTORE U.S. MINERAL DOMINANCE

On January 20, 2025, President Trump signed two Executive Orders aimed at restoring American leadership in rare earth mining and processing. The orders—*Unleashing American Energy* and *National Energy Emergency*—prioritize the strengthening of U.S. production capabilities and supply chain security for critical minerals.

- The *Unleashing American Energy* order focuses on establishing the U.S. as a leading producer and processor of non-fuel materials, including rare earth elements. It seeks to alleviate regulatory burdens, update the USGS critical minerals list, accelerate the identification of unknown deposits, and increase federal funding for critical mineral projects. A key objective is to address and remedy shortfalls in the National Defense Stockpile.
- The *National Energy Emergency* order declares that inadequate access to critical minerals poses an imminent threat to national security. The directive identifies vulnerabilities in permitting, outdated regulations, and insufficient federal attention. It mandates actionable recommendations to mitigate these risks and bolster domestic supply chains.

RARE EARTHS AND AI: THE STARGATE PROJECT

On January 21, 2025, President Trump announced *The Stargate Project*, a \$500 billion dollar AI initiative that underscores the importance of rare earths. Chips and semiconductors essential for advanced AI technologies depend heavily on rare earth elements, making their availability a cornerstone of U.S. technological advancement and competitiveness.

SHEEP CREEK: A SOLUTION TO U.S. RARE EARTH DEPENDENCE

US Critical Materials' Sheep Creek deposit in Montana represents the highest-grade rare earth deposit in the United States, with average concentrations of 90,000 parts per million (ppm). The company is collaborating with the Idaho National Laboratory to develop environmentally responsible processing and separation methods, positioning Sheep Creek as a cornerstone of U.S. rare earth independence.

Unlike most rare earth sources globally, where extraction is complex due to mixed ore compositions, Sheep Creek's deposits offer a more straightforward and efficient processing pathway. This makes it a uniquely valuable domestic resource, capable of reducing U.S. reliance on imports while bolstering national security.

GLOBAL COMPETITION FOR CRITICAL MINERALS

The Trump administration's interest in Greenland has drawn significant attention, given its strategic importance as a source of critical minerals. However, based on reports from the Geological Survey of Denmark and Greenland, Greenland's rare earth grades average just 1.5% (15,000 ppm), far below the 9% (90,000 ppm) concentration found at Sheep Creek. Additionally, Greenland faces considerable permitting, access, and political challenges, making Sheep Creek a far more viable and strategically advantageous option.

CONCLUSION

Rare earths and critical minerals are the backbone of modern and emerging technologies, making their secure and reliable supply a matter of national urgency. The development of Sheep Creek's rare earth resources offers a unique opportunity to address U.S. vulnerabilities, strengthen supply chains, and ensure the country's continued leadership in critical industries. By investing in domestic production and processing, the U.S. can mitigate supply risks, safeguard national security, and drive economic growth.

Highlights 2024



US Critical Materials Announces the Results of Study by Idaho National Laboratory Showing Definitive High Grade, Economic Gallium at Sheep Creek, Montana Deposit.



US Critical Materials can confirm that Idaho National Laboratory measured grades of gallium from 180 parts per million (ppm) to 385 ppm.



According to the 2024 USGS gallium Mineral Commodity Summary, the average gallium content worldwide is 19 ppm, and potential U.S. gallium deposits consist mainly of subeconomic resources. No gallium is currently produced in the United States.



"We are now able to confirm the presence of high-grade gallium at Sheep Creek. We look forward to continuing our work to develop a sustainable and efficient separation process for gallium and other elements." Dr. Robert Fox, US Critical Materials Business Lead at Idaho National Laboratory



"The gallium and rare earth grades, calculated and verified by Idaho National Laboratory, are higher than any that we are aware of in the United States."

**Jim Hedrick, US Critical Materials
President, and former 31- year rare earth
commodity specialist for the USGS and US
Bureau of Mines**

GALLIUM SEPARATION AND PROCESSING METHOD



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Electrochemical Extraction and Purification of Gallium

The US Critical Materials/ INL project targets extraction of >90% Ga and the full spectrum of rare earth critical minerals from carbonatite ore leachate through use of a novel Electrochemical Membrane Reactor (EMR).

The proposed recovery methodology overcomes technical barriers associated with state-of-the-art critical mineral extraction technologies including fractional precipitation and carbonation methods; commercial electrolysis methods (i.e., mercury usage); solvent extraction; and ion-exchange. The proposed EMR will use only electricity, water, and N₂ gas without need for other chemical reagents to recover REE's from the ore leachate. US Critical Materials will file national and international patents on these technologies.

The electrochemical method here is targeted at Ga, however the method is adaptable and useful for recovery of many value-add metals. Although Sheep Creek carbonatites are the target feedstock for this study, the EMR can be used on multiple critical mineral and material sources that have undergone chemical dissolution to form a metal-rich liquor.

High-grade gallium, rare earths verified

[Shane Lasley, Metal Tech News](#) | May 30, 2024

Idaho National Lab tests

Sheep Creek samples; one rock from Montana project contains 17.8% rare earths and 350 ppm* gallium.

Recent analysis by Idaho National Laboratories confirms that US Critical Materials Corp.'s Sheep Creek project in southwestern Montana hosts extremely high concentrations of gallium alongside the high-grade rare earth elements found there.

"The gallium and rare earth grades, calculated and verified by Idaho National Laboratory, are higher than any that we are aware of in the United States," US Critical Materials President Jim Hedrick said upon receiving a report detailing the national lab's analysis of several samples collected from Sheep Creek.

Both rare earths and gallium are highly critical to America's high-tech sector, as well as the nation's overall economic well-being and security.

The suite of 15 rare earth elements lend their extraordinary properties to a broad range of high-tech applications, including electric vehicles, wind turbines, and military hardware.

Gallium is an important ingredient for semiconductors used in 5G communication technologies, smartphones, satellite systems, solar energy, and next-generation defense systems.



Idaho National Laboratory's sampling of this rock collected from Sheep Creek (SH-7) returned 17.8% rare earths and 350 ppm gallium

During 2023, the U.S. relied on imports for 95% of its rare earths and 100% of its gallium, according to the U.S. Geological Survey.



U.S. Critical Minerals Chief Geologist Peter Mejstrick measures the dip of a carbonatite vein enriched with high-grade rare earths, gallium, and other critical minerals in a historical underground adit at the Sheep Creek project in Montana.

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China, which dominates the global supply of both, has put in place state-controlled restrictions on its gallium exports and has previously used its rare earth monopoly as a geopolitical and economic tool.

According to the 2024 edition of USGS's annual Mineral Commodity Summaries, China is the world's top producer of [at least 29 of the 50 minerals](#) deemed critical to the U.S.

"Despite a great deal of rhetoric around supply chain security, China continues to be our top source of the minerals needed by our economy and these numbers show very little movement to get us back on competitive and secure footing," National Mining Association President and CEO Rich Nolan said.

Extraordinary rare earths, gallium

Recent analysis carried out at Idaho National Lab highlights Sheep Creek's potential as an extraordinarily high-grade domestic source of both rare earth and gallium.

Highlights from the samples analyzed by Idaho National Lab include:

- **13.45%** total rare earth elements (TREE) and approximately 250 parts per million* gallium in sample SH-1.
- **13.82%** TREE and approximately 300 ppm* gallium in sample SH-6d.
- **17.78%** TREE and approximately 350 ppm* gallium in sample SH-7.

The nine Sheep Creek rock samples analyzed by Idaho National Lab averaged 8.48% TREE and 451.8 ppm* gallium. These samples were collected over a two-mile-long area of the Sheep Creek property.



Robert Fox manages the Materials Separations and Analysis department at Idaho National Lab.

"We have confirmed that Sheep Creek is the highest-grade rare earth deposit in the United States, with a multibillion-dollar resource value," said Hedrick, who served as a rare earth commodity specialist at the USGS and former U.S. Bureau of Mines for three decades.

"Over the course of my 30-year career evaluating properties for the U.S. government, I have never encountered a deposit with the high rare earth and gallium grades being generated at Sheep Creek."

In addition to the rare earths and gallium currently being evaluated, the southwestern Montana project hosts niobium, scandium, strontium, and other minerals critical to the U.S.

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Developing processing tech

U.S. Critical Materials work with Idaho National Lab is less about evaluating the quantities of rare earths and gallium, which had [previously been quantified by another lab](#), and more about developing a process to separate and extract the rare earths and 11 other critical minerals found at Sheep Creek.

Late last year, the critical materials exploration company and national lab entered into a cooperative research and development agreement (CRADA) focused on developing a technology to recover and separate the rare earths, gallium, and other critical minerals found at Sheep Creek efficiently and sustainably.

The U.S. has very little commercial rare earth processing capabilities," said Hedrick. "This research agreement, and the tech that will be developed, will help advance U.S. rare earth processing proficiency."

Idaho National Lab, which has been involved with rare earth separation since the dawn of the nuclear age, brings more than six decades of expertise to bring to the table.

"Our latest separations technologies target the energy critical materials and span the entire supply chain from mining to recycle/recovery," Robert Fox, materials separation and analyses department manager at Idaho National Laboratory, told Metal Tech News in an email. "Our CRADA with US Critical Materials allows us to continue to develop our prowess and to expand our technological solutions to solve rare earth element challenges."

The Sheep Creek sample analysis that turned up the high-grade rare earth and gallium values was part of the analysis being carried out at the national lab.

The more important part of this preliminary analysis, when it comes to developing processing and separation technology, is gaining a better understanding of the mineralization to determine the best way to extract the critical minerals.

Moving forward, the research team at Idaho National Lab will further characterize the rare earths- and gallium-bearing minerals ahead of designing and testing a method of extracting these highly critical elements.

"Not only is our gallium high grade, but we are also confident that working together with Idaho National Laboratory, we will be able to create a proprietary separation process that will be environmentally respectful," said Hedrick.



US Critical Materials Announces the Results of Study by Idaho National Laboratory Showing Definitive High Grade, Economic Gallium at Sheep Creek, Montana Deposit

Newsfile Corp. December 4, 2024 (4 min read)

Idaho National Laboratory is currently exploring ways to separate and process the Sheep Creek gallium and other Critical Minerals.

Salt Lake City, Utah—(Newsfile Corp. - December 4, 2024) - US Critical Materials is pleased to announce that Phase One of the Cooperative Research and Development Agreement (CRADA) with Idaho National Laboratory (INL) has been completed. This phase involved studying, testing, and confirming the gallium and other critical minerals content at US Critical Materials Sheep Creek Deposit.

Simultaneously, INL had a team of scientists, engineers, lab technicians, and critical mineral experts begin to explore ways to create a separation and process system for the Sheep Creek ore. The next phase is being structured to cover the next 2 years of continued development of multiple separation and processing technologies.

Idaho National Laboratory is a U.S. Department of Energy (DOE) National Laboratory engaged in world leading critical materials research and development. INL excels in technology development in the Advanced Separation Science & Engineering technology space and is known throughout the DOE system as the Separation Sciences R&D Testbed.

US Critical Materials can confirm that INL measured grades of gallium from 180 parts per million (ppm) to 385 ppm and up to 18% (tree) total rare earth elements. "We are now able to confirm the presence of high-grade gallium at Sheep Creek. We look forward to continued work which will further develop a process to separate the gallium and other elements in an efficient and sustainable manner," stated Dr. Robert Fox, Critical Materials Business Lead for INL Energy, Environment, Science & Technology Directorate.

"The gallium and rare earth grades, calculated and verified by Idaho National Laboratory, are higher than any that we are aware of in the United States," stated Jim Hedrick, US Critical Materials President, and former 31-year rare earth commodity specialist for the USGS and US Bureau of Mines

According to the 2024 USGS gallium Mineral Commodity Summary, the average gallium content worldwide is 19 ppm, and potential U. S. gallium deposits consist mainly of subeconomic resources.

No gallium is currently produced in the United States.

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Gallium is consistently listed as one of the top supply risks related to US National Security, as the U.S. is 100% dependent on imported gallium, primarily from China. In July 2023 the Chinese government embargoed the export of gallium, which is critical for national defense and many other vital applications. Gallium is used for semiconductors, 5G technology, smartphones, satellite systems, critical photonics technologies, and especially current and next generation defense systems.

The US currently has no separation and processing technology, with China dominating the world's critical minerals processing.

The Scope of Work of the CRADA between US Critical Materials and INL includes identification of materials handling, beneficiation, and separations technologies for carbonatite ore handling, preparation, and extraction of targeted, value-added metals. This will be done in a sustainable, efficient manner with a minimal carbon footprint.

"The U.S. has very little commercial rare earth processing capabilities," said Hedrick.

"This research agreement, and the tech that will be developed, will help advance U.S. rare earth processing proficiency. Not only is our gallium high grade, but we are also confident that working together with Idaho National Laboratory, we will be able to create a proprietary separation process that will be environmentally respectful," said Hedrick."

US Critical Materials Corp. is a private rare earths exploration and development company based in Salt Lake City, UT with holdings in Montana and Idaho. Mineral deposits held by US Critical Materials in Montana and Idaho are unique due to high grades of rare earths, low levels of thorium, large numbers of surface carbonatites, and contain some of the highest grades of rare earth minerals in the United States (U.S.) including at least thirteen of the currently listed "critical" minerals (e.g., gallium).

US Critical Materials Corp. is a private rare earths exploration, development and process technology company based in Salt Lake City, UT with holdings in Montana and Idaho. Mineral deposits are held by USCM in Montana and Idaho are unique due to high grades of rare earths, low levels of thorium, large numbers of surface carbonatites, and contains some of the highest grades of rare earth minerals in the United States including at least thirteen of the currently listed "critical" minerals.

Idaho National Laboratory (INL) is a US DOE National Laboratory engaged in world-leading critical materials research and development. INL excels in technology development in the Advanced Separation Science & Engineering technology space and is known throughout the DOE system as the Separation Sciences Testbed. INL has been a core member of the DOE- AMMTO Critical Materials Institute (CMI) for the past decade and will continue to be a core CMI partner leading in Advanced Separations Science & Engineering.

CONTACT: rachelwinn@uscriticalmaterials.com

US CRITICAL MATERIALS

4190 S HIGHLAND DR SUITE #230

SALT LAKE CITY, UT 84124

Office: 801-322-3401

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<https://www.newsfilecorp.com/release/232387>

US Critical Materials Confirms High-Grade Gallium at Sheep Creek, Montana Deposit

Salt Lake City, UT – Jan 13, 2025 – US Critical Materials, a leading critical minerals exploration and development company, has announced groundbreaking confirmation of high-grade gallium deposits at its Sheep Creek site in Montana. The discovery, verified by the Idaho National Laboratory (INL), marks a significant development in addressing the United States' dependency on imported gallium, primarily sourced from China.

Within the past 30 days, the global gallium supply chain has been disrupted due to China's decision to halt gallium exports to the U.S. and impose export restrictions on gallium processing technologies. This action has escalated concerns about national security, as gallium is essential for semiconductors, 5G technology, smartphones, satellite systems, photonics technologies, and next-generation defense systems.

Key Highlights of the Sheep Creek Discovery:

- Gallium grades measured by INL range from 180 to 385 parts per million (ppm), significantly exceeding the worldwide average of 50 ppm.
- US Critical Materials' average grade of 300 ppm represents the highest known concentrations in the U.S. and Greenland.
- The inferred resource value of the Sheep Creek gallium deposit is substantial, as defined by the U.S. Geological Survey.

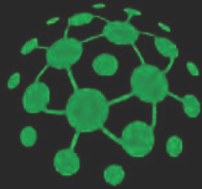
Jim Hedrick, President of US Critical Materials and a former rare earth commodity specialist for the USGS and U.S. Bureau of Mines, emphasized the importance of the discovery: "The U.S. has no gallium production or processing capabilities. Not only is our gallium high-grade, but we are also confident that working together with Idaho National Laboratory, we will create a proprietary separation process that is both efficient and environmentally respectful—far surpassing current processes used in China."

"Dr. Robert Fox, Critical Materials Business Lead at INL, commented on the significance of the findings: "We are now able to confirm the presence of high-grade gallium at Sheep Creek. We look forward to continuing our work to develop a sustainable and efficient separation process for gallium and other elements."

US Critical Materials' efforts come at a pivotal time for national security and technological independence, as the United States remains 100% dependent on gallium imports.

About US Critical Materials Corp.

US Critical Materials is a private critical minerals exploration and development company based in Salt Lake City, UT, with holdings in Montana and Idaho. The company's deposits are notable for their high grades of rare earths, low levels of thorium, and significant quantities of critical minerals.



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FOR MORE INFO PLEASE CONTACT :

rachelwinn@uscriticalmaterials.com

4190 S. Highland Dr. Suite 230

Salt Lake City, Utah 84124

(801) 322-3401