# EXAMINING THE METHODOLOGY AND STRUCTURE OF THE U.S. GEOLOGICAL SURVEY'S CRITICAL MINERALS LIST

## OVERSIGHT HEARING

BEFORE THE

SUBCOMMITTEE ON ENERGY AND MINERAL RESOURCES

OF THE

COMMITTEE ON NATURAL RESOURCES
U.S. HOUSE OF REPRESENTATIVES

ONE HUNDRED EIGHTEENTH CONGRESS

FIRST SESSION

Wednesday, September 13, 2023

**Serial No. 118–58**

Printed for the use of the Committee on Natural Resources

Available via the World Wide Web: http://www.govinfo.gov
or
Committee address: http://naturalresources.house.gov

U.S. GOVERNMENT PUBLISHING OFFICE
53–407 PDF WASHINGTON : 2024

## COMMITTEE ON NATURAL RESOURCES

BRUCE WESTERMAN, AR, *Chairman*
DOUG LAMBORN, CO, *Vice Chairman*
RAÚL M. GRIJALVA, AZ, *Ranking Member*

Doug Lamborn, CO
Robert J. Wittman, VA
Tom McClintock, CA
Paul Gosar, AZ
Garret Graves, LA
Aumua Amata C. Radewagen, AS
Doug LaMalfa, CA
Daniel Webster, FL
Jenniffer González-Colón, PR
Russ Fulcher, ID
Pete Stauber, MN
John R. Curtis, UT
Tom Tiffany, WI
Jerry Carl, AL
Matt Rosendale, MT
Lauren Boebert, CO
Cliff Bentz, OR
Jen Kiggans, VA
Jim Moylan, GU
Wesley P. Hunt, TX
Mike Collins, GA
Anna Paulina Luna, FL
John Duarte, CA
Harriet M. Hageman, WY

Grace F. Napolitano, CA
Gregorio Kilili Camacho Sablan, CNMI
Jared Huffman, CA
Ruben Gallego, AZ
Joe Neguse, CO
Mike Levin, CA
Katie Porter, CA
Teresa Leger Fernández, NM
Melanie A. Stansbury, NM
Mary Sattler Peltola, AK
Alexandria Ocasio-Cortez, NY
Kevin Mullin, CA
Val T. Hoyle, OR
Sydney Kamlager-Dove, CA
Seth Magaziner, RI
Nydia M. Velázquez, NY
Ed Case, HI
Debbie Dingell, MI
Susie Lee, NV

Vivian Moeglein, *Staff Director*
Tom Connally, *Chief Counsel*
Lora Snyder, *Democratic Staff Director*
http://naturalresources.house.gov

---

## SUBCOMMITTEE ON ENERGY AND MINERAL RESOURCES

PETE STAUBER, MN, *Chairman*
WESLEY P. HUNT, TX, *Vice Chair*
ALEXANDRIA OCASIO-CORTEZ, NY, *Ranking Member*

Doug Lamborn, CO
Robert J. Wittman, VA
Paul Gosar, AZ
Garret Graves, LA
Daniel Webster, FL
Russ Fulcher, ID
John R. Curtis, UT
Tom Tiffany, WI
Matt Rosendale, MT
Lauren Boebert, CO
Wesley P. Hunt, TX
Mike Collins, GA
John Duarte, CA
Bruce Westerman, AR, *ex officio*

Jared Huffman, CA
Kevin Mullin, CA
Sydney Kamlager-Dove, CA
Seth Magaziner, RI
Nydia M. Velázquez, NY
Debbie Dingell, MI
Raúl M. Grijalva, AZ
Grace F. Napolitano, CA
Susie Lee, NV
*Vacancy*
*Vacancy*

---

# CONTENTS

# OVERSIGHT HEARING ON EXAMINING THE METHODOLOGY AND STRUCTURE OF THE U.S. GEOLOGICAL SURVEY'S CRITICAL MINERALS LIST

**Wednesday, September 13, 2023**
**U.S. House of Representatives**
**Subcommittee on Energy and Mineral Resources**
**Committee on Natural Resources**
**Washington, DC**

The Subcommittee met, pursuant to notice, at 10:18 a.m., in Room 1324, Longworth House Office Building, Hon. Pete Stauber [Chairman of the Subcommittee] presiding.

Present: Representatives Stauber, Lamborn, Wittman, Gosar, Fulcher, Curtis, Tiffany, Boebert, Collins, Westerman; Ocasio-Cortez, Mullin, Magaziner, Dingell, Grijalva, and Lee.

Mr. STAUBER. The Subcommittee on Energy and Mineral Resources will come to order.

Without objection, the Chair is authorized to declare a recess of the Subcommittee at any time.

Under Committee Rule 4(f), any oral opening statements at hearings are limited to the Chairman and the Ranking Minority Member.

I now recognize myself for an opening statement.

## STATEMENT OF THE HON. PETE STAUBER, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF MINNESOTA

Mr. STAUBER. Today, the Subcommittee on Energy and Mineral Resources will host an oversight hearing to examine the U.S. Geological Survey's critical minerals list.

I would like to begin by thanking all of the witnesses for being here today for this important hearing.

By now we have all seen the numbers: demand for hardrock minerals like nickel, cobalt, zinc, silver, lithium, and many other commodities is expected to climb rapidly in the coming years. Our modern way of life relies on these resources for satellites, cell phones, defense systems, and virtually all other high-tech devices.

Luckily, here in the United States, we are blessed to have some of the most prolific deposits of hardrock minerals, including the district that I represent in northeastern Minnesota, which will power our 21st century economy forward. I use the term "hardrock minerals," which includes nearly all mineral commodities except hydrocarbons and aggregates. However, since the Trump administration's 2017 Executive Order, the term "critical minerals" has been used for a subset of these minerals.

We now have the critical minerals list, which is created and overseen by the U.S. Geological Survey at the Department of the Interior, also known as USGS.

We discuss the importance of mining and minerals in this Committee often, as we should. But what exactly is a critical mineral compared to other hardrock minerals?

Are there tangible benefits to being listed as critical, such as increased access to funding, higher prioritization by Federal permitting agencies, or protection from frivolous lawsuits brought by activists and interest groups?

If so, what happens to those mineral commodities that are not listed?

I am also interested to hear about the similarities and distinctions between the USGS Critical Minerals list and the recently released critical materials list published by the Department of Energy. It is important to fully understand how these lists differ. If minerals benefit in different ways from being on one list or the other, and if there are any considerations given to the DOE list that the USGS might incorporate into its own analysis.

Finally, we need to understand the impact of these decisions on domestic mining projects. We will hear testimony today about how investments in a mineral rich state like my home state of Minnesota can be affected by Federal decisions about which minerals are considered critical and how changes to the list can bring uncertainty to economic development.

One would reasonably assume that if a particular mineral is listed on the critical minerals list, the Administration would prioritize domestic access to and development of it. As we begin the hearing today, I am once again struck by the hypocrisy of this Administration's policy on domestic mineral production.

On the one hand, the Administration advocates for increased renewables and EV mandates, policies that will certainly speed up demand for the minerals needed to build them. The White House has even provided billions of dollars in taxpayer funds for midstream and downstream mineral production.

But on the other hand, we have seen this Administration repeatedly choose to lock up lands with high mineral potential across our nation, such as the 225,504 acres withdrawn from development in Minnesota this past January in the Duluth complex, the biggest copper nickel find in the world.

Just last month, the Administration created a new national monument outside the Grand Canyon, blocking access to some of the richest uranium deposits in the United States.

For that matter, I am very curious why uranium was listed as a critical mineral in the 2018 version of the list, but for some reason it no longer qualified just a few years later for the 2022 list under this current Administration. I hope this policy change was not political, but given this Administration's anti-mining agenda, I am skeptical.

For the sake of our country, I strongly urge the Administration to accept that shutting down domestic mining while increasing demand at the same time will lead the United States to disaster. This Administration must drop its anywhere-but-America, anyworker-but-American anti-mining agenda. I hope my colleagues on both sides of the aisle will join me today in a robust and meaningful discussion of the critical minerals list and any potential changes that will help put the United States into the greatest position

possible to meet future challenges to our supply chain and our national security.

Thank you again to the witnesses for their willingness to join us today and share their testimony.

I now yield to the Ranking Member for her opening statement.

**STATEMENT OF THE HON. ALEXANDRIA OCASIO-CORTEZ, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF NEW YORK**

Ms. OCASIO-CORTEZ. Thank you so much, Chairman Stauber, and thank you to our witnesses for joining us this morning to discuss the U.S. Geological Survey's critical minerals list.

Thank you for joining us, gentlemen.

Recognizing the foundational role many minerals play in our economy, Congress has recently tasked USGS with creating and regularly updating a list of critical minerals. These are minerals that are deemed essential to U.S. economic or national security, and are vulnerable to supply chain disruption. These critical minerals will play a crucial role in our clean energy transition.

For example, we use lithium, cobalt, and nickel among many other minerals in batteries for electric vehicles, in wind turbines, and solar panels, all renewable energy technologies that will help us end our reliance on polluting fossil fuels and stave off the worst effects of the climate crisis. Critical minerals will be especially important for the transition of our transportation sector.

Transportation is currently the No. 1 source of carbon emissions in the United States, which makes this sector crucial to decarbonizing quickly. An important aspect of electrified transportation is demand for minerals, and the most non-replaceable critical mineral for electric vehicle batteries is lithium.

I would like to use lithium as a prescient example here. Lithium is already a bottleneck in the global and domestic supply chains for electric vehicles, or EVs. Today, there is only one operational lithium mine in the entire United States. Most of our lithium is currently imported from countries like Chile and Argentina, and our demand for lithium is only expected to skyrocket in the coming decades. Studies show that if today's demand for electric vehicles is projected outward, the global demand for lithium will increase 42 times by 2040. The vast majority of this new demand will be driven by the United States.

If demand for EVs continues at our current pace, the lithium requirements for the U.S. EV market alone in 2050 would require triple the amount of lithium currently produced on the entire planet today. Corporate interests and their allies in Congress see this as potential for astronomical demand, and point to it as a reason for cutting our bedrock environmental protections, ignoring community input, and abusing vulnerable communities among our international trade partners.

These private interests and their allies will say that we need to spark a rush to the bottom in order to compete with China; that we can't afford our 200-year-old mining law because China's mining regulations are weaker; that we can't afford to pay union wages to U.S. auto workers because Chinese auto workers already make less; and essentially, major corporations are asking us to

engage in a global race to the bottom because when they drive costs down they profit. But they use those profits to then surge and skyrocket their own CEO pay and not drive costs down, but drive them up.

These race-to-the-bottom arguments prey on a fear of scarcity that is emotionally appealing. But like so many arguments based in fear, this is a false choice.

For one, these arguments fail to acknowledge the work the United States can do in other sectors to reduce our reliance on these minerals in the first place. A recent study by UC Davis and the Climate Community Project shows that by increasing mass transit options, bringing EV batteries in line with other nations, and creating a robust battery recycling system, we can reduce our dependence on lithium by as much as 92 percent.

In a world where lithium is hard to come by, these reforms would have huge advantages for our energy and economic security. Race-to-the-bottom arguments also ignore a painful legacy when it comes to mining. Namely, we must recognize that to this day mining disproportionately harms Indigenous communities in the United States and across the globe.

In the United States, 97 percent of known nickel deposits, 89 percent of copper, 79 percent of lithium, and 68 percent of cobalt, all critical energy transition minerals, are within 39 miles of tribal lands. And, unfortunately, mining on public lands in the United States is still governed by the long-outdated Mining Law of 1872, which lacks provisions for tribal consultation, environmental safeguards, permitting requirements, or even royalties so American citizens can see even a return on these publicly-owned resources.

But the clean energy transition is an opportunity to reimagine our supply chain from mineral extraction all the way to end use. And we do not need to choose between sacrifice zones and creating jobs. Using non-partisan data from the USGS, we can improve mineral efficiency, increase recycling, and build economic security. We can require meaningful consultation with tribes. We can work in partnership with organized labor to build family-sustaining union jobs in mineral processing and manufacturing. And lastly, we can develop trade policy that holds our global partners accountable to the same environmental and labor standards established here so that businesses have no incentive to leave the United States for cheaper labor or resources.

It won't be easy, and I firmly believe that with a coordinated, whole-of-supply-chain approach, we can reduce demand, prevent environmental and cultural harms, and uphold Indigenous sovereignty while enforcing strong labor standards. Thank you.

Mr. STAUBER. Thank you very much. The Chair will now recognize the Ranking Member of the Full Committee, Ranking Member Grijalva.

## STATEMENT OF THE HON. RAÚL M. GRIJALVA, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF ARIZONA

Mr. GRIJALVA. Thank you very much, Mr. Chairman and Ranking Member, for the hearing. And let me join in thanking the witnesses for being here today.

The USGS critical minerals list determines which minerals are important for our national and economic security. But what is often left out of that determination is the damage that mining for these critical minerals causes, especially for tribes and other vulnerable communities.

As we have seen over and over, our outdated Mining Law of 1872 doesn't have the appropriate or necessary safeguards in place to protect these communities and the public engagement that is necessary. Mining has repeatedly destroyed public lands and nearby communities, our environment as well, our public health, and our sacred and special places.

With that in mind, we need to think very carefully about how we use the critical minerals list. Some of my colleagues think this list is a free pass to open new mines and rush through or ignore environmental reviews and public input. But doubling down on the mining industry's free-for-all is simply not a viable solution. Advancing environmental justice, strengthening tribal and community engagement, and ensuring a fair return for taxpayers is imperative.

There are no royalties collected from mining at all. And that alone is reason enough to deal with the Mining Law of 1872. We are premising all discussions on the law that is 150 years old, outdated, not part of this century, and the conflicts that come from that law. It is time to modernize it, reform it, bring it up to date, and put in the guarantees and safeguards that is going to make the public believe that truly they are part of the decision-making. As it stands now, they are not.

In fact, just yesterday the Interior Department-led Interagency Working Group on Mining Reform released a report informed by more than 26,000 public comments that include 65 recommendations to do exactly that, to advance environmental justice, to strengthen tribal and community engagement, and assure a fair return for taxpayers.

When it comes to critical minerals, we also need to recognize that, yes, we will need certain minerals for our clean energy transition. Which minerals, in what amounts, and from what sources are far from set in stone. What is critical today may not be critical tomorrow. Demand and a critical status can change quickly, but the mines cannot. Mines take years to start producing, and they cannot simply change the type of minerals they produce when the critical minerals list changes.

The legacy of environmental and cultural harms created by mines last long past the actual life of the mine. That is why we must be more careful with where and how we mine, and not less careful.

We must also take a holistic approach to addressing the risks identified by the critical minerals list. That means using our powers as Congress to promote efficient use and recycling of minerals for the benefit of the environment and communities.

What we should not do is consider every single change to the critical minerals list as an excuse to impulsively open a bunch of new mines whenever and however the industry wants.

Thank you, Mr. Chairman, and I yield back.

Mr. STAUBER. Thank you very much. The Chair now recognizes the Chairman of the Full Committee, Chairman Westerman, for 5 minutes.

**STATEMENT OF THE HON. BRUCE WESTERMAN, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF ARKANSAS**

Mr. WESTERMAN. Thank you, Chairman Stauber, and thank you to the witnesses for being here today.

The people in this room know that we will need to mine six times more in the future than what we mine today to meet our mineral demands. This demand is increasing at a greater and greater rate the more this Administration and international bodies prioritize renewable energy technologies.

I think where we are blessed is the fact that the United States has many of these commodities in our geology. But our national strategy to develop them seems to be all over the place. Over the past 30 years, we have allowed refineries and processing facilities to close and let Federal bureaucracy sink our mineral production into a quagmire of red tape and predatory litigation. Instead, we have become increasingly reliant on imports from other countries to meet our mineral needs, many of whom are not allies of the United States.

Our mineral dependency is now threatening our future. Over the August break, like many Members of Congress, I spent a lot of time in my district. I have a couple of nuclear power plants in my district that I visited, and as we were wrapping up I asked them, "Where do you get your uranium pellets?"

They immediately said, "One hundred percent from Russia."

One hundred percent of 40 percent of the energy in my state is dependent on uranium pellets from Russia. To me, that is unacceptable. And we can do better than that. We have deposits of uranium. Unfortunately, the next day the Biden administration put our most valuable uranium deposits in an off-limits zone where we can't mine them. That makes absolutely no sense to me.

The problems are clear, but the solutions seem to, for some reason, be complicated. In an attempt to identify the most vulnerable supply chains, the U.S. Geological Survey has put together a list of minerals they deem critical. This was a helpful way to focus our nation's attention on the issue, and I appreciate the effort to quantify such a complex issue. However, many questions remain about how effective this list has been in actually reducing our national dependency.

Further, I would like to consider ideas to improve the list methodology so that we can best capture changing demand trends with the highest accuracy possible. The critical minerals list is binary, and what I mean by that is a mineral either makes the list or it doesn't. Looking at minerals in this way as either critical or not critical has its limitations, obviously.

I would like to consider the value of different approaches, such as incorporating forecasting into the list-making process or looking at supply chain vulnerability on a sliding scale. Some of the supply chains we are looking at can change radically with one global

event, and the critical minerals list needs to be nimble enough to respond to account for such changes.

Finally, we have to remember that the critical minerals list exists in the context of domestic mining policy overall. Just yesterday, we finally received the Interagency Working Group's report on mining reform. I regret that many of the Administration's policy recommendations will take us even farther from mineral independence. The Biden administration can talk about the importance of mineral development all they want, but when they recommend an ill-advised conversion to a leasing system, high royalties, and putting mineral-rich areas off limits to development, their actions are speaking louder than their words.

For both sides of the aisle and for all Americans, ensuring a stable supply of mineral resources is essential for our national security and future economic well-being. A thorough examination of the USGS critical minerals list, why some minerals are on it and others are not, and how it might be improved is a necessary piece of that puzzle.

I look forward to a robust discussion on this extremely important topic.

Thank you, Mr. Chairman, and I yield back.

Mr. STAUBER. Thank you, Mr. Chairman.

We will now move to introduce our witnesses. Each witness will have 5 minutes to make their opening statements.

Our first witness is Dr. Nedal Nassar, who serves as Chief of Minerals Intelligence Research, U.S. Geological Survey, in Reston, Virginia.

Dr. Nassar, you are now recognized for 5 minutes.

**STATEMENT OF NEDAL NASSAR, CHIEF OF MINERALS INTELLIGENCE RESEARCH, U.S. GEOLOGICAL SURVEY, RESTON, VIRGINIA**

Dr. NASSAR. Good morning, Chairman Stauber, Ranking Member Ocasio-Cortez, and members of the Subcommittee. Thank you for the opportunity to discuss the U.S. Geological Survey's critical minerals work. My name is Nedal Nassar, and I am the Chief of Minerals Intelligence Research at the U.S. Geological Survey.

The USGS provides the nation's data on domestic and global mineral commodity supply chains. Under the Energy Act of 2020, the USGS analyzes those data in coordination with other Federal agencies to develop a whole-of-government list of critical minerals. The analysis identifies commodities for which supply risk is elevated, including how the supply risk has changed over time. It also identifies bottlenecks in supply chains, quantifies import dependencies, and highlights industries that may be most vulnerable to supply disruptions.

The 2022 list of critical minerals identified gallium as having the greatest U.S. supply risk, a risk that has become a reality as a result of recent export controls imposed by the People's Republic of China on gallium and germanium products. Gallium is, of course, important to semiconductors that are used in telecommunications, including 5G cellular networks, consumer electronics, solar photovoltaics, electric vehicles, and defense applications. Our data

indicate that in 2022, the People's Republic of China produced 98 percent of the world's primary gallium, 98 percent.

Over time, we expect the list to evolve. The Energy Act of 2020 requires that the list be updated once every 3 years. As supply chains are diversified and strengthened, commodities may come off the list. Similarly, commodities may be added to future lists if their supply becomes less secure, or the U.S. economy becomes more dependent on them.

The methodology for developing the list will also continue to evolve as we gather additional data and develop better tools to anticipate and quantify supply and demand disruptions and their impacts.

Since the release of the most recent list of critical minerals, the list and its underlying analysis have informed some of the nation's largest investments in mineral commodity supply chains. These include recent Defense Production Act investments and Bipartisan Infrastructure Law critical mineral provisions focused on multiple supply chain stages. USGS data and analyses are informing partner agencies' decision-making for a number of these investments.

Within the USGS, we are accelerating the Earth Mapping Resource Initiative's assessment of areas with potential to contain critical minerals both still in the ground and in waste streams. Under the Energy Act of 2020, the USGS also uses the list of critical minerals to help prioritize mineral resource assessments.

The USGS analyzes supply chains across sectors, which allows us to understand cumulative supply risks. For example, we examine cross sectoral demand for mineral materials needed for energy, transportation, and construction, and quantify the economic impact the supply disruption may have on mineral-consuming industries, the ripple effects on the downstream industries that rely on them, and the economy as a whole. We provide these analyses and data to a variety of Federal decision-makers, including the Defense Logistics Agency stockpile managers, the National Security Council, the State Department, the Department of Commerce, the U.S. Trade Representative, and the intelligence community.

Over the past several years, our data have provided evidence of supply chain disruptions in mineral commodity production and shipping attributable to the COVID-19 pandemic, natural disasters, regional conflicts, as well as export restrictions imposed by trading partners. We continuously monitor the effects of such disruptions across the suite of mineral commodities that we track.

The Energy Act of 2020 also calls for the USGS to further develop its forecasting capability. Accordingly, the USGS has expanded the range of official statistics reported annually in the mineral commodity summaries, and are developing new series of mineral outlooks. The President's 2024 budget request proposes to further increase the speed and responsiveness of USGS scenario modeling capabilities.

In summary, the USGS provides cross-sectoral, demand-driven analyses that inform whole-of-government efforts to strengthen supply chains. The list of critical minerals is one tool to identify concerns and inform actions. The list and the underlying analysis provide a rich set of data and tools that can be used to better

understand the specific risks affecting individual technologies, industries, and commodities originating from a particular geographic region or trading partner. The information can help policymakers target interventions that will increase the security of our nation's mineral commodity supplies.

Thank you for the opportunity to testify today. I look forward to your questions.

[The prepared statement of Dr. Nassar follows:]

PREPARED STATEMENT OF DR. NEDAL T. NASSAR, CHIEF OF MINERALS INTELLIGENCE RESEARCH, NATIONAL MINERALS INFORMATION CENTER, U.S. GEOLOGICAL SURVEY

Good morning, Chairman Stauber, Ranking Member Ocasio-Cortez, and Members of the Subcommittee. Thank you for the opportunity to discuss the U.S. Geological Survey's critical minerals work. My name is Nedal T. Nassar and I am the Chief of Minerals Intelligence Research at the U.S. Geological Survey (USGS).

**Background**

The USGS is the science arm of the Department of the Interior and brings impartial, actionable science to an array of stakeholders and partners, including decision-makers like yourselves, resource managers, and the public.

Congress passed the USGS's Organic Act in 1879, in part to gain greater understanding of our Nation's mineral resources. That remains central to our mission 144 years later, although our tools have changed, and today our science serves a wider range of objectives. For example, through the Earth Mapping Resources Initiative (Earth MRI) and our growing national mine-waste inventory, we are mapping the potential for mineral occurrence with advanced instruments that are deployed in space, in the air, in the laboratory, and on the ground, all leading to a better understanding of our country's mineral resources both in the ground and in waste streams. And through our mineral supply chain analyses, we advise other federal agencies on supply chain risks and investments in their sectors of expertise.

The United States remains a major mineral producer, and in 2022, the domestic mineral industry mined $98.2 billion worth of mineral commodities.[1] However, over the past half-century, mineral supply chains have become more complex as both new and established technologies rely on an increasing volume and variety of minerals. Most future energy-sector technologies are mineral-intensive, and therefore also potentially land-intensive and water-intensive; neither domestic production nor trade eliminates these challenges. Other economic sectors' mineral demands are also increasing. The U.S. economy is demanding traditional mining products like iron, aluminum, copper, sand, gravel, and cement. We also see rising demand for non-traditional mineral commodities that are required for new technologies essential to our national and economic security. While the USGS addresses all of these mineral commodities, a set of essential mineral commodities for which there are significant supply chain risks are designated as critical minerals, and they are at the center of the USGS' minerals-related research.

**List of Critical Minerals and Changes to the List**

The USGS provides the Nation's data and statistics on domestic and global production and consumption of minerals. Under the Energy Act of 2020, the USGS regularly analyzes those data to develop a whole-of-government list of critical minerals based on global mineral supply chains across all economic sectors. This cross-sectoral approach is coordinated across the Federal Government through the National Science and Technology Council's Critical Minerals Subcommittee (NSTC CMS), which is co-chaired by the White House Office of Science and Technology Policy, the U.S. Department of Energy, and the USGS. The initial methodology and list, published in 2018[2] under the direction of Executive Order 13817, was updated

[1] U.S. Geological Survey, 2023, Mineral commodity summaries 2023: U.S. Geological Survey, 210 p., https://doi.org/10.3133/mcs2023.

[2] Fortier, S.M., et al., 2018, Draft critical mineral list—Summary of methodology and background information—U.S. Geological Survey technical input document in response to Secretarial Order No. 3359: U.S. Geological Survey Open-File Report 2018-1021, 15 p., https://doi.org/10.3133/ofr20181021.

in 2021 in response to the Energy Act of 2020,[3] reviewed by other Federal agencies through the NSTC CMS and by the public, and a final list of 50 critical mineral commodities was published in the Federal Register on February 24, 2022.[4]

In developing the list of critical minerals, we apply data on the Nation's production and consumption of mineral commodities, all provided voluntarily by industry, to evaluate supply risk. When sufficient data to support quantitative analysis are not available, we analyze supply risk qualitatively, for example by identifying supply chains that include a single point of failure. Table 1 shows the 2022 list of critical minerals and their rationale for inclusion. Table 1 also highlights that many mineral commodities on the list are recovered as byproducts from mining and processing of other, non-critical mineral commodities.

Figure 1 lists the commodities for which supply risk was evaluated using quantitative tools, including how the supply risk for each has changed over time; it also shows the countries that are the major producers of each of those commodities. The 2022 list of critical minerals identifies gallium as having the greatest U.S. supply risk, a risk that has become a reality as a result of the recent export controls imposed by the People's Republic of China on gallium and germanium.

Over time, we expect the list of critical minerals to evolve. The Energy Act of 2020 requires that the list be updated at least once every three years. As supply chains are strengthened for minerals currently on the list, or if specific minerals become less important to the U.S. economy or national security, those minerals may come off the list. Similarly, minerals may be added to future lists if their supply becomes less secure or the U.S. economy becomes more dependent on applications for which those minerals are primary inputs.

The methodology for developing the list will evolve as we and our interagency partners gather additional data and develop better tools to anticipate and quantify supply and demand disruptions.

**Recent Federal Investments Guided by USGS Analysis**

Since we released the most recent list of critical minerals, the list and its underlying analysis have informed some of the Nation's largest investments in mineral supply chains. These investments include recent Defense Production Act investments and Bipartisan Infrastructure Law (BIL) critical minerals provisions focused on multiple supply chain stages. USGS data and analyses are informing partner agencies' decision-making for a number of these investments. Within the USGS, we are accelerating Earth MRI mapping of areas with potential to contain critical minerals and investing in the preservation of historical data and samples related to critical minerals. Under the Energy Act of 2020, the USGS also uses the list of critical minerals to help prioritize mineral resource assessments. The USGS is focusing its next series of resource assessments on critical minerals needed for high-capacity batteries and grid-energy storage applications before assessing other critical minerals (Figure 2).

**Scenario Analysis and Forecasting**

The USGS monitors supply chains across sectors, which allows us to understand cumulative supply risks. For example, we examine cross-sectoral competition for materials needed for energy, consumer electronics, and construction. We provide mineral supply chain data and analyses to a variety of Federal decision-makers, including the Defense Logistics Agency's stockpile managers, the National Security Council, the State Department, the Department of Commerce, the U.S. Trade Representative, and the Intelligence Community.

Over the past several years, our data have provided evidence of supply chain disruptions in mineral production and shipping attributable to the COVID-19 pandemic as well as evidence of recovery. Mineral supply chains have also seen disruptions associated with natural disasters and with export restrictions imposed by trading partners. We continuously monitor the effects of such disruptions across the suite of minerals we track.

---

[3] Nassar, N.T., and Fortier, S.M., 2021, Methodology and technical input for the 2021 review and revision of the U.S. Critical Minerals List: U.S. Geological Survey Open-File Report 2021-1045, 31 p., https://doi.org/10.3133/ofr20211045.

[4] 2022 Final List of Critical Minerals https://www.federalregister.gov/documents/2022/02/24/2022-04027/2022-final-list-of-critical-minerals.

The Energy Act of 2020 calls for the USGS to further develop its forecasting capability. Accordingly, the USGS has expanded the range of official statistics reported annually in the Mineral Commodity Summaries and is developing a new series of five-year global mineral outlooks. The President's 2024 budget request proposes to further increase the speed of USGS critical mineral supply chain forecasting and its responsiveness to current events.

This focus on supply chain analysis and forecasting supports whole-of-government efforts to strengthen supply chains. The USGS works to provide strong scientific evidence on the feasibility and impacts of domestic primary and secondary (recycling and reprocessing of waste) production and on the potential to secure supplies through trade with reliable partners. Under the BIL, the NSTC CMS is authorized to coordinate investments in science and technology to support these strategies. In support of these efforts, the USGS identifies potential future critical minerals and evaluates whether these investments are in fact strengthening supply chains.

**Summary**

In summary, the USGS provides cross-sectoral, data-driven supply chain analyses that inform whole-of-government efforts to strengthen supply chains. The list of critical minerals is one tool to inform investments in supply chains. The list and its underlying analyses also provide a rich set of data and tools that can be used to better understand the specific risks potentially affecting individual technologies, industries, or commodities originating from a particular geographic area or trading partner; to identify key trade relationships that may need strengthening; and to target investments in alternative sources of supplies for economically vital products. The USGS has deep expertise in near- and long-term mineral supplies, supply risk, and the potential for supply shocks. By partnering with other agencies that specialize in sector-specific demand forecasting and the potential for demand shocks associated with the emergence and growth of specific technologies, we can provide an even richer picture of the future risks to mineral supply chains. This information can help policymakers target interventions that will increase the security of our Nation's minerals supply.

Thank you for the opportunity to testify today. I look forward to your questions.

*****

**Table 1.** Results of quantitative and qualitative evaluation of supply risk and the 2022 list of critical minerals.

| Highest to lowest supply chain risk, based on quantitative evaluation [5] | Mineral commodity | Included on the 2022 list of critical minerals? | Basis for recommended inclusion | On 2018 list of critical minerals? | Predominantly recovered as byproduct? [6] |
|---|---|---|---|---|---|
| 1 | Gallium | Yes | Quantitative evaluation | Yes | Yes. |
| 2 | Niobium | Yes | Quantitative evaluation | Yes | No. |
| 3 | Cobalt | Yes | Quantitative evaluation | Yes | Yes. |
| 4 | Neodymium | Yes | Quantitative evaluation | Yes | Yes. |
| 5 | Ruthenium | Yes | Quantitative evaluation | Yes | Yes. |
| 6 | Rhodium | Yes | Quantitative evaluation | Yes | Yes. |
| 7 | Dysprosium | Yes | Quantitative evaluation | Yes | Yes. |
| 8 | Aluminum | Yes | Quantitative evaluation | Yes | No. |
| 9 | Fluorspar | Yes | Quantitative evaluation | Yes | No. |
| 10 | Platinum | Yes | Quantitative evaluation | Yes | No. |
| 11 | Iridium | Yes | Quantitative evaluation | Yes | Yes. |
| 12 | Praseodymium | Yes | Quantitative evaluation | Yes | Yes. |
| 13 | Cerium | Yes | Quantitative evaluation | Yes | Yes. |
| 14 | Lanthanum | Yes | Quantitative evaluation | Yes | Yes. |
| 15 | Bismuth | Yes | Quantitative evaluation | Yes | Yes. |
| 16 | Yttrium | Yes | Quantitative evaluation | Yes | Yes. |
| 17 | Antimony | Yes | Quantitative evaluation | Yes | Yes. |
| 18 | Tantalum | Yes | Quantitative evaluation | Yes | No. |
| 19 | Hafnium | Yes | Quantitative evaluation | Yes | Yes. |
| 20 | Tungsten | Yes | Quantitative evaluation | Yes | No. |
| 21 | Vanadium | Yes | Quantitative evaluation | Yes | Yes. |
| 22 | Tin | Yes | Quantitative evaluation | Yes | No. |
| 23 | Magnesium | Yes | Quantitative evaluation | Yes | No. |
| 24 | Germanium | Yes | Quantitative evaluation | Yes | Yes. |
| 25 | Palladium | Yes | Quantitative evaluation | Yes | Yes. |
| 26 | Titanium | Yes | Quantitative evaluation | Yes | No. |
| 27 | Zinc | Yes | Quantitative evaluation | No | No. |
| 28 | Graphite | Yes | Quantitative evaluation | Yes | No. |
| 29 | Chromium | Yes | Quantitative evaluation | Yes | No. |
| 30 | Arsenic | Yes | Quantitative evaluation | Yes | Yes. |
| 31 | Barite | Yes | Quantitative evaluation | Yes | No. |
| 32 | Indium | Yes | Quantitative evaluation | Yes | Yes. |
| 33 | Samarium | Yes | Quantitative evaluation | Yes | Yes. |
| 34 | Manganese | Yes | Quantitative evaluation | Yes | No. |
| 35 | Lithium | Yes | Quantitative evaluation | Yes | No. |
| 36 | Tellurium | Yes | Quantitative evaluation | Yes | Yes. |
| 37 | Lead | No | Not applicable | No | No. |
| 38 | Potash | No | Not applicable | Yes | No. |
| 39 | Strontium | No | Not applicable | Yes | No. |
| 40 | Rhenium | No | Not applicable | Yes | Yes. |
| 41 | Nickel | Yes | Single point of failure | No | No. |
| 42 | Copper | No | Not applicable | No | No. |
| 43 | Beryllium | Yes | Single point of failure | Yes | No. |
| 44 | Feldspar | No | Not applicable | No | No. |
| 45 | Phosphate | No | Not applicable | No | No. |
| 46 | Silver | No | Not applicable | No | Yes. |
| 47 | Mica | No | Not applicable | No | No. |
| 48 | Selenium | No | Not applicable | No | Yes. |
| 49 | Cadmium | No | Not applicable | No | Yes. |
| 50 | Zirconium | Yes | Single point of failure | Yes | Yes. |
| 51 | Molybdenum | No | Not applicable | No | No. |
| 52 | Gold | No | Not applicable | No | No. |
| 53 | Helium | No | Not applicable | Yes | Yes. |
| 54 | Iron ore | No | Not applicable | No | No. |
| [7] | Cesium | Yes | Qualitative evaluation | Yes | Yes. |
| [7] | Erbium | Yes | Qualitative evaluation | Yes | Yes. |
| [7] | Europium | Yes | Qualitative evaluation | Yes | Yes. |
| [7] | Gadolinium | Yes | Qualitative evaluation | Yes | Yes. |
| [7] | Holmium | Yes | Qualitative evaluation | Yes | Yes. |
| [7] | Lutetium | Yes | Qualitative evaluation | Yes | Yes. |
| [7] | Rubidium | Yes | Qualitative evaluation | Yes | Yes. |
| [7] | Scandium | Yes | Qualitative evaluation | Yes | Yes. |
| [7] | Terbium | Yes | Qualitative evaluation | Yes | Yes. |
| [7] | Thulium | Yes | Qualitative evaluation | Yes | Yes. |
| [7] | Uranium | Not evaluated | Not applicable | Yes | No. |
| [7] | Ytterbium | Yes | Qualitative evaluation | Yes | Yes. |

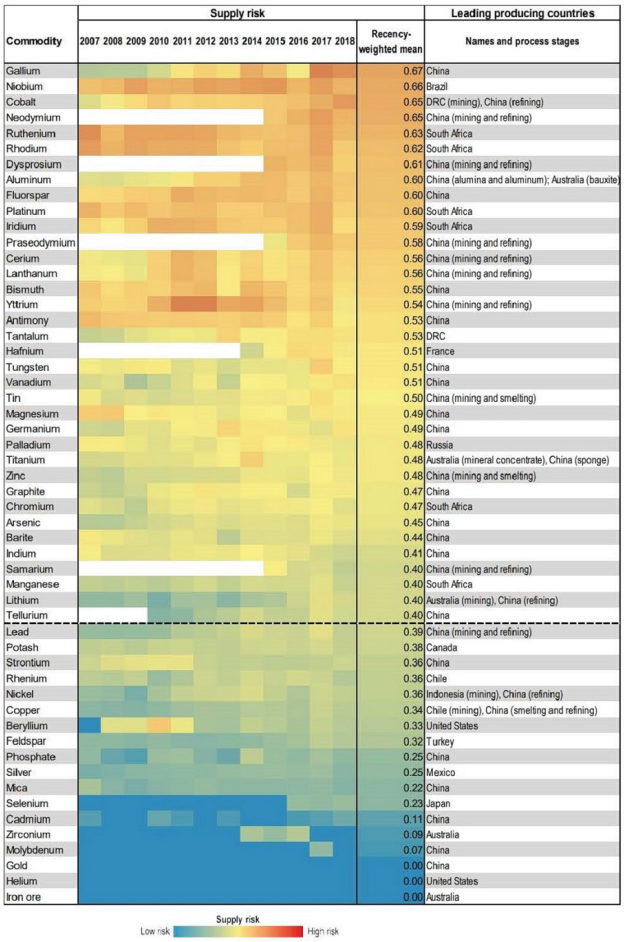
(Source: adapted from https://www.govinfo.gov/content/pkg/FR-2021-11-09/pdf/2021–24488.pdf)

[5] Ranked in order from highest to lowest risk based on a recency-weighted mean of the commodities' overall supply risk scores. See the published methodology (https://doi.org/10.3133/ofr20211045) for further details.

[6] Most mineral commodities are recovered as byproducts to some degree, but the share of primary production as a byproduct for the mineral commodities that are not identified as byproducts in the table is typically small. Rare earth elements (REEs) are mined both as byproducts of other mineral commodities (for example, iron ore or heavy-mineral sands) and as the main product. Where REEs are mined as the main product, the individual REEs are either byproducts or coproducts of each other. For simplicity, all REEs are labeled in the table as having been produced mostly as byproducts. Byproduct status can and does change, although notable changes over short periods of time are rare.

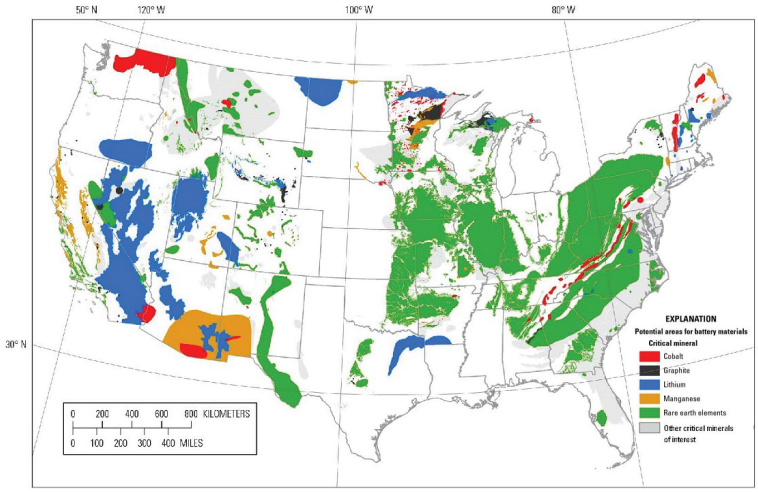
[7] Commodities that were not evaluated using the quantitative evaluation are not given a rank and are ordered alphabetically.

**Figure 1.** Supply risk for 54 commodities with sufficient data for quantitative evaluation, for the years 2007–2018. Warmer (i.e., orange to red) shades indicate a greater degree of supply risk. As indicated by the dashed horizonal line, 36 commodities with a recency-weighted mean supply risk greater than or equal to 0.40 are included on the list of critical minerals. Leading producing countries for each commodity are listed.




(Source: Nassar, N.T., and Fortier, S.M., 2021, Methodology and technical input for the 2021 review and revision of the U.S. Critical Minerals List: U.S. Geological Survey Open-File Report 2021-1045, 31 p., https://doi.org/10.3133/ofr20211045.)

**Figure 2.** Areas with potential subsurface mineral resources required for high-capacity batteries (cobalt, graphite, lithium, manganese, and rare earth elements) across the conterminous United States.




(Source: Dicken, C.L., and Hammarstrom, J.M., 2020, GIS for focus areas of potential domestic resources of 11 critical minerals—aluminum, cobalt, graphite, lithium, niobium, platinum group elements, rare earth elements, tantalum, tin, titanium, and tungsten: U.S. Geological Survey data release, https://doi.org/10.5066/P95CO8LR)

---

QUESTIONS SUBMITTED FOR THE RECORD TO DR. NEDAL NASSAR, CHIEF OF MINERALS INTELLIGENCE RESEARCH, U.S. GEOLOGICAL SURVEY

**Dr. Nassar did not submit responses to the Committee by the appropriate deadline for inclusion in the printed record.**

### Questions Submitted by Representative Stauber

*Question 1. In response to a question from Congressman Collins regarding the possibility of incorporating subcategories of critical minerals by sector or end use into the critical minerals list, you replied this was an interesting idea to consider. How might USGS go about creating such categorizations?*

*Question 2. When can Congress expect the publication of the Annual Critical Mineral Outlook as required by the Energy Act of 2020?*

*Question 3. Given the requirements for forward-looking data gathering in the Energy Act of 2020, does USGS have all the statutory authority it needs to utilize forecasting analysis in the formation of future iterations of the critical minerals list should it be directed to do so by Congress?*

*Question 4. How was the Fraser Institute's policy perception index, an opinion survey of mining executives, decided on for the sole source of data on a country's ability to supply resources (ASI)?*

*Question 5. Were non-subjective sources of data on the socio and geopolitical stability of source countries (for example, Uppsala University's Uppsala Conflict Data Program) considered as measures of a country's ability to supply (ASI)? If so, why were they not utilized?*

*Question 6. The methodology for trade exposure (TE) reviews trade activity for a mineral at a single point in time. How does this methodology address minerals with no immediate critical need, but which are predicted to become critical under common scenario analyses?*

*Question 7. The methodology relies heavily on the accurate and fulsome identification of source countries. How were the source countries identified, and what criteria was used in determining whether a single or multiple countries would be examined as a source for a mineral?*

*Question 8. If USGS had not interpreted the Energy Act of 2020 as barring uranium from consideration as a critical mineral, would the known vulnerabilities in the uranium supply chain have otherwise qualified it for inclusion in the updated 2022 Critical Minerals List?*

**Questions Submitted by Representative Wittman**

*Question 1. How frequently is the Critical Mineral List updated, and what factors trigger updates or revisions to the list? Are there any plans to make this process more regular or responsive to changing market conditions?*

*Question 2. Are there fixed or universally defined thresholds fo criteria to determine if a mineral is classified as critical? ff not, why not?*

*Question 3. How transparent is the decision-making process for what minerals are classified as critical?*

---

Mr. STAUBER. Thank you very much for your testimony. Our next witness is Mr. Reed Blakemore. He is the Director of Research and Programs for the Global Energy Center with the Atlantic Council, based right here in Washington, DC.

Mr. Blakemore, you are now recognized for 5 minutes.

**STATEMENT OF REED BLAKEMORE, DIRECTOR OF RESEARCH AND PROGRAMS, GLOBAL ENERGY CENTER, ATLANTIC COUNCIL, WASHINGTON, DC**

Mr. BLAKEMORE. Thank you, Chairman Stauber and Ranking Member Ocasio-Cortez, and thank you to the distinguished members of the Subcommittee for the invitation to appear before you today. My name is Reed Blakemore, and I am the Director of Research and Programs at the Atlantic Council's Global Energy Center, a non-partisan, non-profit think tank headquartered here in Washington, DC.

Before I begin, I would like to note that my remarks and written testimony represent my observations as an expert, and do not necessarily represent the views of my colleagues or institution.

To summarize my more detailed testimony, I would like to provide a broad overview of our understanding of what makes a mineral critical, and how we should approach a global economy increasingly dependent on an ever-diverse set of minerals and materials.

As many of my colleagues today will reiterate and as has been reiterated by the Chairman and Ranking Member, many minerals, many of which are supply constrained, are fundamental to strategically important industries of the United States, such as defense, energy, pharmaceuticals, and semiconductors. Access to these minerals is essential to limiting inflation, our global economic leadership, and our national security. The security of supply for such minerals has been strategically relevant to the United States for some time, and will continue to be so.

Nonetheless, as has already been noted, the rapidly expanding mineral requirements of the energy sector are reshaping how much attention is needed to secure these supply chains. These demands

are not only reframing how we think about energy security, but new energy technologies, opportunities for exports, and additional economic leadership. Resource security is critical to enabling this leadership in emerging sectors such as electric vehicles and renewable power.

Importantly, the United States is not alone in observing this shift. Allies, partners, peers, and rivals are moving quickly to seize the strategic value of influence in mineral supply chains, exacerbating geopolitical risk and supply concentration, which have long been features of minerals markets. For instance, in just one example here, through tariffs and export bans many mineral-rich countries are enacting policies to push investment toward value-added economic activities, so they can capture the economic windfall opportunities beyond simply extracting raw materials for export. This shapes how we need to think about supply chain intervention and securing our resources moving forward for the next 30 years.

The risks of inaction here abound. This is why a priority of the U.S. Government across consecutive administrations has been to identify specific minerals that it deems critical, and focus policy attention on improving access to or the security of these supply chains.

Deciding which minerals are critical, of course, is based on dependency, our demand, and the ability to access them reliably, the available supply. However, with 50 minerals now on at least one of the three critical minerals lists being produced across the U.S. Government, we would do well to think through the relative criticality of minerals that are designated to this list to mature our strategic planning and act effectively.

Though there are a number of mineral-specific factors that apply to this notion, several stand out as useful first steps for consideration. On the demand side, these include the growth rate of specific mineral demands over time, the demand elasticity and substitutability of certain minerals, and differing technology deployment scenarios.

On the supply side, I applaud the critical efforts of the USGS to improve our knowledge of the resource base. Nonetheless, the supply picture is also increasingly shaped by several additional features, including difficult project economics and ore quality declines, lengthy project life cycles and permitting challenges, and new sourcing methods such as recycling or waste conversion.

Contextualizing these features is an appreciation for the vulnerability of supply to disruption, namely trade exposure and supply chain concentration. Provided that the United States cannot supply all of its mineral needs domestically, mitigating these supply risks requires work to build trusted supply chain partnerships that limit the possibility of physical interruptions, market imbalances, and government interventions. This balance defines the space for how we should resolve a particular criticality, which is equally if not more important than listing a particular mineral in the first place.

To conclude, there are certain minerals that are structurally important to our national and economic security, and our needs for them are diverse, dynamic, and growing. Identifying these minerals signals a need for action and forms the basis for interagency coordi-

nation. But while lists are important, we shouldn't rely on lists alone. We need to ensure that our minerals policy does not become overly clerkish, prescribing problems rather than solving them. Capturing the supply and demand dynamism between each critical mineral will illuminate the pathways to build a cohesive mineral strategy.

To be clear, many of the foremost issues in our minerals policy stem from a need for broader reform, be it through permitting or deeper international engagement. Nonetheless, a properly curated list helps inform decisions on those fronts. I therefore commend this Committee for attention to this issue, and look forward to continuing to support its efforts in this area. Thank you.

[The prepared statement of Mr. Blakemore follows:]

PREPARED STATEMENT OF REED BLAKEMORE, DIRECTOR OF RESEARCH AND PROGRAMS, GLOBAL ENERGY CENTER, ATLANTIC COUNCIL

**I. Introduction**

Chairman Stauber, Ranking Member Ocasio Cortez, and distinguished members of the Subcommittee, thank you for the invitation to appear before you today.

My name is Reed Blakemore, and I am the Director of Research and Programs at the Atlantic Council's Global Energy Center.

The Atlantic Council is a non-partisan, non-profit policy organization headquartered in Washington, DC. Our work at the Global Energy Center develops and promotes pragmatic and nonpartisan policy solutions designed to advance global energy security, enhance economic opportunity, and accelerate pathways to net-zero emissions. Critical minerals and materials is one of the core pillars of our work.

Before I begin, I should note that my remarks and written testimony represent my observations, and do not necessarily represent the views of my colleagues or institution.

This hearing focuses on the methodology and structure of the USGS Critical Minerals List. However, I would like to provide a broad overview on our understanding of what makes a mineral "critical" and how the United States can best prepare to act on the vulnerabilities inherent in a world of diverse mineral demands.

The distinction of a mineral or material as 'critical' ascribes that a mineral should be treated with additional concern, intended to inform the strategic thinking of policymakers with respect to domestic mining legislation, public investments, trade policy, development policy, and more. It can also signify a need for action from policymakers and government officials, whether that is an addition of a material to the National Defense Stockpile, the DOE Loan Programs Office making an investment in a processing plant at home, or Development Finance Corporation investing in a project abroad.

Yet what determines criticality is ultimately in the eye of the beholder. Minerals that are critical to one industry or policy objective may not be essential for another, and the minerals that are critical for the United States may not be so for another nation. As such, continued reflection on what is 'critical' and how one plans to address that criticality is essential in a minerals and materials-intense world, and I commend this committee for their efforts in this regard. My esteemed co-panelists will explain in detail the methodology of critical minerals list-making and the implications for minerals that are placed on that list. However, I would like to begin with a top-level overview of what factors, generally-speaking, influence the determination of what makes certain minerals or materials fall into this category.

**II. Why are certain minerals and materials 'critical'**

A suite of core minerals and materials are fundamental pieces of the structure of our economy and national security. While the importance of certain metal commodities to the United States' national economic health is well-understood, a small number of niche, supply-constrained minerals are equally-as important to industries such as pharmaceuticals and semiconductors. Access to these minerals is key/essential to limiting inflation and maximizing economies of scale, making them central to prosperity at home and economic leadership abroad.

Defense needs also entail demand for certain materials that have been deemed critical, such as gallium, ferromanganese, antimony, lithium, nickel, and many

others. Every SSN-774 Virginia-class submarine requires about 9,200 pounds (half the weight of a school bus) of rare earth elements, while F-35 Lightning II aircraft require roughly 920 pounds.[1] Cobalt is an important component of permanent magnets which are used in energy technologies, but also military technologies such as smart bombs, aircraft, and guided missiles.[2]

The security of supply of these minerals, therefore, has been strategically relevant to the United States for some time and will continue to be so.

Now, the mineral and material requirements of the energy sector demands equal attention, especially as the energy transition changes the structural makeup of the global economy.

Much of this demand is policy driven. Electrifying large swaths of the economy necessarily implies the use of a significant number of materials that can carry that electricity. Furthermore, renewable energy generation technologies require a large quantity of durable materials, as opposed to our present energy system, which relies on consumable fossil fuels.

Over time, our energy generation, storage, and transmission technologies will become increasingly dependent on materials such as copper, nickel, manganese, graphite, lithium, cobalt, and many others. Since the passage of the Inflation Reduction Act, forecasts of demand in 2035 for lithium have increased by 15 percent, and nickel by 13 percent.[3] The United States' total combined energy technolgy-related demand for lithium, nickel and cobalt will be 23 times higher in 2035 than it was in 2021.[4]

Similar trends around the world amplify the importance of these minerals to the global economy. Globally, policies to decrease greenhouse gas emissions by 2050 are accelerating. A higher reliance on critical minerals is already being observed as a result—since 2010, the average amount of minerals needed for a new unit of power generation capacity has increased by 50 percent as the share of renewables in new investment has risen.[5] Some minerals such as lithium, copper, graphite and nickel may see a 40-fold increase in demand globally due to their importance in batteries, electric vehicles, semiconductors, transmission lines, and clean electricity generation technologies.[6]

Meanwhile, the steady transformation of a new energy system is opening market opportunities for new clean energy technology exports, with resource security a critical component of the supply chains that will enable leadership in industries new and old.

We have seen this manifest in industrial ambitions for several nations associated with building out mining and processing infrastructure which can meet future demand. For instance, Indonesia is developing polysilicon plants to feed solar panel manufacturing, while also banning unrefined nickel exports, which is necessary for the manufacturing of materials for lithium-ion.[7] Many mineral-rich countries are enacting policies to push investment towards downstream 'value-added' economic activities so they can more effectively control their supply chains during the global transition and capture the windfall that will be associated with producing those materials for export. The latter is particularly true for those countries that view critical mineral industries as a development opportunity, such as Zimbabwe and

---

[1] Runde, Daniel F., and Austin Hardman. "Elevating the Role of Critical Minerals for Development and Security." CSIS, September 1, 2023. https://www.csis.org/analysis/elevating-role-critical-minerals-development-and-security#:~:text=Critical%20minerals%20are%20also%20characterized,the%20economy%20or%20national%20security.%E2%80%9D.

[2] Ibid.

[3] "United States Faces New Challenges Meeting Increased Demand for Critical Minerals One Year after Historic Inflation Reduction Act, S&P Global Study Finds." News Release Archive. Accessed September 11, 2023. https://press.spglobal.com/2023-08-15-United-States-Faces-New-Challenges-Meeting-Increased-Demand-for-Critical-Minerals-One-Year-After-Historic-Inflation-Reduction-Act,-S-P-Global-Study-Finds#:~:text=Adding%20the%20post%2DIRA%20demand,than%20it%20was%20in%202021.

[4] Ibid.

[5] International Energy Association. "Executive Summary—the Role of Critical Minerals in Clean Energy Transitions—Analysis." IEA. Accessed September 11, 2023. https://www.iea.org/reports/the-role-of-critical-minerals-in-clean-energy-transitions/executive-summary.

[6] Ibid.

[7] Listiyorini, Eko. "Tropical Indonesia Wants t Start Making a Key Solar Panel Part." Bloomberg.com, January 24, 2022. https://www.bloomberg.com/news/articles/2022-01-25/tropical-indonesia-wants-to-start-making-a-key-solar-panel-part?sref=a9fBmPFG; International Energy Association. "Prohibition of the Export of Nickel Ore—Policies." IEA, October 31, 2022. https://www.iea.org/policies/16084-prohibition-of-the-export-of-nickel-ore.

Namibia, which have banned exports of unprocessed lithium ore, to keep more economic activity in their nations.[8]

This drive to capture value from the economic opportunity of the new energy technologies extends down the energy technology value chain.[9] Global EV sales increased from 716,000 vehicles in 2015 to 10.6 million vehicles in 2022.[10] Solar power saw global growth of nearly 200 Gigawatts—equivalent to the grid of Brazil—the most of any form of electricity generation.[11] Growth in areas such as these form the impetus to capture the value stemming from such a dramatic economic transformation.

Clearly, there is an emerging dynamic wherein influence and access across critical mineral supply chains is viewed as a strategic lever. By a similar vein, concentration and geopolitical risk abound in critical mineral supply chains. One country, the Democratic Republic of the Congo, accounts for 70 percent of global cobalt production.[12] Indonesia holds about 22 percent of the world's total nickel reserves, and about 40 percent of global nickel output.[13] Roughly 50–60 percent of lithium resources are found in three countries in Latin America (Argentina, Chile, and Bolivia).[14] Many of the countries that produce and process critical minerals are not our preferred trade partners by means of a free trade agreement. By 2035, it is forecast that as much as 90 percent of all nickel products, for instance, will be processed by countries that do not hold a free trade agreement with the United States.[15] China, meanwhile, enjoys significant control across the minerals supply chain through near-monopolistic control of processing for key minerals, and a dominant position in the financing or ownership of upstream mineral resource development.[16]

Taken together, though minerals have long had a significant role in ensuring the prosperity and security of the United States, the makeup of this role is changing dramatically as the mineral requirements underpinning US energy and geoeconomic priorities become more diverse and competitive in response to projected changes in energy markets

## III. The Characteristics of 'Listmaking' and Increasing Importance of Relative Criticality

As the 'minerals intensity' of the global economy increases, assessing and acting upon possible vulnerabilities or opportunities will be a feature of the strategic landscape. This is why a priority of the US Government across consecutive administrations has been to identify specific minerals that it deems "critical" and therefore focus policy attention on improving access to or the security of those supply chains.

Though 'listing' has been a feature of US policymaking for over a century, these efforts intensified in 2008 with a National Academy of Sciences study, which informed the creation of the first contemporary critical materials list, the DOE's 2010 Critical Materials Strategy. With Executive Order 13818 under the Trump

---

[8] Dempsey, Harry, and Joseph Cotterill. "How China Is Winning the Race for Africa's Lithium." Financial Times, April 3, 2023. https://www.ft.com/content/02d6f35d-e646-40f7-894c-ffcc6acd9b25.

[9] Blakemore, R., & Ryan, P. (2023, August 16). One year after the IRA, the hard work to build resilient mineral supply chains is only beginning. *Atlantic Council Global Energy Center*. September 11, 2023, https://www.atlanticcouncil.org/blogs/energysource/one-year-after-the-ira-the-hard-work-to-build-resilient-mineral-supply-chains-is-only-beginning/

[10] Department of Energy. "2023 Critical Materials Assessment—Department of Energy." 2023 U.S. Department of Energy Critical Materials Assessment, July 2023. https://www.energy.gov/sites/default/files/2023-05/2023-critical-materials-assessment.pdf.

[11] International Renewable Energy Agency. "Record Growth in Renewables Achieved despite Energy Crisis." IRENA, March 21, 2023. https://www.irena.org/News/pressreleases/2023/Mar/Record-9-point-6-Percentage-Growth-in-Renewables-Achieved-Despite-Energy-Crisis.

[12] Kelly, Lauren. "Top 10 Cobalt Producers by Country (Updated 2023)." INN, August 19, 2023. https://investingnews.com/where-is-cobalt-mined/.

[13] Falak Medina, Ayman. "Unleashing Nickel's Potential: Indonesia's Journey to Global Prominence." ASEAN Business News, June 20, 2023. https://www.aseanbriefing.com/news/unleashing-nickels-potential-indonesias-journey-to-global-prominence/#:~:text=Indonesia's%20nickel%20reserves,22%20percent%20of%20global%20reserves.

[14] Economic Commission for Latin America and the Caribbean. "Lithium Extraction and Industrialization: Opportunities and Challenges for Latin America and the Caribbean." CEPAL, July 2023. https://www.cepal.org/en/publications/48965-lithium-extraction-and-industrialization-opportunities-and-challenges-latin.

[15] Goodman, Peter S, and Ulet Ifansasti. "How Geopolitics Is Complicating the Move to Clean Energy." The New York Times, August 18, 2023. https://www.nytimes.com/2023/08/18/business/indonesia-nickel-china-us.html.

[16] Wilson Center. "Critical Mineral Maps." Wilson Center, March 17, 2022. https://www.wilsoncenter.org/article/critical-mineral-maps; Wells, Katherine. "China's Monopoly over Critical Minerals." Georgetown Security Studies Review, May 31, 2023. https://georgetownsecuritystudiesreview.org/2023/06/01/chinas-monopoly-over-critical-minerals/.

Administration came the direction for the Department of the Interior to publish a critical minerals list—which has now been published in 2018, and updated in 2022. Other countries have been developing Critical Mineral lists modeled after the US lists, including the EU, UK, South Korea, Japan and Australia, but their definitions of "critical" are different and reflect independent strategic priorities.

Yet as policymakers' attention to the possible vulnerabilities of a minerals-intensive world has grown, the scope of these lists has also evolved considerably. The first mineral list, titled War Minerals, was created in 1917 to aid the US WWI effort. It was comprised of only 5 minerals: tin, nickel, platinum, nitrates, and potash. Now, almost every element on the periodic table is used in global manufacturing, and 50 minerals are now on at least one of the three formal lists being produced across the USG.

This suggests that the United States would do well to think through the features of what makes a particular mineral critical, with particular attention to the relative criticality of minerals that are designated to these lists. Doing so will allow the United States to better understand its mineral and material vulnerabilities, communicate those priorities to partners in the marketplace, and more effectively act to secure key supply chains.

Fundamentally, a determination of which minerals are critical is broadly based on dependency on those minerals (demand—or the *impact of supply risk*) and the ability to access them reliably (supply—or the *risk of supply disruption*). Though the relationship between the two is at the core of whether a mineral should be deemed 'critical' or not, there are some independent features of each that provide some necessary color to a mineral's relative criticality.

The risk of not meeting future demand for minerals is not just a function of global geopolitical risks. It is also affected by the economic forces that impact the ability of mineral supply chains to meet future demand, and thus adequately supply the market.

**IV. Demand**

Assessing mineral demand is mostly an exercise in forecasting. As mentioned above, the accelerating momentum of renewable energy technology deployment has led to a general consensus of demand growth for key minerals for the next several decades. However, particularly for transition minerals and metals, several additional characteristics of demand warrant consideration. These include:

1. **The trendline of demand over time**. The growth in demand for certain materials will be larger at the outset of the energy transition than it will be over a prolonged period of time. Demand for certain minerals required for the buildout of transition infrastructure will grow rapidly in response to the energy transition but may become steadier over time given the long life cycle of those projects. Certain minerals may offer opportunities for recycling, as technology matures, suggesting that while a large demand signal for mined material will present itself initially, recycling can alleviate demand stress. Either example offers a framing to better understand vulnerability to certain mineral demands *now* vs. those *over time*.
2. **Demand elasticity**. The relative sensitivity of a particular mineral to being replaced by an alternative in response to disruption also helps contextualize how severe certain mineral vulnerabilities are relative to each other. While the unique properties of most minerals limit elasticity on a 1-1 basis, marginal input elasticity for technologies is emerging—for example in battery chemistries where concerns around cobalt resourcing have enabled the development of zero-cobalt or lithium-phosphate chemistries. Additionally, minerals used for EV batteries will not be necessary for batteries used for stationary grid storage, enabling substitution within that end-use.[17]
3. **Transition Technology Criticality (and corresponding elasticity)**. Related is the notion that some technologies (and their underlying minerals) will be more or less replaceable in the energy system of the future. For example, while there are few options to replace transmission infrastructure required for expanding the grid, there are a wide range of possibilities as to the scale of the hydrogen economy. Similar principles apply to highly innova-

[17] Blakemore, Reed, Paddy Ryan, and William Tobin. "Alternative Battery Chemistries and Diversifying Clean Energy Supply Chains." Atlantic Council, September 13, 2022. https://www.atlanticcouncil.org/in-depth-research-reports/issue-brief/alternative-battery-chemistries-and-diversifying-clean-energy-supply-chains/.

tion-exposed sectors of the economy and national defense. The potential variation in deployment of certain technologies implies a range in corresponding materials needed for manufacturing—this is observed in the stark variation observed in modelling of future demand for key minerals.[18]

**V. Supply**

Assessment of available supply to fulfill mineral demand is twofold: an understanding of the resource base both now and in the future, and the vulnerability of the resource base to disruption.

Our understanding of the resource base continues to mature, and I applaud the efforts of the USGS to continue to improve our knowledge of where certain minerals are available and in what quantities. Nonetheless, the supply picture is increasingly shaped by a number of additional features that bear strongly on relative criticality.

1. **Project Economics & Ore Quality**. Mining project economics are typically defined by the concentration of the desired material that is found in the ore at the mine site—ore being the naturally occurring sediment or brine. However, ore grades for certain materials are declining globally, precisely as we are in need of more. Mines for those metals are being dug deeper at greater expense and environmental impact (due to higher tailings—wastewater and waste rock). This increases prices to obtain the same quantity of the desired material. In Chile, for instance, which has borne the brunt of this problem due to its degrading copper mines, the capital intensity of new mines has ballooned from 4–5,000 dollars per ton of copper, to as much as 44,000 dollars per ton.[19] Many materials also require specialized technologies and processes to adjust extraction to certain ore profiles. This is the case for lithium, where ore bodies can differ drastically, and for nickel, where new technology has been necessary to adjust to the predominating variety of nickel ore.[20]

2. **Project Lifecycle**. Certain mining projects require much more time to bring supply to market than others. This not only varies between minerals, but in some cases from project to project, with a new lithium brine project requiring much less time to come to production than a lithium hard rock project. Challenging lead times induced by regulatory processes such as permitting also make it difficult for new entrants and projects to break into the market.[21] For instance, critical materials projects in the United States such as Pebble copper mine in Alaska, the Twin Metals copper mine in Minnesota, and a titanium mine in Georgia have failed to progress due to this process.[22]

3. **Non-traditional Sourcing**. New sources of supply are increasingly being developed in response to tightening markets. Full-value mining, which uses tailings from existing material processing to retrieve other critical minerals, is emerging as a useful corollary to circular economies of recycling minerals. These non-traditional sources of supply can offer both additional as well as marginal sources of supply, depending on the mineral. Materials R&D also remains vitally important to developing new processes or materials that can reduce supply chain constraints—whether in recycling, or producing critical materials from other forms of waste, such as captured carbon.[23]

---

[18] "IEF Critical Minerals Outlooks Comparison." International Energy Forum. Accessed September 11, 2023. https://www.ief.org/focus/ief-reports/critical-minerals-outlooks-comparison.

[19] "Copper mines becoming more capital intensive and costly to run" Ahead of the Herd. Accessed September 11, 2023. https://aheadoftheherd.com/copper-mines-becoming-more-capital-intensive-and-costly-to-run/

[20] Tang, J. (2023, April 25). *Infographic: Indonesian projects to boost Nickel Supply*. S&P Global Commodity Insights. https://www.spglobal.com/commodityinsights/en/market-insights/latest-news/metals/042423-infographic-indonesian-projects-to-boost-nickel-supply

[21] Blakemore, R., Ryan, P., & Bell, R. (2022, March 27). The United States, Canada, and the minerals challenge. *Atlantic Council Global Energy Center*. September 11, 2023, https://www.atlanticcouncil.org/in-depth-research-reports/report/the-united-states-canada-and-the-minerals-challenge/

[22] Northey, H., & Holzman, J. (2022, August 15). *Biden wants minerals, but mine permitting lags*. E&E News by POLITICO. https://www.eenews.net/articles/biden-wants-minerals-but-mine-permitting-lags/

[23] Tobin, W. (2022, April 28). The US should leverage 45Q for the graphite supply crunch. *Atlantic Council Global Energy Center*. September 11, 2023, https://www.atlanticcouncil.org/blogs/energysource/the-us-should-leverage-45q-for-the-graphite-supply-crunch/

Each of these features add necessary color to our understanding of how big the gap between supply and demand for certain minerals may be and what obstacles may shape the manner in which that gap can be filled.

Supply risk, meanwhile, can manifest in several ways.[24] Though it primarily comes in the form of trade exposure, wherein there is a high degree of import reliance, these risks are complicated by overconcentration of supply in a certain country, which can create a risk of disruption of supply in certain cases. Provided that the United States cannot supply the entirety of its mineral needs domestically, mitigating supply risk is more art than science—requiring an assessment of which minerals have relatively clearer pathways to build trusted supply chain partnerships that hedge against or limit the possibility of physical interruptions in the supply chain, market imbalances, and government interventions.

Taken together, these elements of what shapes the relative risk of a critical mineral or material offers some additional nuance to an increasingly diverse suite of minerals that underpin national security and economic prosperity. It helps us understand when risks to certain minerals will be more or less severe (an exercise I commend the Department of Energy for beginning to undertake in its most recent Critical Minerals Assessment), and how policymakers should consider intervening in a world where nearly every mineral and metal is of strategic importance.

**VI. Conclusion**

To conclude, there are certain minerals that are structurally important to our national and economic security. As energy transition proceeds, those mineral requirements are increasingly diverse and dynamic.

As a result, the practice of designating minerals as critical is necessary as a strategic review of national vulnerabilities in a minerals-intensive world, and the work of USGS and their interagency peers to this end is deeply important.

However, I will end with some final thoughts.

Lists signify a need for action and form the basis for interagency coordination, where it is invariably the case that we need to show our receipts and provide justification for actions that leverage the US taxpayer dollar in an environment of increasing demand for public money.

But while lists are important, we shouldn't rely on lists alone. We need to ensure that our minerals policy does not become overly clerkish, prescribing problems rather than solving them. Maturing those lists to capture the supply/demand dynamism between each critical mineral will illuminate the pathways to address the relative criticality inherent in these lists.

Many of the foremost issues in our minerals policy stem from a need for broader reform, whether in permitting, benefit-sharing, or international engagement.

Nonetheless, a properly curated list helps inform decisions on those fronts.

Thank you and I look forward to your questions.

---

Mr. STAUBER. Thank you very much for your testimony. I am going to yield to Representative Lamborn to introduce our next witness.

Mr. LAMBORN. Thank you, Mr. Chairman. I am pleased to introduce Dr. Roderick Eggert, Deputy Director of the Critical Minerals Institute at the DOE Energy Innovation Hub and Research Professor at the Colorado School of Mines in Golden, Colorado.

Colorado School of Mines is a leading center of education for geology and mining engineering, and represents the foremost level of academia in this industry. They are on the cutting edge of mineral and mining innovation, and are training the next generation of leaders in the mining industry, which we know is sorely needed.

Dr. Eggert, we are pleased to have you here representing the mining industry, the Colorado School of Mines, and the great state of Colorado.

---

[24] Neumann Strengthened Federal Approach Needed to Help Identify and Mitigate Supply Risks for Critical Raw Materials, J., Strengthened Federal Approach Needed to Help Identify and Mitigate Supply Risks for Critical Raw Materials.

**STATEMENT OF RODERICK EGGERT, RESEARCH PROFESSOR OF ECONOMICS AND BUSINESS AND COULTER FOUNDATION CHAIR IN MINERAL ECONOMICS, COLORADO SCHOOL OF MINES, GOLDEN, COLORADO**

Dr. EGGERT. Well, thank you very much for that kind introduction.

Chairman Stauber, Ranking Member Ocasio-Cortez, other members of the Committee, thank you very much for the opportunity to testify today. Let me use my oral remarks to summarize two of the issues from my written testimony.

First, let's think about and compare the 2022 USGS assessment with the 2023 Department of Energy assessment and list.

So, what is the USGS assessment? It is broad in scope, a screening of something like 70 non-fuel minerals and their supply chains in the context of their importance for national security and, really, overall economic affairs in the country.

It is U.S.-centric and asks the question for what minerals is the United States at risk. It is based on data from the present and recent past, so it is only forward-looking to the extent that the indicators themselves provide insight into the future, which, to be fair, some sense of which can be gained from looking at the 10-year trends which are part of the assessment.

Finally, it is a single list with 50 of the 70 elements scored designated as critical.

The DOE lists an assessment of critical materials for energy. It is narrower in scope. Not surprisingly, it focuses on energy technologies. It is also global in scope in the sense that the question that this assessment asks is what are the material risks that threaten the development and deployment of energy technologies.

It is explicitly forward-looking by incorporating demand scenarios into its analysis, demand scenarios that have two time frames: out to 2025, and then a longer look out to 2035.

It presents a more nuanced list. In some sense, it is actually four lists of materials. There are critical materials and then, separately, near-critical materials for both time frames, near term or short term out to 2025, and the medium term out to 2035.

So, the USGS list is U.S.-centric, broad, and based largely on the present and recent past. The DOE assessment is energy-centric, narrower, and more forward-looking. So, that is my first topic.

The second topic, more broadly and philosophically: why have a list? The simple answer, perhaps a statement of the obvious, is to inform public policy, to prioritize things like research and development activities, geologic mapping, market analysis, aspects of commercial policy such as tax credits and other issues.

A more complicated answer, in my view, a list is most useful when it is viewed as an intermediate product rather than the final word. It is really an initial screening and identification of minerals and materials deemed important for further, more detailed assessment in more specific contexts. The danger of a simple list of minerals and materials as either critical or not critical is that it obscures the complexity of criticality, suggesting that criticality is yes or no, rather than a continuum of risk and importance. The longer a list is, the less it represents a prioritization and the less

useful the designation "critical" is. As many have said, if everything is critical, then is anything really critical?

Finally, a couple of comments more specifically about the USGS list. The list is long, 50 elements or minerals. The scope is broad, encompassing both national security and economic affairs. Thus, in my view, the primary uses of the list should be two: first, to signal in a very broad way the importance of minerals, their essentiality, and the degree to which they are subject to supply chain risks; and second, to identify specific supply chains for further analysis.

Designation as critical should by itself not qualify a mineral or material for special treatment, which should require more in-depth analysis of particular supply chains. In other words, and this is finally-finally, the USGS list should inform, but not determine public policy.

Thank you very much.

[The prepared statement of Dr. Eggert follows:]

PREPARED STATEMENT OF RODERICK G. EGGERT, RESEARCH PROFESSOR AND COULTER FOUNDATION CHAIR IN MINERAL ECONOMICS, COLORADO SCHOOL OF MINES

Chairman Stauber, Ranking Member Ocasio-Cortez, and other Members of the Subcommittee, thank you for the opportunity to provide testimony on the U.S. Geological Survey's Critical Minerals List. I am a research professor in the Department of Economics and Business at Colorado School of Mines and hold the Coulter Foundation Chair in Mineral Economics. As part of my university responsibilities, I am deputy director of the Critical Materials Institute, an Energy Innovation Hub established by the U.S. Department of Energy in 2013, to accelerate innovation in energy materials and led by the Ames National Laboratory.

Of relevance for this hearing, I have been involved in the topic of critical minerals and materials for more than 15 years. In 2007–2008, I chaired the committee of the National Research Council that developed a conceptual framework for criticality assessment that is reflected in many of the criticality assessments since the committee's report was published (National Research Council, 2008).

My testimony represents my personal views, although these views reflect work I have done and opportunities I have had at Colorado School of Mines and with the Critical Materials Institute.

I organize my testimony around four topics: the concept of a critical mineral or material; a review of selected other (non-U.S. Geological Survey) assessments of mineral and material criticality; a comparison of the U.S. Geological Survey's 2022 assessment with the 2023 assessment by the U.S. Department of Energy; and consideration of the question, why have a list?

**Concepts**

A critical mineral or material provides essential functionality to a modern engineered material, component or system; has few if any easy substitutes; and is subject to supply-chain risks or longer-term concerns about availability. It is the combination all three of these characteristics that makes a mineral or material 'critical' in the specialized sense of the concept—not simply that a mineral or material is indispensable or essential, the common meaning of the word.

Five key aspects of critical minerals and materials are:

First, *risks come in two basic forms: physical unavailability and price*. Physical-unavailability risk reflects the probability and consequences of not being able to obtain a needed mineral or material. Price risk reflects the probability and consequences of unexpected fluctuations in price.

Second, the consequences of lack of physical availability or unexpected price changes differ from circumstance to circumstance. In other words, *something important is at risk but exactly what is at risk depends on the circumstance*. For a company, profits and growth are at risk if a supply disruption leads to physical unavailability of a material or to unexpected increases in input costs. For a nation's manufacturing sector, at risk are the viability of the sector and jobs in the sector. For national security, at risk is the ability of a nation's military and associated civilian infrastructure to respond during and immediately following a national emergency. For the energy transition, at risk is the transition itself if input minerals and

materials are not available in sufficient quantities and at affordable costs from sources that are secure, environmentally sustainable and socially responsible.

Third, *the sources of risk vary from one mineral and material to another and differ between the short term and long term*. In the short term (one or a few years, up to about a decade), the principal sources of risk relate to the fragility of the geography of existing production, processing and use of minerals and the materials. More specifically, these risks include:

- —Geographically concentrated production in a small number of mines, companies or countries;
- —Geopolitical risks in important producing countries;
- —The small, opaque markets that exist for many of the minor metals included in most assessments of critical minerals and materials, which leaves market participants vulnerable to unexpected disruptions and, moreover, discourages investment in the sector because investors do not sufficient knowledge about a sector to make them comfortable investing in the sector; and
- —Reliance on byproduct production of a mineral or metal, in which case the availability of the byproduct is a function not just of market conditions for the byproduct but also conditions facing the main product.

In the long term (a decade or more into the future), the principal sources of risk relate to more fundamental determinants of mineral availability:

- —How abundant is a mineral in the earth's crust?
- —Is there a technology proven at scale that can recover the mineral at prices customers are willing to pay, with environmental impacts that are acceptable to society?
- —Can companies and local communities work together to effectively manage the environmental and social impacts that often accompany mining and processing?
- —Given the long lead times in developing new mines, will there be sufficient investment today to ensure that a decade or two from now we have sufficient and affordable quantities of minerals to meet the growing demands of society?

Fourth, *criticality is dynamic*. Which specific minerals and materials are 'critical' changes over time. As technologies evolve and change, so too do material requirements. As we transition from lead-acid batteries in internal-combustion engines to lithium-ion batteries in electric vehicles, lead becomes less critical, while lithium and other associated battery materials (such as nickel and cobalt) become more critical. Another example comes from lighting. As society moved from compact-fluorescent bulbs to light-emitting diode (LED) bulbs, the demand and prices for the rare-earth element europium fell considerably as did europium's criticality.

Fifth, *it's about processing, not just mining*. While mining is the essential starting point for mineral-derived materials, in many cases what is missing in the United States or represents a choke point elsewhere in the world is processing and the production of intermediate products that occur after mining.

**Selected Assessments of Critical Minerals and Materials**

Many entities have conducted formal assessments. For a recent paper that reviews criticality studies and methods, see Schrijvers and others (2020). For an earlier and detailed discussion of methodology from the perspective of corporations, nations and the world, see Graedel and others (2012).

One of the early studies in the modern era of concern about critical minerals and materials (beginning in about 2005) was National Research Council (2008), which I referred to earlier in my testimony. The major contribution of this study was a conceptual framework for assessing material criticality emphasizing two criticality dimensions: likelihood of a supply disruption, and the consequence of the disruption should it occur. Indicators of a supply disruption include those listed in the previous section of this testimony, which differ depending on whether one is concerned about the short term or long term. Many subsequent studies use modified versions of this conceptual framework, customizing the assessment around those factors that are important in a particular circumstance.

*Corporate assessments:* A number of companies evaluate their raw material risks through assessments of materials criticality. For example, Ku and Hung (2014) describe General Electric's approach that, at the time, evaluated the materials used

in its manufacturing and commercial operations, scoring each material in two dimensions: supply and price risk, and impact on General Electric operations.

*National or regional assessments:* A number of countries or regions, other than the United States, have assessed the raw material risks faced by their economies or that threaten national security. Notably, the European Union assessed critical raw materials and published lists in 2011, 2014, 2017, 2020 and 2023 (European Commission, 2023). All these assessments are organized around two determinants of criticality: supply risk, and economic importance. Hatayama and Tahari (2015) evaluated critical minerals and materials from the perspective of Japan. Lusty and others (2021) assessed minerals and materials critical for technology applications in the United Kingdom (UK), based on two considerations: global supply risk, and UK economic vulnerability. The Indian Ministry of Mines (2023) identifies 30 minerals critical to India's economy.

Nearly all assessments of critical minerals and materials, including the national assessments listed above, reflect the perspective of mineral and material consumers. However, two nations, Australia and Canada, have assessed critical minerals and established lists of critical minerals that reflect opportunities for these nations to produce and export minerals to customers in countries facing supply-chain risks (Australian Government Department of Industry, Science and Resources 2023, Natural Resources Canada 2023).

*Energy-transitions assessments:* The International Energy Agency (2021) and the International Renewable Energy Agency (Gielen 2021) published assessments of minerals essential for low-carbon energy technologies subject to supply-chain risks and uncertainties about long-term availability.

*World:* For an evaluation of material criticality for the world as a whole, see Graedel and others (2015), which assesses criticality in three dimensions: supply risk, vulnerability to a supply restriction, and environmental implications of mineral and material production.

**Comparing U.S. Assessments**

We in the United States have three current, public and published assessments and lists of critical minerals and materials: the U.S. Geological Survey 2022 list that is the focus of this hearing, the U.S. Department of Energy's 2023 assessment and list of critical materials for energy (U.S. Department of Energy 2023), and the Defense Logistics Agency's evaluation and list of strategic materials for military and essential civilian uses (see https://www.dla.mil/Strategic-Materials/). Table 1 presents a basic comparison of the U.S. Geological Survey and U.S. Department of Energy assessments and lists. Table 2 summarizes the lists emerging from these two assessments. I have not included the assessment of the Defense Logistics Agency because I am less familiar with this assessment than the other two assessments.

**Table 1. Comparing Two U.S. Assessments and Lists of Critical Minerals and Materials**

| | U.S. Geological Survey 2022 | U.S. Geological Survey 2023 |
|---|---|---|
| Narrow purpose | To comply with the Energy Act of 2020, and more broadly inform government and the public about critical minerals | To inform DOE strategy on critical minerals & materials research, development, demonstration, and commercialization |
| What or who is at risk | U.S. national security and economic development | The global development and deployment of low-carbon energy technologies |
| Material scope | 70 nonfuel mineral commodities (usually listed as chemical elements) | Screening analysis of 37 materials, detailed evaluation of 23 materials with important uses in energy technologies |
| Time frame | Not explicitly forward looking, except to the extent that data on the present and recent past provide insight into the future | Explicitly forward looking (short term = 2020–2025, medium term = 2025–2035) |

| | U.S. Geological Survey 2022 | U.S. Geological Survey 2023 |
|---|---|---|
| Key criticality indicators | Disruption potential (essentially lack of diversity in supply), international trade exposure (net import dependence), and economic vulnerability aggregated into a single supply-risk score. A single point of failure. | Importance to energy applications, supply risk |
| Role of data, expert judgment, forecasts and future scenarios | Draft list relies to the extent possible on objective data on the present and recent past. Final list also includes consideration of interagency feedback and public comment. | Relies on both (a) objective data on the present and recent past and (b) future demand scenarios compared to current production capacity. Preliminary list of critical and near critical materials released for public comment prior to issuance of the final report. |
| Number of minerals in the list | 50 critical minerals, 36 on the basis of quantitative assessment, 3 based on a single point of failure, and 11 based on qualitative assessment when insufficient data were available to allow for quantitative assessment. | A number of critical materials for energy. For the short term (to 2025): 7 critical, 9 near critical. For the medium term (2025–2035): 13 critical, 6 near critical. |

Sources: Nassar, N.T., and Fortier, S.M., 2021. *Methodology and technical input for the 2021 review and revision of the U.S. Critical Minerals List*: U.S. Geological Survey Open-File Report 2021-1045, 31 p., https://doi.org/10.3133/ofr20211045; U.S. Department of Energy, *Critical Materials Assessment*, July 2023, available at: https://www.energy.gov/sites/default/files/2023-07/doe-critical-material-assessment_07312023.pdf.

**Table 2. The Priorities Identified by the U.S. Geological Survey and the U.S. Department of Energy**

| Element or Material | U.S. Geological Survey, 2022, Critical Minerals | U.S. Department of Energy, 2023, Critical Materials for Energy, Near Critical or Critical | |
|---|---|---|---|
| | | Short Term (2020–2025) | Medium Term (2025–2035) |
| Aluminum | X | | X |
| Antimony | X | | |
| Arsenic | X | | |
| Barite | X | | |
| Beryllium | X | | |
| Bismuth | X | | |
| Cerium | X | | |
| Cesium | X | | |
| Chromium | X | | |
| Cobalt | X | X | X |
| Copper | | | X |
| Dysprosium | X | X | X |
| Electrical steel | | X | X |
| Erbium | X | | |
| Europium | X | | |
| Fluorspar | X | X (fluorine) | X (fluorine) |

| Element or Material | U.S. Geological Survey, 2022, Critical Minerals | U.S. Department of Energy, 2023, Critical Materials for Energy, Near Critical or Critical | |
|---|---|---|---|
| | | Short Term (2020–2025) | Medium Term (2025–2035) |
| Gadolinium | X | | |
| Gallium | X | X | X |
| Germanium | X | | |
| Graphite | X | X (natural) | X (natural) |
| Hafnium | X | | |
| Holmium | X | | |
| Indium | X | | |
| Iridium | X | X | X |
| Lanthanum | X | | |
| Lithium | X | X | X |
| Lutetium | X | | |
| Magnesium | X | X | X |
| Manganese | X | | |
| Neodymium | X | X | X |
| Nickel | X | X | X |
| Niobium | X | | |
| Palladium | X | | |
| Platinum | X | X | X |
| Praseodymium | X | X | X |
| Rhodium | X | | |
| Rubidium | X | | |
| Ruthenium | X | | |
| Samarium | X | | |
| Scandium | X | | |
| Silicon | | | X |
| Silicon carbide | | X | X |
| Tantalum | X | | |
| Tellurium | X | | |
| Terbium | X | X | X |
| Thulium | X | | |
| Tin | X | | |
| Titanium | X | | |

| Element or Material | U.S. Geological Survey, 2022, Critical Minerals | U.S. Department of Energy, 2023, Critical Materials for Energy, Near Critical or Critical | |
|---|---|---|---|
| | | Short Term (2020–2025) | Medium Term (2025–2035) |
| Tungsten | X | | |
| Uranium | | X | X |
| Vanadium | X | | |
| Ytterbium | X | | |
| Yttrium | X | | |
| Zinc | X | | |

Sources: U.S. Geological Survey, Department of the Interior, 2022, "2022 Final List of Critical Minerals," *Federal Register*, 87 FR 10381, pp.10381-10382. February 24; U.S. Department of Energy, *Critical Materials Assessment*, July 2023, available at: https://www.energy.gov/sites/default/files/2023-07/doe-critical-material-assessment_07312023.pdf.

The U.S. Geological Survey list consists of 50 minerals that meet the threshold for designation as critical minerals. But this assessment presents much more detail than implied by the single list. Fifty-four minerals are ranked from most to least risky when sufficient data were available to allow for quantitative assessment. Eleven additional minerals were evaluated qualitatively. Three minerals were designated critical on the basis of a single point of failure in the domestic (U.S.) supply chain even though they did not qualify as critical on the basis of the quantitative assessment.

The U.S. Department of Energy designates materials as critical, near critical and not critical and makes these determinations over two time periods—the short term (2020–2025) and the medium term (2025–2035). A larger number of materials are critical or near critical for the medium term compared to the short term—19 for the medium term, 16 for the short term. Aluminum, copper and silicon are critical or near critical in the medium term but not in the short term.

Overall, *the U.S. Geological Survey assessment is broad and U.S.-centric, focusing on minerals important for U.S. national security and economic activity; and is based on data from the present and recent past, and thus is forward-looking only to the extent that these data provide insight into the future. The U.S. Department of Energy assessment is energy-centric and takes a global perspective, focusing on materials important for energy technologies, and is explicitly forward looking with perspectives on the short term (2020–2025) and medium term (2025–2035)*. Both assessments are described in sufficient detail that others can easily see the basis for a material's designation as critical. Others also could replicate the analysis or modify the approach if they wish.

**Why Have a List?**

*Broad considerations:* An evaluation of mineral and material criticality can be indispensable in setting priorities and informing private-sector decisions and government policies. A list is simply the most basic of the outputs of an evaluation.

A list is most useful when it is viewed as an intermediate product rather than the final word—the result of an initial screening and identification of minerals and materials deemed important for further, more-detailed evaluation.

The danger of a simple list of minerals and materials as either critical or not critical is that it obscures the complexity of criticality, suggesting that criticality is "yes/no" rather than a continuum of risk and importance.

The longer a list is, the less it represents a prioritization and the less useful the designation 'critical' is. If everything is critical, then is anything really critical?

The broader the scope of analysis is, the less useful it is for specific decisions and policies. A narrow focus, for example, on military preparedness or energy technologies is potentially more useful for policy making than an assessment and list based on all economic sectors of an economy, especially for a large economy such as the United States.

*The U.S. Geological Survey list:* The list is long (50 minerals), and the scope is broad (national security, national economic activity). Thus, the primary uses of the list should be (1) to signal to government officials and the broader public that minerals are essential and subject to supply-chain risks and (2) to identify specific

supply chains for further analysis. Designation as 'critical' should not by itself qualify a mineral for special treatment, which should require this more in-depth analysis of particular supply chains.

In other words, the U.S. Geological Survey list should inform but not determine public policy. A list should simply be one of several inputs to the formulation of public policy.

**References**


Australian Government Department of Industry, Science and Resources, 2023. *Critical Minerals Strategy 2023–2030*. Available at: https://www.industry.gov.au/sites/default/files/2023-06/critical-minerals-strategy-2023-2030.pdf.

European Commission, 2023. *Study on the critical raw materials for the EU 2023—Final report*. Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs. M. Grohol and C. Veeh. Publications Office of the European Union. Available at: https://data.europa.eu/doi/10.2873/725585.

Gielen, D., 2021. *Critical materials for the energy transition*, International Renewable Energy Agency. Available here: https://www.irena.org/Technical-Papers/Critical-Materials-For-The-Energy-Transition.

Graedel, T.E. and others, 2012. "Methodology of Metal Criticality Determination," *Environmental Science and Technology*. DOI: https://dx.doi.org/10.1021/es203534z.

Graedel, T.E. and others, 2015. "Criticality of metals and metalloids," *PNAS*, vol. 112, no. 14, 4257-4262. DOI: www.pnas.org/cgi/doi/10.1073/pnas.1500415112.

Hatayama, H. and K. Tahara, 2015. "Criticality assessment of metals for Japan's resource strategy," *Mater. Trans*. 56, 229-235. DOI: https://doi.org/10.2320/matertrans.M2014380.

International Energy Agency, 2021 (revised corrected version, March 2022). *The Role of Critical Minerals in Clean Energy Transitions*. Available at: https://iea.blob.core.windows.net/assets/ffd2a83b-8c30-4e9d-980a-52b6d9a86fdc/TheRoleofCriticalMineralsinCleanEnergyTransitions.pdf.

Ku, A. and S. Hung, 2014. "Manage Raw Material Supply Risks," *Chem. Eng, Prog*. 110, 28-35.

Lusty, P.A.J. and others, 2021. *UK criticality assessment of technology critical minerals and metals*. British Geological Survey Commissioned Report CR/21/120. Available at: https://www.bgs.ac.uk/download/uk-criticality-assessment-of-technology-critical-minerals-and-metals/.

Ministry of Mines (India), 2023. *Critical Minerals for India, Report of the Committee on Identification of Critical Minerals*. Available at: https://mines.gov.in/admin/storage/app/uploads/649d4212cceb01688027666.pdf.

Nassar, N.T., and Fortier, S.M., 2021. *Methodology and technical input for the 2021 review and revision of the U.S. Critical Minerals List*: U.S. Geological Survey Open-File Report 2021-1045, 31 p., https://doi.org/10.3133/ofr20211045.

National Research Council. 2008. *Minerals, Critical Minerals, and the U.S. Economy*. Washington, DC: The National Academies Press. https://doi.org/10.17226/12034.

Natural Resources Canada, 2023. *The Canadian Critical Minerals Strategy*. Available at: https://www.canada.ca/content/dam/nrcan-rncan/site/critical-minerals/Critical-minerals-strategyDec09.pdf.

Schrijvers, D., and others, 2020. "A review of methods and data to determine raw material criticality," *Resources, Conservation and Recycling*. DOI: https://doi.org/10.1016/j.resconrec.2019.104617.

U.S. Department of Energy, *Critical Materials Assessment*, July 2023, available at: https://www.energy.gov/sites/default/files/2023-07/doe-critical-material-assessment_07312023.pdf.

U.S. Geological Survey, Department of the Interior, 2022. "2022 Final List of Critical Minerals," *Federal Register*, 87 FR 10381, pp.10381-10382. February 24.

Mr. STAUBER. Thank you, Dr. Eggert. I will now introduce our next witness, Dr. Dustin Mulvaney. Dr. Mulvaney is a professor at the Environmental Studies Department at San Jose State University in San Jose, California.

Dr. Mulvaney, you are now recognized for 5 minutes.

**STATEMENT OF DUSTIN MULVANEY, PROFESSOR, ENVIRONMENTAL STUDIES, SAN JOSE STATE UNIVERSITY, SAN JOSE, CALIFORNIA**

Dr. MULVANEY. Greetings, Chairman Stauber, Ranking Member Ocasio-Cortez, and other members of the Subcommittee on Energy and Minerals. It is a great honor to be with you today. Thank you for the invitation, and special thanks to the Committee staff for all their work putting together this hearing.

My name is Dustin Mulvaney. I am a Professor of Environmental Studies at San Jose State University and a fellow at the Payne Institute for Public Policy at the Colorado School of Mines. This testimony reflects my views and expertise on the topics herein, and I am not speaking on behalf of my affiliated organizations or anyone but myself.

The development and strengthening of supply chains to support metals, minerals, and materials that we will need for decarbonization, green infrastructures, transportation, health care, defense is of serious national importance. Supply chain disruptions from bottlenecks, geographic concentration, and trade restrictions in recent years have shown vulnerabilities to the economy and decarbonization efforts.

The dependence on critical minerals of many key technologies to the U.S. economy makes securing adequate supplies crucial to the success of other important public policies, including the 2021 Inflation Reduction Act and the Energy Act of 2020, as well as efforts by states and local governments.

The development of a critical minerals list is an excellent starting point for a conversation about how to develop clean energy supply chains responsibly, and to the highest possible labor and environmental standards. We need a framework also that brings together both new, responsible critical minerals development, but also one that emphasizes circular economy approaches that can augment supply significantly.

To date, much of the conversation and public policy effort has focused on domestic mining. But recycling, alternative extraction techniques, resource efficiency, harvesting materials from waste streams offer significant promise for enhancing the nation's supply of critical minerals and lessening the risks and exposures to supply chain disruptions. These latter activities are more recently gaining attention and policy support, including from this Congress, which is welcome news to those of us who have been working on waste and recycling issues.

While we cannot recycle or mine our way out of these challenges, we should be collecting as much of these critical materials from the waste stream as feasible. It seems profoundly wasteful that we would allow critical materials to be landfilled at the same time we talk about the dire economic and national security consequences of a lack of supply and promote greenfield mine development

elsewhere. Today in the United States, less than 40 percent of copper is recycled, only 5 percent of lithium is recycled. No gallium is recycled, and only small amounts of germanium are recovered and exported for recycling. These are lost resources that we should not be throwing away.

I have several suggestions for areas in my experience and understanding that would result in helping make critical minerals supplies less vulnerable, while at the same time safeguarding environmental protection, cultural resources, and respecting Native American self-determination and sovereignty, and at the same time creating high-quality, high-road domestic jobs, and I detail these more in my written testimony.

But to summarize, building a circular economy on critical minerals should: (1) promote more cradle-to-cradle approaches to the critical minerals challenge; (2) develop robust takeback and collection systems to enhance the prospects of recycling; (3) recover more critical materials from waste streams and increase resource efficiency; (4) advance materials science, input substitution, and alternatives to hardrock mining; (5) strengthen tribal consultation; (6) reform the 1872 Mining Law; (7) avoid unnecessary groundwater and ecological impacts; (8) strengthen environmental review; and (9) provide community benefits.

Emphasizing these aspects will result in more secure critical mineral supplies, as well as more community acceptance of and consent to mining and extractive industry activities. Taken together, these suggestions will help get more public support for responsible natural resource development, product stewardship policies, public investments and innovations in materials science, increased resource efficiency, and better processing to augment supplies of critical minerals for the U.S. economy.

Thank you for the opportunity to testify before you today on these important matters.

[The prepared statement of Dr. Mulvaney follows:]

PREPARED STATEMENT OF DUSTIN MULVANEY, PROFESSOR, ENVIRONMENTAL STUDIES, SAN JOSÉ STATE UNIVERSITY

**Introduction**

My name is Dustin Mulvaney and I am a Professor of Environmental Studies at San José State University, and a Fellow at the Payne Institute for Public Policy at the Colorado School of Mines. This testimony reflects my views and expertise on the topics herein, and I am not speaking on behalf of my affiliated organizations or anyone but myself.

My areas of expertise and research are on land use change, life cycle analysis, recycling & waste, and the environmental justice impacts of energy technologies, supply chains, and infrastructures. I have published research on numerous energy technologies with extensive emphasis on the life cycle impacts of solar photovoltaics and lithium-ion batteries. I have a Ph.D. in Environmental Studies from the University of California, Santa Cruz, a Master's of Science degree in Environmental Policy Studies, and a Bachelor's of Science degree in Chemical Engineering, the latter two from the New Jersey Institute of Technology. My professional private sector experience includes work in chemical manufacturing, environmental remediation, and environmental consulting. I have been an expert witness at the California Public Utilities Commission for 13 years, and have participated in the development of waste, land use, and energy policy with California legislators, and state and county agencies over the past decade. I serve on the Technical Advisory Committee to the Recycling and Waste Reduction Commission of Santa Clara County, the Technical Committee for an Ultra-Low Carbon Solar Standard for photovoltaics recently developed by the Green Electronics Council, and am part of the Lithium Valley Equity

Technical Advisory Group advising Comite Civico del Valle on issues related to the development of geothermal and lithium near the Salton Sea in Imperial County, California.

Thank you for the opportunity to testify before this committee. Special thanks to the committee staff, and thank you for your attention to these important matters.

The development and strengthening of supply chains to support metals, minerals, and materials that we will need for decarbonization, green infrastructures, transportation, healthcare, and defense is of serious national importance.

Supply chain disruptions from bottlenecks, geographic concentration, and trade restrictions in recent years have shown vulnerabilities to the domestic economy and decarbonization efforts.

The dependence on critical minerals of many key technologies to the U.S. economy make securing adequate supplies crucial to the success of other important public policies including the 2021 Inflation Reduction Act and the Energy Act of 2020, and well as efforts by states and local government. The development of a critical minerals list is an excellent starting point for a conversation about how to develop clean energy supply chains responsibly and to the highest possible labor and environmental standards. We need a framework that brings together both the need for new responsible critical minerals development, but also that emphasizes circular economy approaches that can augment critical mineral supplies significantly in the short term.

To date, much of the conversation and public policy effort has focused solely on mining. But recycling, alternative extraction techniques, resource efficiency, and harvesting materials from waste streams offer significant promise for enhancing the nation's supply of critical minerals, and lessening the risks of and exposures to supply chain disruptions. These latter activities are more recently gaining attention and policy support, including from this Congress, which is welcome news to those of us that have long been working on waste and recycling issues.

While we cannot recycle or mine our way out of these challenges, we should be collecting as much of these critical minerals in the waste stream as feasible. It seems profoundly wasteful that we would allow critical materials be landfilled at the same time we talk about the dire national security consequences of a lack of supply and promote greenfield mine development elsewhere.

In the testimony that follows, I have several suggestions for areas that in my experience and understanding would result in helping make critical minerals supplies less vulnerable, while at the same time safeguarding environmental protection, cultural resources, respecting Native American self-determination and sovereignty, and creating quality high-road domestic jobs.

Building a circular economy on critical minerals should (1) Promote more circular economy approaches to the critical minerals challenge, (2) Develop robust take back and collection systems and recycling, (3) Recover more critical minerals from waste and increase resource efficiency, (4) Advance materials science, input substitution, and alternatives to hard rock mining, (5) Strengthen Tribal consultation, and (6) Reform the 1872 mining law, (7) Avoid unnecessary groundwater and ecological impacts, (8) Strengthen environmental review, (9) Provide community benefits.

Emphasizing these aspects will result in more secure critical minerals supplies as well more community acceptance of mining activities. Taken together these suggestions will help get more public support for responsible natural resource development, product stewardship policies, increased resource efficiency, and innovations in materials science and processing to augment supplies of critical minerals for the U.S. economy.

**1. Promote more circular economy approaches to the critical minerals challenge**

The National Academy of Sciences 2008 report recognized the need to analyze the risks posed by critical mineral supply chains for national security and domestic industries. The U.S. in 1973 was the top producer of non-fuel minerals, and that position 50 years later has been ceded largely overseas. The United States has recognized this in a series of public policies intended to strengthen the resilience of supply chains, which will have the added benefits of geographic diversification and reduced environmental impact.

The idea of criticality as the United States Geologic Survey uses it involves understanding supply risks across three domains (1) how likely a disruption is to occur, (2) how exposed a supply chain is to disruption, and (3) whether the disruption can be overcome. Copper for example is sourced from a wide variety of places. This geographic diversity means that disruption due to anything from geopolitics to natural disaster, does not rise to the level of risk of say gallium or germanium, where over 90% of production is concentrated in one regional geography.

**2. Develop robust take back and collection systems and recycling**

Despite concerns about the availability of copper and other metals, minerals, and materials, the federal government has no comprehensive electronics and electronical equipment waste take back and recovery law. This is missing opportunities to recover important inputs the United States economy will need from waste flows, and to avoid unnecessary mining. Recycling can significantly augment critical minerals supplies. Some estimates put these values at 25% for lithium, 35% for cobalt and nickel and 55% for copper, based on projected demand and technology adoption scenarios. According to the Copper Alliance, less than 40% of global copper is currently recycled. According to research from Fraunhofer Institute for Systems and Innovation, two-thirds of end-of-life copper are sent to landfills annually.

Waste flows from end-of-life electronic products often have significantly more critical minerals by percent than the ores they are obtained from in mining. Rare earth elements in end-of-life electronics are mostly lost through waste flows in the United States. Less than 5% of rare earth elements globally are recycled according to the trade press *Recycling International*. Recycling consumer electronic products and utilizing byproducts of other materials processing could yield double to ten times the rare earth elements that could be extracted through processing the raw materials. Three to four times more dysprosium can be obtained from recycling headphones than from rare earth element ores. An iPhone touch screen has more lanthanum to make those bright colors, than is typically found in rare earth element ores. Similarly, there is a higher percent of neodymium obtained from recycling wind turbine magnets, than are found in those rare earth element ores. In an era of declining ore grades, these waste flows should be seen as resources to boost critical mineral supplies.

Lithium-ion battery recycling rates are slowly ticking up, but still most collected at end-of-life are only recovered for copper, cobalt, nickel, graphite, and aluminum. We have not developed a lithium battery recycling ecosystem in the United States and as a result most lithium-ion batteries are sent to China, South Korea, and Europe for reprocessing into new feedstocks. This means not only are these places securing new supplies, they are developing the technologies to do so. Developing recycling infrastructure in the United States would allow battery recyclers to be suppliers of metal and minerals to materials refiners producing battery input precursors.

Developing recycling programs for electronic waste will hasten United States innovation in this space and allow it to catch up with the rest of the world on recycling technology.

Germanium and gallium were in the news last month (August 2023) as critical minerals that would be restricted from export by China. Yet we do very little recycling of LEDs, scrap materials, and everyday devices and appliances containing germanium- and gallium-based semiconductors including microwaves, blue ray players, and other electronic products that are often landfilled today. No gallium is recycled in the United States. Small amounts of germanium are recovered and exported for recycling.

Tellurium is used in cadmium telluride photovoltaics and night vision goggles, and is 1000 times more rare than rare earths. Over 40% of the global tellurium supply goes to one photovoltaic supply chain. But tellurium also goes into steel dissipatively, meaning that the amount in the product is lower than that found in typical copper and gold ores where tellurium is obtained. Dissipative uses of critical metals typically means losing them to future products forever. More research into substitutes for materials used this way will free up existing supplies and encourage more recovery.

Indium is a critical mineral used to make indium tin oxide, essential to the functioning flat-panel displays, mobile phones, photovoltaics, aerospace and other telecommunications applications because of its conductivity and transparency. The production of indium is mostly in China, and countries like Japan have secured supplies of indium from indium tin oxide scrap at electronic waste recovery facilities.

Comprehensive electronic waste recycling rules can foster these emerging industries and technologies. Singapore created an extended producer responsibility law, and in 2021 opened its first battery recycling facility. Rules for end-of-life products can help ensure that emerging recyclers are recovering as much of the waste stream as possible. For these nascent recycling industries, getting waste volumes is critically important to economic viability and scale.

A recent *Wall Street Journal* article about Redwood Materials noted that the company is now valued at $5 billion. Redwood Materials claims a 90% reduction in greenhouse gas emissions using recycled cathode product as feedstock for new

battery cathodes. These investments show that the battery recycling industry is ripe for growth and passing laws to encourage the take back and collection of batteries for recycling will only help these industries grow. American Battery Technology Company, Li-Cycle, and Ascend Elements are a few more companies in this space employing thousands of people and attracting private sector investment to recycling lithium ion batteries.

The European Union's Battery Directive and battery passport system requires supply chain due diligence, has strong environmental protections, from sourcing through end-of-life. A similar policy in the United States could go a long way to utilizing recycling to augment supplies of critical minerals. Battery manufacturers in the United States currently fund a non-profit to do some collection, but it still only about 5% of lithium-ion batteries that are collected; in Europe this number is closer to 40%.

PV Cycle has developed take back and recycling infrastructure for photovoltaics since 2007 and in Europe over 95% of photovoltaics are recycled, compared to less the 5% in the United States. This is because of the Waste Electronics and Electrical Equipment (WEEE) Directive promotes cradle-to-cradle materials handling and added photovoltaics to mandatory take back and recycling policy in 2014. The United States on the other hand, uses only a cradle-to-grave approach to materials management, only managing the most hazardous of electronics products. With the few photovoltaics collected in the United States today, very little silver, an element considered by not listed currently as a critical mineral, is recovered as the modules are mainly used as smelter flux and those smelters are not designed to recover silver. The solar industry uses over 10% of the global silver supply for metallization pastes.

The Green Electronics Council has developed an Electronic Product Environmental Assessment Tool (EPEAT) to leverage procurement in raising the environmental standards of photovoltaics, which supports companies with comprehensive take back and recycling programs. Federal government procurement could further help develop these programs as described by the U.S. Environmental Protection Agency: "EPA recommends the following private sector standards/ecolabels be used when purchasing photovoltaic modules and inverters or energy savings performance contracts or power purchase agreements." [1]

It seems imprudent to be letting critical minerals go to landfill or dissipative uses. We need to build the infrastructures for a circular economy in—not just critical minerals—but all metals and mineral flows that are practicable. One way to bring value to waste is to not let it be landfilled or disposed of for free. Extended producer responsibility and other product stewardship laws and programs can ensure that materials are diverted from landfill where it will never return to products.

**3. Recover more critical minerals from waste and increase resource efficiency**

Waste is an important resource for critical metals. With over 400,000 to 500,000 abandoned mines in the United States, according the several estimates, policies and practices that encourage waste and "tailings valorization" is another strategy to augment critical mineral supplies. There are also opportunities to recover these materials from coal ash, red mud, slag piles, mine tailings, and other wastes. Recovery of critical minerals from mine waste particularly looks promising in environmental remediation, where work to process materials may be underway anyways for cleanup.

Environmental remediation can be expensive, which is why it is important to modernize our mining laws, payments, and royalty programs. Effective reforms could raise revenues to clean up legacy mine waste and further augment needed supplies of critical minerals. Some materials recovery may require novel processing that needs more research and development support. Abandoned mine lands sites in particular provide an opportunity to augment critical mineral supplies, while cleaning up and remediating legacy pollution from past mining activities. Unfortunately there has been a historic lack of interest for among other reasons, there is little information about the composition and potential value of most of these legacy wastes.

Materials recovery in mining and downstream processing is optimized for profitability not maximizing materials or biproducts. More incentives to develop biproducts, recover materials at smelters, or increase recovery rates could help drive up recycling of materials. Smelters in the United States are not designed to recover

[1] https://www.epa.gov/greenerproducts/photovoltaic-modules-and-inverters

many critical minerals. For example, there are no smelters that can recover cobalt in the United States.

There are also excellent examples of resource efficiency avoiding significant amounts of materials. A photovoltaic module today, thanks to increased resource efficiencies, uses about five times less silver than a photovoltaic module today. Similar, semiconductor wafers in the same technology are two to three times thinner than just a decade ago. This has translated to lower energy inputs and silicon feedstocks needed for the solar industry.

There are other ways to increase resource efficiency across society as well. In a recent report from the Climate and Community Project they found up to 90% of lithium demand can be reduced by encouraging public transportation and more lightweight electric vehicles and other modes of transportation.

**4. Advance materials science, input substitution, and alternatives to hard rock mining**

It is fundamentally important to emphasize incentives and policy that develops substitutes and alternatives to critical minerals as sustainable ways to secure domestic supplies. This would help mitigate extensive impacts from extractive industries, which can be poorly regulated and environmentally-damaging.

The critical mineral of concern a few years ago for lithium-ion batteries was cobalt. In a few short years, projections for use of cobalt—75% of which according to Benchmark Minerals currently goes to making lithium-ion batteries—has fallen dramatically with lowering of cobalt content and advances non-cobalt batteries. Companies concerned about bottlenecks and reputational risks have begun to eschew cobalt supply chains. We are already seeing companies move away from nickel and manganese as well in next generation in lithium iron phosphate batteries.

These shifts in technology are sometimes beyond the horizon. We do not necessarily know the battery chemistries and composition of tomorrow's lithium-ion batteries, how do we know which materials to prioritize for development today?

The next generation batteries may have no lithium at all. We are also seeing the development of non-lithium batteries. One of the largest battery makers in the world BYD announced in August 2023 a partnership to build sodium-ion batteries and has plans to put in their popular and inexpensive Seagull electric vehicle. It is not clear how widespread this technology will eventually be, but it is a perfect of example of how materials demand can change in a short time.

Not far off in the future, we are likely to see batteries that altogether avoid graphite, currently used as the anode in 95% of lithium-ion batteries today, as well.

We are also using many of these critical minerals in ways that make it difficult or expensive to recover germanium and gallium for example often are alloyed in a way that complicates recovery. Use of critical minerals in low concentrations in alloys like this is another area where research into substitutes could allow more minerals to be available for green infrastructures.

Supply chain diversification also means supporting alternative mining methods. While might be too early to characterize environmental impacts, the prospects of direct lithium extraction seems to offer significant benefits over hard rock mining for lithium.

**5. Strengthen Tribal consultation**

The energy transition is likely to be significantly impactful to Native American tribes. Most mining activity in the United States is in the American West, and within close proximity to Native American communities. 79% of lithium mining claims, 89% of copper, and 97% of nickel deposits are within 35 miles of a Native American reservation. Furthermore, the Bureau of Land Management has an obligation to conduct prior consultation on projects proposed across public lands because of important sacred sites off-reservation on their ancestral territories.

Mining activities puts both drinking water, cultural resources at risk, making it of the utmost importance to ensure community acceptance and respect for tribal sovereignty and cultural resources. I have read many public comments and spoken with representatives from Tribes over the years in my research and it is not uncommon to hear that the federal consultation process for National Historic Preservation Act to take one example is "failing tribes" on adequate and meaningful consultation.

Instead of looking for ways to short circuit environmental and cultural resource review—by undermining nation-to-nation consultation or expediting review—the United States should strengthen Tribal consultation in the National Environmental Policy Act around the ideas of self-determination and "Free, Prior and Informed Consent" as described by International Labour Organization's Convention number 169, the United Nation Declaration on the Rights of Indigenous Peoples. There is

often emphasis on how the United States' mining practices are the best in the world because they have the strongest global regulations. But the issue of Tribal consultation needs significant improvement to catch up with international norms and standards on relations between mining activities and Indigenous peoples.

**6. Reform the 1872 mining law**

The 1872 mining law makes mining the highest and best use of public lands and reflects a time long since passed. The exploratory claims-based system is outdated, with most other parts of the world having lease-based systems that are more competitive and result in better decision-making on land uses.

Reform to the royalty system would benefit taxpayers, given there are no royalties for hard rock mining under the law today. Reform of the royalty program could raise substantial revenues to help finance the clean up and remediation of legacy mine pollution.

Mining law needs a better plan to pay for remediation of old mines. The 1872 mining law set the bar too low for bonding mine sites for reclamation and cleanup. The Government Accountability Office (GAO) estimates that federal agencies spent $2.9 billion in the decade from 2008 to 2017 on cleanup activities, and this could cost taxpayers up to $54 billion to clean up the nation's 400,000 to 500,000 abandoned mine sites that pose hazardous threats to communities.

The Initiative for Responsible Mining Assurance (IRMA) could be a model for reforming the 1872 law. IRMA allows for independent audits of mines to ensure environmental and social performance. Even the White House refereed to IMRA as a "method for U.S. companies and the Federal Government to ensure that minerals are being sourced from mines with robust environmental, social, and financial responsibility policies."[2]

The 1872 law was intended for settler colonialism on the western frontier not for mining in a modern high-tech economy. Federal and public lands should not be new sacrifice zones for decarbonization. Without key reforms, the antiquated mining law will continue to cause unnecessary environmental degradation and environmental inequality.

**7. Avoid unnecessary groundwater and ecological impacts**

The impacts of mining to water resources and riparian habitat across the United States cannot be understated. According to an analysis from Trout Unlimited, "half of the known critical mineral deposits in the U.S. are within trout and salmon habitat, and one in ten deposits are in protected public land areas like wilderness."[3] The same report notes that many critical minerals overlap with sage grouse habitat and major big game wildlife corridors. Rhyolite Ridge is a lithium mining project proposed by an Australian mining company that will impact Tiehm's buckwheat (*Eriogonum tiehmii*), a species that only exists on that particular site.

Across the American West, impacts to groundwater are of particular concern. Groundwater depletion can easily occur from over-pumping. The recently permitted Thacker Pass mine will use 2,500 acre feet per year for 41 years, which is about 104,000 acre-feet of water total, posing threat to the Kings River aquifer. There are several new gold mines under development and proposed in Nevada not far from Death Valley National Park, that are using substantial amounts of water, including one mining operation that will use water from a spring in the park, which receives about two inches of rain per year.

In Amargosa Valley near the Ash Meadows reserve, an exploratory lithium development project was almost allowed under that 1872 law to drill 30 boreholes without any environmental review, within 2,000 feet of springs that are critical habitat for the endangered Ash Meadows Amargosa pupfish. If not for the community and an environmental group recognizing the BLM mistake, this critical habitat could have been comprised by a speculative venture.

As far as alternative extraction techniques go, we also at this point do not have the full picture of the groundwater impacts from Direct Lithium Extraction for example in the Salton Sea area, where several pilot projects are underway.

Public policy efforts to develop critical minerals should do so responsibly and should not undermine bedrock environmental laws. Predictability to developers is often the emphasis when describing environmental oversight, but predictability is also important to environmental groups and tribes to know what land is protected,

---

[2] The White House, *Building Resilient Supply Chains, Revitalizing American Manufacturing, and Fostering Broad-Based Growth: 100-Day Reviews Under Executive Order 14017*, June 2021, https://www.whitehouse.gov/wp-content/uploads/2021/06/100-day-supply-chain-review-report.pdf

[3] https://www.tu.org/cmr-a-path-forward/

and that there are community safeguards like strong environmental rules and opportunities for public participation.

**8. Strengthen environmental review**

The need to prioritize development of domestic minerals supplies should not undermine meaningful environmental review. In my experience, conservation groups, Indigenous peoples, and local communities feel that environmental review, even where an environmental impact statement might be required, is a foregone conclusion. Many communities view the NEPA process as a "decide-announce-defend" development strategy where developers and investors decide where they want to propose a project, announce it to the public, and then spend the review process defending the project.

Instead, more collaborative approaches are shown to be effective at gaining community support and trust. Transparent and meaningful public participation processes should result in responsible mine development and reduced community opposition to new mines.

It is often claimed that it takes 7 to 10 years or more to permit a new mine. The reality is the time to permit a hard rock mine is two years according to the GAO. The GAO did find variation with some mines taking up to eleven years, but their interviews with agencies and mine operators found delays were overwhelming caused by the applicant. More broadly, another GAO report found only 1% of NEPA covered projects need an Environmental Impact Statement. Only 5% of covered projects require an Environmental Assessment, a shorter environmental disclosure document that typically is completed in nine months or so.

There have been recent changes that promise to address any lingering NEPA issues. The IRA made the FAST-41 Act permanent, extended the provisions of the law to mining, and provided significant funding for agencies to process permits.

Thacker pass for example initiated the NEPA process in 2020 shortly after they submitted an operating plan to the BLM and is under construction today, despite being incredibly controversial.

To build infrastructure projects getting community support in a collaborative way is important. Finding a way to get communities, NGOs, and Tribes involved from the start can help ensure the community accepts and gives consent to the project, an makes it more likely benefits from the project recirculate in the community.

Some are concerned that the funding available through the IRA will be undermined by environmental review and make it difficult to spend all of the money. Lessons from the American Recovery and Reinvestment Act projects are a great example of how projects can be built on time. None of the $90 billion in clean energy projects missed deadlines because of environmental review. This includes large scale solar and wind facilities, a nuclear power plant, and photovoltaic, electric vehicle, and battery manufacturing plants. Concerns that IRA projects will be stopped by environmental review are overblown.

**9. Provide community benefits**

Where mines will be developed, bringing community benefits to the table will be important tools for public support, buy-in, and trust. Furthermore, to reap more community benefits, more value added industries to support the development of critical minerals supplies can ensure more jobs and local revenues are generated. Mining tends to have a very low value added without these downstream manufacturing activities.

Community benefits should be broadly construed to benefit as many as possible. The widely celebrated community benefits agreement between Lithium Americas and Thacker Pass and the Fort McDermitt Paiute and Shoshone Tribe is a one example worth looking at closely. While benefits accrue to some communities from this project, other tribes with ancestral claims to the landscape such as the People of Red Mountain feel their voices were not acknowledged and will receive no benefits.

Other examples that could be a model for how to build in community benefits is the approach used in the Salton Sea and suggested by the Blue Ribbon Commission on Lithium Extraction in California. That process is early on, but will be worth watching closely.

Community benefits will help gain local acceptance and collaboration with project development.

**Conclusion**

To conclude, securing supplies of critical minerals is essential to national security, domestic industries, and decarbonization efforts. More emphasis on diverting waste flows that contain critical minerals from landfills to supply chains will encourage a circular economy in materials that results in less waste, fewer greenhouse gas emissions, the development of domestic industries, and the reduction of risks and exposures to vulnerabilities in global supply chains.

We need to move beyond the "take-make-waste" cradle-to-grave management approach to critical minerals and create a circular economy based on practices and policies to encourage us to "make-use-recycle" in a cradle-to-cradle framework.

I appreciate this opportunity to offer these remarks and I look forward to the oversight hearing.

---

QUESTIONS SUBMITTED FOR THE RECORD TO DUSTIN MULVANEY, PROFESSOR, ENVIRONMENTAL STUDIES, SAN JOSÉ STATE UNIVERSITY

**Questions Submitted by Representative Grijalva**

*Question 1. Is recycling critical minerals a net energy winner or loser? In other words, does it take more energy to mine a critical material and turn it into a product, or to recycle a critical material for the same product? What are the environmental benefits of using recycled materials, and can you share any examples?*

Answer. Recycling metals to recover critical minerals is nearly always a net energy winner. It takes far less energy to recover metals from recycled electronic and electrical equipment waste than the energy required to liberate metals from ores and brines. Some metals that have very high rates of recycling because it is not only energy saving, but it is highly economic. This is because some waste materials have very high concentrations of metals, much higher than one can find in ores, brines, or other natural resources.

The exception to this rule is when metals are used dissipatively, in lower concentrations than found in ores. Steel for example uses very low quantities of tellurium and aluminum and recovering such low concentrations requires correspondingly more energy. This is what I emphasized in my original testimony innovations in materials science to replace materials used dissipatively which if substituted can be found can augment critical minerals supplies. Some screenings of critical metals have found that most have dissipative use rates over 50%, which is consistently much higher than other metals. But to the main question, there is extensive research documenting the high energy savings associated with recovering and recycling metals. Recycling and other waste recovery efforts help bring a life cycle approach to the critical minerals challenge.

Many end-of-life items that are recycled at high rates include automobiles, where steel where over 90% of steel is recovered and made into new steel. A report from McKinsey suggests that a battery made of recycled metals has four times fewer energy requirements than a battery made from virgin natural resources (McKinsey 2023). Another example is aluminum, which is also recycled at high rates because of relatively low energy requirements than recovery of bauxite. Recycling these metals can result in the avoidance of up to 90% of the energy used to produce these material from natural resources. The reason these materials go uncollected is the lack of rules and regulations that require their recovery and collection. According to a 2022 GAO report, "DOE officials stated that most critical minerals, such as rare earth elements (REE), are not collected for recycling on a large scale, in part because of variations in recycling programs" (p 16, GAO 2022). "Moreover, according to an EPA report, U.S. recyclable collection infrastructure is outdated." (p. 17, GAO, 2022).

*Question 2. Could you expand upon the social and economic benefits of developing circular economy approaches to mitigating critical minerals supply chain risks?*

Answer. The social and economic benefits of developing a circular economy for critical minerals supplies are manyfold. Critical area that would benefit from expanded recycling and collection systems for materials include job creation, infrastructure investments, and workforce development. Developing a value chain for various critical metals here in the United States can help buffer supplies that might be vulnerable to disruption. Developing leadership in this space could result in

valuable industry as the value of battery recycling alone is poised to be over $95 billion per year by 2040 (McKinsey 2023).

*Question 3. Please expand on the community and environmental benefits of reforming the Mining Law of 1872, and why these reforms are needed to build a sustainable domestic supply chain for critical minerals and materials.*

Answer. The interagency working group report on Responsible Mining on Public Lands identified over sixty actions that can help create better predictability for environmental groups, Tribes, and mining companies. Reforming the 1872 mining law according the report and other experts suggest that community benefits from these reforms come in a variety of forms including more certainty, accountability, and stakeholder perspectives that result in better project outcomes.

*Question 4. How should Tribal consultation, cultural heritage, water supplies, and endangered species factor into mine permitting?*

Answer. Water supplies particularly across the American West's public lands system are critical to thriving communities and ecosystems. Given the extensive legacy contamination of water it is critical that new mine permitting processes take water concerns seriously and ensure that there are revenues set aside to clean up potential groundwater contamination during operations through mine closure and reclamation. Ongoing regional droughts across the west mean that its important to ensure that groundwater and surface waters are not over drafted for mining activities.

Tribal consultation is often described as failing Tribes. It is important that Tribes are consider more than merely stakeholders or members of the public but as sovereign nations with important expertise on cultural resources. We need to collectively do more to center Tribal voices in mining permitting decisions because often these perspectives are in strong alignment with sustainable land use stewardship and protecting cultural heritage and endangered species.

**References**

Damgaard, A., Larsen, A.W., & Christensen, T.H. (2009). Recycling of metals: accounting of greenhouse gases and global warming contributions. *Waste Management & Research*, 27(8), 773–780. https://doi.org/10.1177/0734242X09346838

Government Accountability Office, 2022. Critical Minerals Building on Federal Efforts to Advance Recovery and Substitution Could Help Address Supply Risks. 2022-06-01. https://www.gao.gov/products/gao-22-104824

Interagency Working Group. 2023. Recommendations to Improve Mining on Public Lands. https://www.doi.gov/pressreleases/biden-harris-administration-report-outlines-reforms-needed-promote-responsible-mining

McKinsey, 2023. Battery recycling takes the driver's seat. March 13, 2023. https://www.mckinsey.com/industries/automotive-and-assembly/our-insights/battery-recycling-takes-the-drivers-seat

---

Mr. STAUBER. Thank you for your testimony. I will now yield to Representative Curtis to introduce our final witness.

Mr. CURTIS. Thank you, Mr. Chairman. It is my honor to introduce Mr. Brian Somers. I am grateful that we had the opportunity to invite him here. Brian has been the President of the Utah Mining Association, or UMA, since 2019.

UMA works tirelessly to ensure that the country has a stable supply of minerals for the United States to lead globally in energy and other industries.

Brian, it is a delight to have you with us. Thanks for traveling to Washington, DC.

**STATEMENT OF BRIAN SOMERS, PRESIDENT, UTAH MINING ASSOCIATION, SALT LAKE CITY, UTAH**

Mr. SOMERS. Thank you for that kind introduction, Congressman, and good morning to Chairman Stauber, and Ranking Member Ocasio-Cortez, and other members of the Committee. I appreciate the invitation to testify in today's hearing. My name is Brian Somers, and I am the President of the Utah Mining Association, or UMA.

UMA was founded in 1915 and represents Utah's hardrock, coal, and industrial mineral mine operators and related support industries. UMA also works closely with the National Mining Association and other state and regional industry groups. UMA's mission is to advocate on behalf of Utah's mining industry, its workers, and the communities they support.

Mining is a critical industry in Utah, contributing $7.7 billion to the state's GDP, supporting nearly 57,000 direct and indirect jobs, and powering Utah's broader economy by producing the coal which provides 62 percent of Utah's low-priced electricity. Mining jobs in Utah are family and community-sustaining jobs, with mining salaries averaging 46 percent more than the average Utah wage.

Since Utah's first commercial mining district was established in 1863, 33 years before Utah became a state, Utah's mining industry has labored diligently to develop Utah's vast mineral wealth and provide the mined commodities markets demand. I believe the fundamental reason a hearing like this, a discussion about how and why particular minerals have been deemed critical is even necessary, is due to interference by bad actors like China who seek to distort and control commodity markets, and by misguided regulatory burdens, policy decisions, and investment signals by the Federal Government.

A recent report entitled, "Critical Minerals of Utah" released by the Utah Geological Survey states, "The concept of critical minerals is not new. And in the United States, various lists of commodities and definitions of what qualifies as critical have been developed since the early 1900s."

Again, the fact that a hearing like today's is still necessary more than 100 years on is prima facie evidence that making lists, however methodologically sound, is not as useful as letting the diverse demands of free markets, environmental responsibility, operational efficiency, technological innovation, economic security, and national security determine which minerals are critical at any given time.

More simply, perhaps we could adopt the definition of criticality put forth by our friends at the National Mining Association, which is that minerals that are unavailable when we need them should be considered critical.

Utah provides an example of how, as NMA presciently observed in a comment letter on the original critical minerals list, "World events can redefine criticality in an amazingly short period of time."

A 2020 report from the Utah Geological Survey stated that Utah hosts 28 of the 35 minerals on the original critical minerals list, and had active production of 8 of them. When the U.S. Geological Survey released the revised critical minerals list in 2022, 4 of those

8 critical minerals Utah was producing were removed from the list: uranium, potash, helium, and rhenium.

Just 2 days before the revised critical minerals list was published in the Federal Register, Russia invaded Ukraine. In the aftermath of the invasion, global prices for uranium spiked and remained at near-record highs as alternatives to uranium supplied by Russia and Russian-aligned countries are explored, especially in light of the greatly diminished capacity of the United States' once thriving uranium mining, milling, and enrichment industries. Prices for potash also spiked after the invasion and have remained high, given that Russia and Belarus account for 41 percent of global trade in potash, with resulting negative effects on food supply and prices.

Ongoing shortages and high prices for helium also continue, putting further strains on the global semiconductor shortage which began during the COVID pandemic, as semiconductor manufacturing constitutes the second largest use of helium worldwide.

Almost in real time, world events was highlighting the criticality of uranium and potash and helium as the USGS was downgrading their critical status.

I should also note that Utah is home to the nation's last functioning conventional uranium mill in Mr. Curtis' district and is also the only state in the Union which produces the higher-value sulfate of potash, or SOP, which made the exclusion of uranium and potash in the revised critical minerals list especially puzzling to Utahns.

There are many other concerns and inconsistencies related to the Federal Government's designation of critical minerals and its management of the nation's mineral estate, which I hope we can discuss today. These include competing Federal mineral and material criticality assessments, such as the Department of Energy's critical materials list and the Defense Logistics Agency's National Defense Stockpile; the accelerated withdrawal of public lands from mineral production during the Biden administration; implications of the fact that many minerals designated as critical are collocated and produced with other minerals which may not share a criticality designation; the severe diminishment of domestic mineral processing, smelting, refining, and other beneficiation capacity over the last few decades; and the Federal Government's Byzantine and burdensome permitting processes which are far outside the norm of other allied countries with similar labor and environmental protections, and which discouraged capital investment.

Again, I urge the Committee to consider the idea that any minerals that are unavailable when we need them should be considered critical. There are far too many minerals which are unnecessarily unavailable and constrained because we have neglected our nation's vast mineral resources, our highly trained mining workforce, and our unrivaled capacity for innovation. Thank you.

[The prepared statement of Mr. Somers follows:]

PREPARED STATEMENT OF BRIAN SOMERS, PRESIDENT, UTAH MINING ASSOCIATION

Good morning, Chairman Stauber and members of the Committee. I appreciate the invitation to testify in today's hearing. My name is Brian Somers and I am the president of the Utah Mining Association (UMA). UMA was founded in 1915 and represents Utah's hardrock, coal, and industrial mineral mine operators and related support industries. UMA also works closely with the National Mining Association and other state and regional industry groups.

UMA's mission is to advocate on behalf of Utah's mining industry, its workers, and the communities they support. Mining is a critical industry in Utah, contributing $7.7 billion to the state's GDP, supporting nearly 57,000 direct and indirect jobs,[1] and powering Utah's broader economy by producing the coal which provides 62% of Utah's low-priced electricity.[2] Mining jobs in Utah are family- and community-sustaining jobs with mining salaries averaging 46% more than the average Utah wage.[3]

Since Utah's first commercial mining district was established in 1863—33 years before Utah became a state—Utah's mining industry has labored diligently to develop Utah's vast mineral wealth and provide the mined commodities markets demand. I believe the fundamental reason a hearing like this—a discussion about how and why particular minerals have been deemed "critical"—is even necessary is due to interference by bad actors like China who seek to distort and control commodity markets, and by misguided regulatory burdens, policy decisions, and investment signals by the federal government.

A recent report entitled "Critical Minerals of Utah" released by the Utah Geological Survey states, "The concept of critical minerals is not new, and in the United States various lists of commodities and definitions of what qualifies as critical have been developed since the early 1900s."[4] Again, the fact that a hearing like today's is still necessary more than 100 years on is *prima facie* evidence that making lists—however methodologically sound—is not as useful as letting the diverse demands of free markets, environmental responsibility, operational efficiency, technological innovation, economic security, and national security determine which minerals are "critical" at any given time.

More simply, perhaps we could adopt the definition of criticality put forth by our friends at the National Mining Association (NMA), which is that, ". . . minerals that unavailable when we need them should be considered critical."[5]

Utah provides an example of how, as NMA presciently observed in a comment letter on the original critical minerals list, "World events can redefine criticality in an amazingly short period of time."[6] A 2020 report from the Utah Geological Survey stated that Utah hosts 28 of the 35 minerals on the original critical minerals list and had active production of eight of them.[7] When the U.S. Geological Survey (USGS) released the revised critical minerals list in 2022, four of the eight critical minerals Utah was producing were removed from the list: uranium, potash, helium, and rhenium.

Just two days before the revised critical minerals list was published in the Federal Register, Russia invaded Ukraine. In the aftermath of the invasion, global prices for uranium spiked and remain at near-record highs[8] as alternatives to uranium supplied by Russia and Russian-aligned countries are explored, especially in light of the greatly diminished capacity of the U.S.' once thriving uranium mining, milling, and enrichment industries. Prices for potash also spiked after the invasion and have remained high given that Russia and Belarus account for 41%

---

[1] McCarty, T.J., Wang, Z., Kim, M., and Evans, J., 2022, The economic contribution of Utah's energy and mining industries: Utah Geological Survey Miscellaneous Publication 176, 12 p., 4 appendices, https://doi.org/10.34191/MP-176

[2] https://www.nei.org/resources/statistics/state-electricity-generation-fuel-shares

[3] https://jobs.utah.gov/jsp/utalmis/#/industry/list

[4] Mills, S.E., and Rupke, A., 2023, Critical minerals of Utah, second edition: Utah Geological Survey Circular 135, 47 p., https://doi.org/10.34191/C-135.

[5] Sweeney, Katie. National Mining Association letter to Secretary of the Interior Ryan Zinke. 19 March 2018.

[6] ibid.

[7] Mills, S.E. and Rupke, A., 2020, Critical minerals of Utah: Utah Geological Survey Circular 129, 49 p., https://doi.org/10.34191/C-129. *The report notes that uranium was not produced from ores mined directly in Utah—despite proven reserves and significant historical production—but from the extraction of uranium from alternate feeds from out-of-state sources which were processed at the White Mesa uranium mill in Blanding, Utah.*

[8] https://tradingeconomics.com/commodity/uraniumhttps://tradingeconomics.com/commodity/uranium

of global trade in potash,[9] with resulting negative effects on food supply and prices. Ongoing shortages and high prices for helium also continue, putting further strains on the global semiconductor shortage which began during the Covid pandemic as semiconductor manufacturing constitutes the second-largest use of helium worldwide.[10]

Almost in real-time, world events were highlighting the criticality of uranium, potash, and helium as the USGS was downgrading their critical status. I should also note that Utah is home to the nation's last functioning conventional uranium mill and is the only state in the union which produces the higher-value sulphate of potash or SOP,[11] which made the exclusion of uranium and potash from the revised critical minerals list especially puzzling to Utahns.

There are many other concerns and inconsistencies related to federal government's designation of critical minerals and its management of the nation's mineral estate which I hope we can discuss during committee questions. These include: Competing federal mineral and material criticality assessments such as the Department of Energy's Critical Materials List and the Defense Logistics Agency's National Defense Stockpile; the accelerated withdrawal of public lands from mineral production during the Biden administration; implications of the fact that many minerals designated as critical are co-located and produced with other minerals which may not share a criticality designation; the severe diminishment of domestic mineral processing, smelting, refining, and other beneficiation capacity over the last few decades; and the federal government's byzantine and burdensome permitting processes which are far outside the norm of other allied countries with similar environmental and labor standards and which discourage capital investment.

Again, I urge the committee to consider the idea that any minerals that are unavailable when we need them should be considered critical. There are far too many minerals which are unnecessarily unavailable or constrained because we have neglected our nation's vast mineral resources, our highly trained mining workforce, and our unrivaled capacity for innovation.

Thank you, again, for the opportunity to testify, and I look forward to answering any questions.

---

Mr. STAUBER. Thank you, Mr. Somers, and it is great to see you again. Visiting Kennecott Mine was very, very impressive and very informational for us. Thank you.

I am now going to recognize Members for 5 minutes of questions, and I am going to recognize myself first.

Dr. Nassar, I would like to ask you about the forecasting abilities of USGS. I understand that today you analyze risks for a given mineral using current supply and demand data only, but do not use forecasting to analyze how risks may change in the next few years. How does your current structure address mineral commodities that are predicted by multiple reports and models to have extremely high demand in the future?

Dr. NASSAR. Chairman, thank you for that question. You are correct. Our analysis looks at contemporary data regarding current production and demand. But as we have seen recently, our analysis has predictive power, as in the case of gallium.

And, indeed, our analysis that we started with the National Science Technology Subcommittee on Critical Minerals in a report that we did back in 2016 highlighted that we could have, using the same indicators, identified that rare earths would have been a

---

[9] https://www.ifpri.org/blog/russia-ukraine-war-after-year-impacts-fertilizer-production-prices-and-trade-flows

[10] https://pubs.aip.org/physicstoday/article/76/9/18/2908156/Helium-prices-surge-to-record-levels-as-shortage

[11] Rupke, A., Mills, S.E., Vanden Berg, M.D., and Boden, T., 2023, Utah mining 2022—metals, industrial minerals, uranium, coal, and unconventional fuels: Utah Geological Survey Circular 136, 32 p., https://doi.org/10.34191/C-136.

problem as early as 2001 and cobalt as early as 2010. So, these analyses, while using contemporary data, do have predictive power.

We are looking at developing our forecasting capabilities, but currently complete data sets in terms of reliable forecasts that are internally consistent regarding future supply and demand across all commodities and all industries that we cover, currently don't exist.

Mr. STAUBER. Well, let's take copper as an example.

Dr. NASSAR. Sure.

Mr. STAUBER. I am sure you are aware of the multiple requests to add copper to the critical minerals list, given its increasing demand. The Director of the USGS, David Applegate, sent a letter to Senator Sinema, declining her request to re-evaluate copper as a critical mineral this past April.

However, just in July, the Department of Energy published its list of materials, and copper was included in that list. Can you explain why copper is considered at-risk enough to be considered critical material by the DOE but not sufficiently at risk to be a critical mineral at your agency?

Dr. NASSAR. Thank you, Chairman, for that question. I am happy to answer it.

Copper is an important mineral commodity not only for the United States, but for the world, and has been since antiquity. While copper is clearly essential, its supply chain risks are mitigated by a large and diverse global supply chain that spans over 50 countries, reliable trade partners, dependable domestic production, and significant recycling capacity that supplies over a third of U.S. copper supply.

USGS has and will continue to analyze copper supply and demand. It is a commodity that we study and will continue to invest research and assessments in. And I am happy to lean on some of the testimony that Professor Eggert mentioned in terms of the differences between the DOE analysis, which is global and specific——

Mr. STAUBER. And that is going to be a great segue, so thank you.

Dr. Eggert, what do you consider to be the most significant difference between the USGS critical minerals list and the DOE critical minerals list, and what do you think the impact of these differences may be?

Dr. EGGERT. The key differences are those that I identified in my statement: narrower in focus, energy technology-specific, and forward-looking over different time frames.

Obviously, it makes a difference in terms of what qualifies, although it is noteworthy that both lists, the DOE and the USGS lists, have significant overlap.

Mr. STAUBER. OK. Mr. Somers, do you think the USGS critical mineral list and the methodology for creating such a list is nimble enough to react to changing market conditions and geopolitical events?

Mr. SOMERS. Thank you for the question. No, I don't. And I highlighted some of the issues with the critical minerals that were removed from the list in this last go-round, and the world events that perhaps made the removal of those minerals unwise. And I

think that a list that is updated every 3 years, again, no matter what the methodology is, is simply not nimble enough to respond to very quickly changing world and economic events.

Mr. STAUBER. What is the value or implication of a mineral being on the critical minerals list for the mining companies that are operating in Utah?

Mr. SOMERS. I think that, to be honest, we haven't seen investment decisions being driven thus far by inclusion or non-inclusion under the critical minerals list.

I think that one of the things that we need to highlight here, though, is that, again, most of these minerals, especially the ones where we have major foreign reliance, they are not primary targets of mining. They tend to be collocated with other minerals. And in many cases, these are not minerals that are on the list.

As you were visiting Kennecott, the Bingham Canyon Mine a few months ago, that is a copper porphyry deposit. So, yes, copper is the primary target, but it also provides gold, silver, molybdenum, and also critical minerals like rhenium and platinum, palladium, and tellurium.

So, I think that in many cases you have to make sure that there is a base for a target mineral which can support a very large and complex and capital-intensive mining operation. And also in many cases that is going to provide some of these minerals that are a little bit harder to extract and maybe not economical to extract on their own.

Mr. STAUBER. And then one quick question for Mr. Blakemore.

Mr. Blakemore, what is the biggest factor in mineral supply chain vulnerability that is not addressed by the USGS critical minerals list today?

Mr. BLAKEMORE. I would suggest it is the assessment of what does that criticality look like by the time we reach 2050? As it relates to the technologies we are dependent on in the energy space and beyond. These are all high innovation sectors where the technology is changing, the underlying minerals are changing for many of these technologies, but also the innovations around substitutability and supply chain circularity for certain minerals and materials are also changing.

So, those features are critical to develop a holistic plan of action in terms of how we both modernize, adapt, and act on any sort of critical minerals list that is being produced, not just by the USGS, but by other parts of the U.S. Government, writ large.

Mr. STAUBER. Thank you very much, and my time has expired. I am now going to recognize Representative Ocasio-Cortez for 5 minutes of questioning.

Ms. OCASIO-CORTEZ. Thank you so much, Chairman. And thank you again to our witnesses. It is important for us, I think, as policymakers, to understand how the USGS critical minerals list works and, frankly, to communicate this to the public. I think part of our hearings is also an effort in public education on a lot of these different issues. So, I want us to zoom out a little bit and ask Dr. Nassar.

In explaining to a layperson, what does it mean for a mineral or a critical mineral to be added to the USGS critical minerals list?

What are the implications of that, and what does that mean to the average person?

Dr. NASSAR. Thank you, Congresswoman. The simplest way I can put it is that these are commodities for which there is a heightened degree of supply risk, meaning that they are commodities that are not only important, but for which supply may be disrupted in the near future.

The benefits of the list is the ease of communication. But as my colleagues on the panel have mentioned, it is definitely a nuanced issue. There are a lot of concerns with just having a simple binary. We agree with that, which is why we provide a ranking methodology that prioritizes things.

In one sense, it is a way to prioritize both government action and to highlight issues and concerns.

Ms. OCASIO-CORTEZ. And there are also policy implications for a mineral being added to the critical minerals list, correct? There are tax credits, as have been mentioned, and other sorts of policy incentives for investment, for example, through the Infrastructure and Jobs Act.

Dr. NASSAR. Correct. As I mentioned in my opening testimony, other Federal agencies have used the critical minerals list as a way to prioritize. Within USGS, we use it also to prioritize our research, which commodities we should focus on.

That doesn't mean that we don't look at commodities and do research on commodities that are not on the critical minerals list.

Ms. OCASIO-CORTEZ. Yes, and I think from a policy perspective this creates a little bit of a tension, where we want to make sure that this list is accurate, that it contains all of the minerals that truly are a priority, but also, I think for us, we deal with a profound incentive because it creates a large pressure for people who want to add minerals to this list and have access to some of those perks and benefits. So, we have to make sure that we are having the appropriate amount of minerals on this list while also dealing with, frankly, very real political incentives to pile on things to this list that perhaps may not be necessary.

But in addition to that, I also want us to explore further the implications of that. As was mentioned earlier, there are very real needs, of course, for minerals in our economy, everything from EVs to a wide range of different uses. But I do want us to explore a little bit on how we can reduce the need for the intensity of these minerals overall.

Dr. Mulvaney, what are some of the ways that we can actually reduce some of these supply chain risks for critical minerals that don't necessarily involve mining?

And what are some of the economic and social benefits of developing a circular economy here?

Dr. MULVANEY. Recycling and recovery programs in Europe are creating new stockpiles of end-of-life materials that can then be brought back into feedstocks for new materials. So, that is one area that is kind of closing the loop on these materials and not letting them get away.

We could also substitute for materials. We have seen even recently cobalt and nickel falling, a few years ago people were saying 20-fold increase in cobalt needed by X date, and we have

seen those numbers come down quite significantly because of advances in materials substitution. So, there is less cobalt in the batteries that have cobalt. And then we have seen a lot of companies just go away from cobalt and nickel altogether to the lithium iron phosphate batteries, which created a supply chain crunch, by the way, in the manufacturing sector, and caused those battery prices to go up. That was independent of the minerals extraction and all of that.

And furthermore, just resource efficiency in general. We make solar panels with less silicon, with less silver, with less glass, less energy, so we can be more efficient with the materials that we use.

Ms. OCASIO-CORTEZ. Fabulous. And I was wondering, as well, if you could dig into the current state of battery recycling and other forms of recycling that could potentially reduce our reliance on minerals. How does that comparatively look in the United States, compared to some of our European counterparts? And what are some of the largest opportunities that you see for investment there?

Dr. MULVANEY. Europe has had a comprehensive electrical equipment and electronics legislation, as well as battery recycling policy across the board for 15, 20 years now. And now the European Battery Directive has just been released that requires, for example, certain amounts of recycled content to be in the battery. That is, I think, very promising for jumpstarting those industries.

One thing I have noticed having served on various recycling and waste management boards and things like that, is recycling is pretty volatile also. We recyclers, sometimes paper is worth stuff, sometimes aluminum is worth stuff, sometimes it is not worth anything. And that bounces around, too. So, rules like that, where you have content requirements, how much recycled content is in a battery, for example, can help drive recycling.

Batteries, because of the value of some of those materials, we are starting to see investment in those. We see state laws, for example, that require the recycling of batteries. So, that has jumpstarted many recycling industries, for example, that are getting located in Nevada, partly because of California's requirements for battery recovery.

So, we are getting there. We need more Federal policy. We have had a lot of Federal inaction. The only waste electronical equipment we collect is, we actually don't collect. The only waste electrical equipment that we require be handled in certain ways is just hazardous stuff. So, we are landfilling way too much copper, too much lithium.

And the benefits of having recycling programs, we have had quite a few fires, for example, at material recovery facilities because of a little battery in a card, like a Hallmark card, might have a battery in it and that goes through a shredder and it causes a fire, it causes $5 million worth of damage at a MRF. And that costs taxpayer money and causes public health challenges for people exposed to those fires.

Ms. OCASIO-CORTEZ. Thank you so much. I appreciate it.

Mr. STAUBER. Thank you very much. The Chair now recognizes Mr. Lamborn for 5 minutes.

Mr. LAMBORN. Thank you, Mr. Chairman. I am pleased to have the Climax and Henderson molybdenum mines in my state of

Colorado. I used to represent one of these two mines in my former district lines. They are the only pure molybdenum mines outside of China, and together produce 33 percent of our entire domestic production. And it is critical for energy and infrastructure projects.

The Henderson mine alone is able to recycle 75 percent of its water, or roughly 2 billion gallons in 2022. And much of this water is even sent to the city of Denver and reclaimed as drinking water.

So, Dr. Eggert, while our Colorado mines specifically target molybdenum, it is more often the case that critical minerals are produced as a byproduct of a host mineral. Can you explain the relationship between critical minerals and host minerals, and how important is it to have a robust mining industry for all minerals if we want to harvest critical minerals?

Dr. EGGERT. As several people have said, many of the minerals listed as critical are produced as minor byproducts of other things, some of which are not major or listed as critical minerals. It is both a risk, but it is also an opportunity because in places like the Kennecott Bingham Canyon Mine in Utah, for example, there are unrecovered minor amounts of critical minerals that are waiting to be recovered. There are emerging efforts in this regard, and I think they are worthy of greater attention.

Mr. LAMBORN. OK, thank you. China recently announced that it will curb the export of gallium for which they produce the bulk of the world's supply, and germanium upon which the United States is 54 percent reliant on Chinese exports. These two minerals are critical for semiconductors, solar cells, integrated circuits, fiber optics, and more. The United States is more than capable of producing these items domestically, and it is unacceptable not to do so, considering the amount of money and attention we have placed upon microchip production in the last few years.

In 1943, U.S. bauxite production, for example, which is the host mineral for gallium, peaked at 6.3 million tons. By 2013, that had dropped to 128,000 tons, which is less than 1 percent of global supply.

Now, China, by the way, is not as environmentally responsible as we are. In my opinion, if we are less dependent on China, this creates a race to the top, bringing production to our shores where we do such a better job. By offshoring production to China, we are poisoning the world as well as endangering our national security.

So, Dr. Nassar, if we allow the development of critical minerals in general, would the United States be less dependent on China?

Dr. NASSAR. Congressman, thank you for that question. I agree that the United States is not a major bauxite producer. In fact, we import quite a bit of our bauxite to produce alumina. So, when we did a quick analysis in terms of the gallium content of the imported bauxite, there was quite a bit in there that potentially could be produced in the United States. And in the latest list, our analysis specifically examines country metrics that evaluate how reliable those supplies may be.

Mr. LAMBORN. On another topic, demand for minerals and metals is expected to drastically increase to meet manufacturing, infrastructure, energy, and national defense needs. The DOD's Logistics Energy Agency provides economic analysis and forecasts for

strategic and critical minerals. That is one of the three lists that we talked about in your testimony.

How does the Defense Logistics Agency's analysis compare to that of DOE or USGS?

And are the components of that methodology that USGS could pick up?

And I will start with you, Dr. Eggert.

Dr. EGGERT. The Defense Logistics Agency analysis has a much shorter time frame. It evaluates emergent national emergencies of months to several years. It focuses on both military preparedness and essential civilian infrastructure in times of national emergency. It is very detailed. I don't have a lot of insight into it, but it is an example of a narrower focus and a specific type of emergency that is being evaluated.

Mr. LAMBORN. Dr. Nassar, do you have anything to add to that real quickly?

Dr. NASSAR. No, I think that is accurate.

I would add just quickly that the USGS provides data for both the Defense Logistics Agency and the Department of Energy to analyze their issues and provide their reports.

Mr. LAMBORN. OK. Thank you, Mr. Chairman. I yield back.

Dr. GOSAR [presiding]. The gentlelady from Nevada, Ms. Lee, is recognized for her 5 minutes.

Ms. LEE. Thank you, Mr. Chair. And I really appreciate us having this hearing. I come from Nevada. As we transition to a clean energy economy, as well as the focus on hardrock mining, we are no strangers to these issues and stand to economically, of course, benefit tremendously from this transition. So, I appreciate us taking the time to really delve into this area in terms of critical minerals.

I thank you all for being here, and I hope that your testimony will help inform us as we navigate this important transition.

Companies like MP Materials are playing an absolutely essential role in securing our clean energy future and shoring up our strategic positioning in the critical minerals sectors. And this is particularly true and concerning in light of the reality that countries like the Democratic Republic of Congo and China are currently responsible for up to 70 percent of the global production of key rare earth elements. As vital as this is, and I agree with Chair Stauber that we have to onshore production of this, but it is only half of the story.

Professor Mulvaney, I wanted to ask you, is there any reality in which the United States would simply be able to just mine our way out of the need for critical minerals?

I think it is fair to say. Would you agree that a whole-of-supply-chain approach is the most effective, efficient, and most realistic way to help us achieve this goal?

Dr. MULVANEY. Yes, a whole supply chain approach would certainly shore up more minerals because we are literally letting stuff fall through our fingers a lot. So, yes.

Ms. LEE. And back in my state of Nevada, Nevada-born and Nevada-based Redwood Materials is building a battery recycling facility near Reno that is creating 5,000 jobs and will be able to process enough recycled materials to supply a million EVs a year.

To me, that sounds like a win-win. Would you agree that this not only stands to benefit our environment, but also our economy, this type of approach?

Dr. MULVANEY. Yes, especially since a lot of those batteries come from California. And I have looked at data, and that stuff goes all over the country. So, having it closer to California is, I think, and plus in Nevada, I know Nevada has batteries, too.

I had read that the cathode material that they are processing has a 90 percent reduction in greenhouse gas emissions, as well.

So, as we recover more materials, often it is the case that they actually are less greenhouse gas intensive and less energy intensive. So, it benefits in multiple ways, as well as creates jobs, too.

Ms. LEE. Thank you.

Dr. Nassar, I wanted to turn to Earth MRI, decreasing the nation's reliance on foreign sources of critical minerals by shining a spotlight on relevant resources in states like my home state of Nevada and assisting in locating and mapping abandoned hardrock mine sites. As you know, this is a bipartisan health and safety concern in the Western United States, and particularly in a state like mine where there are at least 900 known abandoned hardrock mines within 100 square miles of the Spring Mountains.

Can you just talk about how this will assist us in dealing with abandoned mines?

Dr. NASSAR. I will do my best. Earth MRI is not my area of expertise, but I do know from my colleagues that mineral exploration is hampered due to lack of adequate geological, geophysical, and topographic data. These data can be used for not only identifying areas of potential for critical minerals, but also identifying and characterizing legacy hardrock sites.

Ms. LEE. Is there any other expert who wants to comment on this?

No? OK. Well, thank you. I yield back.

Dr. GOSAR. I thank the gentlelady. The gentleman from Utah, Mr. Curtis, is recognized for 5 minutes.

Mr. CURTIS. Thank you, Mr. Chairman.

Mr. Nassar, I am going to continue on this theme that you have heard from a number of us this morning. And I want to talk about helium, specifically. As you know, the Biden administration removed helium from the critical minerals list. Helium is vital to our economy, including in defense, semiconductors, health care, and more.

And there is also a well-documented shortage of helium. In fact, Gary Stanley, the Director of the Office of Materials Industries at the Commerce Department, in 2021 stated, "You can see helium is at the center when you look at the medical side, climate change, health care, the whole area of the U.S. economic growth and recovery from COVID-19. We see that helium is one of the most critical minerals that can be seen at the center of that conversation."

Shortly after that, in February 2022, the Biden administration removed helium from the critical minerals list. Given the Commerce Department's comments, can you please explain why helium was removed?

Dr. NASSAR. Thank you, Congressman, for that question. One of the key factors that we look at is import dependence, net import dependence. And the United States is the world's largest producer of helium, and has been for a long time, and a net exporter of helium. That is the main reason it was taken off the critical minerals list.

Mr. CURTIS. There is a well-documented shortage of helium. Can you explain why helium was taken off the list?

Dr. NASSAR. Yes, sir. I believe those are commercial issues. The fact of the matter remains that the United States is a net exporter of helium, producing significantly larger quantities of helium than it consumes domestically.

Mr. CURTIS. So, I think you are sensing a brain freeze from a lot of us up here that your definition of a critical mineral has a lot to do with supply chain. And I would disagree with you on the availability. All of those things can be disrupted and changed in moments. So, how is it that things can be critical and not be critical?

Dr. NASSAR. I think the issue is definitional. I think critical is a word that I often try not to use because it gets conflated for that reason. It gets conflated with a word of importance. I think there is no doubt that helium and basically every mineral commodity is important to somebody, right?

What we are looking at is trying to understand what is the supply risk to the entire U.S. economy. And that is how we do the analysis. And for commodities for which we are a net exporter, we are dependent on domestic sources for those commodities.

Mr. CURTIS. OK. But yes, we are a net exporter, but we have a shortage. We don't have enough.

Dr. NASSAR. My understanding is that, based on the USGS estimates of reserves, there are 8.5 billion cubic meters of helium reserves. That is not all there is, that is just the reserves that are known. So, there is significant supply for decades, if not centuries, of helium.

Mr. CURTIS. All right. We are going to agree to disagree on that.

Mr. Somers, you and I understand Utah well, and the mining industry. I would like to kind of have you opine for a minute on this concept that we talk about a lot, that somehow it is OK to seek these minerals in other countries, where we don't see and hear some of the human rights, some of the standards, some of the emission standards that are in play.

Is it fair to say that is viewed hypocritically sometimes in the state? And can you kind of explain how that feels to our U.S. miners in the United States and in Utah?

Mr. SOMERS. Absolutely. And with your indulgence, Mr. Curtis, I would actually like to talk about the helium for a second.

Mr. CURTIS. Please, yes. Actually, I should have started with that, but please jump in.

Mr. SOMERS. Again, with your indulgence, most of the helium targets in Utah are in your district, as you know.

Mr. CURTIS. Right.

Mr. SOMERS. We actually had been seeing quite a bit of exploration activity around potential helium development. And most of that is frozen up. And my understanding is that a large

reason for that is because of the re-establishment or the expansion of the Bears Ears National Monument, which is very close to many of those helium targets. And then also because of litigation. Many of the helium targets that have been looked at in your district have been the subject of litigation almost pre-emptively.

So, to your other point, I do think that it is very hypocritical when we can mine these commodities much better in a more environmentally friendly way with regard to labor protections, with regard to technological innovation here in the United States better than they can do it in foreign places. And it is always baffling to me that many people will drive across town for a fair trade coffee bean, but their car is full of cobalt that has come from child miners in the Congo, and it is just not acceptable.

Mr. CURTIS. Another way to say that, and unfortunately, we are almost out of time, is this body literally controls every aspect of the way that is mined in Utah and in the United States, and we have zero control on how that is mined overseas.

Mr. SOMERS. Absolutely.

Mr. CURTIS. Thank you.

Mr. Chairman, I am regrettably out of time. I yield back.

Dr. GOSAR. And to the gentleman, don't forget Helium-4, and these new ideas about fission.

Mr. CURTIS. Thank you.

Dr. GOSAR. The gentlewoman from Michigan, Mrs. Dingell, is recognized for 5 minutes.

Mrs. DINGELL. Thank you, Mr. Chairman.

Today's hearing is focused on critical minerals, which we all know is critical and essential for our transition to the clean energy economy and electric vehicle manufacturing, which I know my colleagues on the other side love. But my home state of Michigan is home to a major hub for electric vehicle manufacturing, which is why I am entirely focused on ensuring the United States has the capacity to reach our full potential when it comes to the buildout of electric vehicles for both jobs and the climate.

The Inflation Reduction Act changed the requirements for electric vehicle tax credits for consumers, requiring either assembly in North America or at least 40 percent of the value of critical minerals used for the vehicle to be extracted, processed, and/or recycled domestically or in a country that the United States has a fair trade agreement with.

So, I have a question for you, Dr. Mulvaney. We know that current laws for domestic mining have not been meaningfully updated in over 150 years, and that has tipped the scales toward mining companies and away from the communities who want to have a fair say in the decision-making if we are going to build a strong, enduring mining industry in the United States, especially one that is going to fit the needs to meet the vehicles of the future.

So, Dr. Mulvaney, can you expand on why it is essential that we reform the Mining Law of 1872 as we build a sustainable domestic supply chain for electric vehicles?

Dr. MULVANEY. Thank you for the question. I noted in reading some of the testimony that the mining law is older than the USGS, which I think is worth pointing out.

Native Americans in particular, I think, have borne the brunt of the negative impacts of mining across the United States, and that is partly due to the proximity of mining developments. And I think it is something like 600,000 Native Americans live within 6 miles of an abandoned mine, and that usually has implications for groundwater and other things.

If we were to try to think about a new reform around mining, cleaning up some of these legacy wastes, I think, would be one area to focus on. Raising revenues to do that, I think we don't raise enough money for those kinds of things, and the taxpayer ends up paying for a lot of the mine waste cleanup at the end of the day.

And then, as the Ranking Member pointed out in the opening remarks, a lot of these clean tech minerals are also very close to Native American communities. So, ensuring that they get the benefits and don't have the burdens from this transition, I think, are also really critically important there.

And then I guess——

Mrs. DINGELL. I am going to ask you to cut off there, but I would like to have you maybe expand on this because I think we need to have a sustainable supply. That is something we all want to work on.

But Dr. Nassar, we also know that mining is not always the risk factor for minerals on the critical minerals list. Sometimes we do have sustainable supplies from allied countries, but things like processing are the issue. Dr. Nassar, can you expand on how often mining is the bottleneck of our critical minerals versus other stops along the supply chain?

Dr. NASSAR. Thank you for that question.

Mineral commodities supply chains, of course, begin with mining. Actually, one could argue that they begin with exploration and having good geological data. However, what we have seen in our data and analysis is that, more often than not, the middle of the supply chain is where production becomes extremely concentrated. For example, China does not dominate lithium or cobalt mining, but it does refining. And we assess supply chain risk at multiple supply chain stages and identify the bottlenecks for that purpose.

Mrs. DINGELL. Thank you.

Dr. Mulvaney, in the short period left, can you give us, in your perspective, what are some more of the sustainable ways to address these issues?

And what are the economic and social benefits of these approaches, including job creation?

And maybe you can do more for the record later.

Dr. MULVANEY. Yes, I will just highlight a life cycle approach, I think, is key because there are lots of opportunities to recover from waste. And I think community benefits and early engagement with communities will help make projects be more socially acceptable and better and more sustainable in the long run.

So, more collaborative approaches to mine development instead of the approach that we use today, which is what we call decide, announce, defend.

Mrs. DINGELL. Thank you. I yield back, Mr. Chairman.

Dr. GOSAR. I thank the gentlewoman. The gentleman from Wisconsin, Mr. Tiffany, is recognized for 5 minutes.

Mr. TIFFANY. Yes, thank you, Mr. Chairman.

In reading your testimony, Dr. Mulvaney, I take it that you view the permitting process as not burdensome at all here in the United States of America for mineral and natural resources projects that use natural resources.

Dr. MULVANEY. If you are specifically talking about the National Environmental Policy Act review process, then yes. That is the part of the permitting process that I am most familiar with.

Mr. TIFFANY. Yes. And you don't view that as burdensome?

Dr. MULVANEY. I do not.

Mr. TIFFANY. Yes. It says in here the reality is the time to permit a hardrock mine is 2 years, according to the GAO. What do you tell Congressman Stauber about the mine that has taken 17 years in his district?

Dr. MULVANEY. I am not familiar with that mine, and I would love to learn more about that because that sounds like it is out of the bounds that I typically hear from——

Mr. TIFFANY. Yes, you said in regards to the American Recovery and Reinvestment Act, that is a great example of how our projects can be built on time. Are you familiar with the Cardinal Hickory line that is supposed to be bringing so-called renewable energy from Iowa into Wisconsin, and how it is delayed?

Dr. MULVANEY. I am not familiar with that one, no.

Mr. TIFFANY. Yes, you should take a look at that, because I don't think your testimony is accurate in regards to, that is one project that is supposedly going to bring renewable energy in.

Isn't it correct recycling is a net energy loser? Haven't there been detailed studies that have been done that have shown that, really, recycling is a net energy loser between all the trucks that we run on roads and stuff like that, that we actually end up using more hydrocarbons as a result of recycling?

Dr. MULVANEY. I can see certain circumstances where there might be net energy losses in certain systems. But in general, I do not think that that is true. Recycling is a net energy winner in most cases.

Mr. TIFFANY. I would urge you to review some of the documentation out there. In particular, I would point you to a fellow Californian who is in academia, Steven Hayward, and see some of the work that he has done.

I see you are in the College of Social Sciences. Are all the hard sciences at San Jose State University housed in the Social Sciences Department?

Dr. MULVANEY. No, our department has gone back and forth between natural sciences and social sciences because we are an interdisciplinary department.

Mr. TIFFANY. Dr. Nassar, a very good chart here in regards to supply risk. What is the one consistent thing above the line there that we all see in regards to all these minerals, especially trace minerals? What is the one consistent thing that we see there on the right side of the chart in terms of supply risk?

Dr. NASSAR. I am not exactly sure what you are referring to, but I would imagine that you are referring to the largest producer being China.

Mr. TIFFANY. Yes, the largest producer and refiner is China. Does that bring you any pause?

Dr. NASSAR. That is definitely of concern, and the reason why we do the analysis that we do in terms of understanding which countries may be not reliable trade partners going forward.

Mr. TIFFANY. Mr. Chairman, as we debate the Department of Defense budget here this week, it is very clear that this is as big a national security concern as you can possibly have. For those of you that have not studied the chart, take a look at it really closely. Leading producing countries, both production and refinery.

Dr. Eggert, has the United States of America done a better job of mitigating risk in regards to mining over the last 100 years?

Dr. EGGERT. I would say it is a mixed bag. I think we are more aware of the issues and the problems now, but there is always room for improvement.

Mr. TIFFANY. Yes, but do you believe that we have gotten better about mitigating that risk?

Dr. EGGERT. Well, I think a lot of risk mitigation occurs in the private entities that are directly focused on supply chain risks, the companies that use the materials for the products that they manufacture and use——

Mr. TIFFANY. Well, specifically in regards to mining, because there are no environmental protections put in place when I think about the mining district that is north of me in the community of Hurley and then Ironwood, Michigan. And now you could never build a mine like that.

Dr. EGGERT. It is correct, obviously, that there is a lot more to mining law than the mining law itself. Certainly, environmental rules have grown up around the mining law, and there is room for improvement in the permitting processes and related activities.

Mr. TIFFANY. One quick question to Mr. Somers. Did I hear you say that the USGS has downgraded potash? I came in right when you were giving your testimony. Could you give us some detail on what is going on there?

Mr. SOMERS. Yes, correct. In the 2022 list, potash was removed as a critical mineral. And then, as I mentioned in my testimony, this was 2 days after Ukraine was invaded by Russia, and Russia and Belarus supply about 41 percent of the global potash commodity that we have. So, that has a resulting increase in fertilizer prices and availability around the world.

Mr. TIFFANY. Yes, isn't potash a critical element for farmers to be able to grow crops?

Mr. SOMERS. Correct.

Mr. TIFFANY. I yield back.

Dr. GOSAR. I thank the gentleman. The gentleman from Rhode Island, Mr. Magaziner, is recognized for 5 minutes.

Mr. MAGAZINER. Thank you, Chairman.

In order for the United States to remain competitive in this century, we must have access to a reliable supply of critical minerals that are vital to our national security, our energy independence, and our economy. These minerals are used in consumer electronics, in our phones, in our cars, and also found in Rhode Island in some of our most important economic sectors.

General Dynamics Electric Boat at Quonset Point in my district builds Virginia-class submarines which need large quantities of rare earth minerals. Offshore wind turbines like we have in Block Island and like we are rolling out as part of the Revolution offshore wind project also require mineral inputs, just to use some examples.

The Energy Act of 2020 requires the Department of the Interior to review and update the list of critical minerals, update the methodology used to identify potential critical minerals, and accept feedback from the public every 3 years. This legislation, along with the Infrastructure Investment and Jobs Act, the Inflation Reduction Act helps strengthen the U.S. supply chain for critical minerals.

The U.S. Geological Survey is at the center of this work, and is entrusted with developing a framework for understanding which of these resources is most vulnerable to disruption, and forecasting short-term and long-term trends based on the data.

Dr. Nassar, since the passage of the Energy Act of 2020, can you explain how USGS's methodology has evolved and changed?

Dr. NASSAR. Yes, I would be happy to, Congressman.

The initial methodology examined two factors quantitatively. We looked at net import reliance and production concentration, regardless of where the production was taking place.

In the updated methodology, after the passage of the Energy Act of 2020, we modified that indicator by taking into account country factors. So, production concentrated in Canada and Australia don't get the same rating as production concentrated in Russia or China.

Going forward, we are moving toward having a more economic impacts model, where we are able to understand and quantify the impact that a certain supply disruption scenario may have not only consuming industries, but downstream industries and the economy overall.

Mr. MAGAZINER. Thank you. And it was alluded to in one of the prior Member's remarks that there is a lot of political pressure around which minerals are on this list or not, and a lot of stakeholders that approach your organization to lobby for inclusion versus not.

So, how are you able to insulate the process from political pressure so that this is truly based on empirical data, based on sort of a rational analysis of the facts, and not political pressure or lobbying?

Dr. NASSAR. Thank you again for that question, Congressman.

The USGS is a Federal science agency. And as part of our fundamental science practices, USGS analyses and reports go through multiple layers of review and approval, including peer review. The critical minerals list methodology, in addition to the internal review process, went through an external review process in a peer-reviewed journal.

In addition to that, we performed, as required by the Energy Act, an interagency working group that reviewed the analysis and the methodology, and had a chance to review the results before its release.

Mr. MAGAZINER. Thank you. I have heard some of my colleagues from the other side intimate that because there are critical minerals found in clean energy development, that that means that

we should pump the brakes on rolling out clean energy to reverse climate change and protect our environment, that we should stop building windmills, stop building solar panels. Interestingly, I don't hear them saying the same thing about cell phones, cars, and other products that use critical minerals.

But I was wondering, Mr. Mulvaney, if you could just, at a high level, say is scarcity of critical minerals a reason that we should pump the brakes and not move forward on transitioning to clean energy and fighting climate change?

Dr. MULVANEY. No, it is a good reason to take a life cycle approach to thinking in a circular economy approach to recovering these materials.

Mr. MAGAZINER. Yes, and on that, and I know you spoke to this earlier, but I think this is an important point, in addition to sourcing these critical minerals, we need to be focused on recycling them and using them efficiently because they are scarce.

So, with the time we have left, could you just reiterate what are some of the things that we, as Congress, should be doing to promote the recycling of critical minerals?

Dr. MULVANEY. What makes recycling typically work is the reverse logistics. You need comprehensive takeback and collection systems to recover all of the electrical equipment, because every bit of electrical equipment has some copper in it somewhere, or aluminum. So, we really need to be focused on making sure that those materials don't end up in the landfill, and end up in new products.

Mr. MAGAZINER. Thank you. I yield back.

Dr. GOSAR. I thank the gentleman. The gentleman that is the Chairman for the Full Committee, Mr. Westerman from Arkansas, is recognized for 5 minutes.

Mr. WESTERMAN. Thank you, Mr. Gosar, and thank you again to the witnesses.

Dr. Nassar, in the 2018 critical minerals list, USGS included uranium, despite it having both fuel and non-fuel uses, saying that input from other agencies emphasized uranium's important non-fuel uses.

Then Director Fortier defended the decision to include uranium when he testified before this Committee in 2019, listing the important non-fuel uses of uranium, including radiation shields, counterweights, and armor-piercing kinetic energy penetrators, as well as medical applications such as medical isotope production.

However, uranium was noticeably absent from the updated list under this Administration. The explanation for this cited uranium fuel's uses as the disqualifying factor.

I have sent Secretary Haaland a letter on this issue in February 2022, before the new critical minerals list was finalized, asking DOI to consider its decision to list uranium as military tensions in Eastern Europe came to a head. Unfortunately, that request was denied.

I would like to submit that letter to the record.

Dr. GOSAR. So ordered, without objection.

[The information follows:]

**U.S. HOUSE OF REPRESENTATIVES**
**Committee on Natural Resources**
**Washington, DC 20515**

February 3, 2022

Hon. Debra Haaland, Secretary
U.S. Department of the Interior
1849 C Street, N.W.
Washington, DC. 20240

Dear Secretary Haaland:

The military tensions in and around Russia, Ukraine, and Kazakhstan could have serious impacts on the United States' critical mineral supply chains.

At the beginning of January, anti-government protests in Kazakhstan turned violent, resulting in hundreds of deaths[1] and leading Kazakhstani authorities to call in the Russian military.[2] Backlash against the protestors has been fierce, with around 10,000 people detained and some allegedly facing death threats from government-backed forces.[3] The Biden administration's response has been referred to as "toothless," illustrating that the President's "idealistic words alone are insufficient" to lead on the world stage.[4]

Almost simultaneously, Russia increased its military pressure on Ukraine, amassing more than 100,000 troops along the Ukrainian border, prompting the U.S. Department of Defense to place 8,500 troops on high alert and ready to deploy in response to a crisis in the region.[5] While the Biden administration continues to fall short of its responsibility to lead a coordinated response to this growing international crisis,[6] conditions in the region have deteriorated such that the White House confirmed that Russia could invade Ukraine "at any point."[7] These escalations, and the Biden administration's failure to lead a global response, present an unknown number of risks to Europe and the rest of the world.

One of many concerns is the effect these continued international crises will likely have on global supply chains, including for minerals sourced from these countries and the surrounding area. As you work to finalize the Department of the Interior's (DOI's) Final Critical Minerals List of 2022, we strongly encourage you to consider the prolonged unrest in the region and its potential impacts on mineral supply chains in your determination of which resources to include.

As you know, the Energy Act of 2020 (later included in Public Law No: 116-260) defines a "critical mineral" as a resource "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 through-out the supply chain)," in addition to other qualifications.[8] This makes the risk of supply chain disruptions a required consideration when evaluating minerals to include on DOI's List of Critical Minerals.

The 2021 Draft List of Critical Minerals was released on November 9, 2021, months before the period of elevated unrest involving Russia, Ukraine, and Kazakhstan. Unfortunately, the growing instability in the region and the Biden administration's confused response to these crises have increased uncertainty for a number of mineral supply chains. Resources listed as "critical" on the draft list are

---

[1] Abdujalil Abdurasulov, "Kazakhstan unrest: 'If you protest again, we'll kill you'," BBC News, January 21, 2022, https://www.bbc.com/news/world-asia-60058972.

[2] "Kazakhstan: Why are there riots and why are Russian troops there?" BBC News, January 10, 2022, https://www.bbc.com/news/explainers-59894266.

[3] Abdujalil Abdurasulov, "Kazakhstan unrest: 'If you protest again, we'll kill you'," BBC News, January 21, 2022, https://www.bbc.com/news/world-asia-60058972.

[4] Ingrid Burke Friedman, "Kazakhstan Exposes the Central Flaw of Biden's Foreign-Policy Doctrine," Foreign Policy, January 13, 2022, https://foreignpolicy.com/2022/01/13/kazakhstan-csto-tOKev-biden-foreign-policy-democracy-autocracy/

[5] Robyn Dixon, David L. Stern, Isabelle Khurshudyan and John Hudson, "Russia moves troops and U.S. sends weapons as fear of war mounts in Ukraine," The Washington Post, January 25, 2022, https://www.washingtonpost.com/world/2022/01/25/ukraine-russia-nato-biden.

[6] Michael Crowley and Steven Erlanger, "Biden Strengthens Words on Ukraine After Flustering European Partners," The New York Times, January 20, 2022, https://www.nytimes.com/2022/01/20/world/europe/ukraine-biden-eu.html.

[7] Shannon Pettypiece, "White House warns Russian invasion of Ukraine may be imminent," NBC News, January 18, 2022, https://www.nbcnews.com/politics/white-house/white-house-warns-russia-invasion-ukraine-may-be-imminent-n1287649.

[8] Energy Act of 2020, Section 7002(c)(4)(A).

known to have insecure supply chains, by definition, but this recent unrest has also greatly affected resources that were not listed, such as helium and uranium.[9]

For example, Russia is a major producer of helium, and, as markets are already stressed by the upcoming closure of the Federal Helium Reserve in the U.S.,[10] Gazprom's helium plants were expected to help ease global supply concerns in 2022.[11] However, recent fires and an explosion at Gazprom's Amur facility demonstrates how irresponsible it is to rely on Russia to meet the world's need for an element essential to medical imaging, high tech computing, semiconductor manufacturing, telecommunications and metal fabrication worldwide.[12] Similarly concerning, Kazakhstan is the world's largest producer of uranium, and any supply disruptions due to the humanitarian and diplomatic crisis unfolding there could have vast effects on global markets.[13] As it stands, about 97 percent of U.S. demand for uranium is met by foreign imports, despite a large domestic supply and repeated calls by Members of Congress for the Biden Administration to develop our own natural resources at home.[14,15,16]

The lukewarm response from this administration regarding Russia's menacing behavior has been too slow and insufficient to mount a strong deterrent. Secretary Blinken may have threatened "a swift, a severe and a united response" should Russia invade Ukraine, but without an administration-wide willingness to address this challenge on every front, these strong words will remain hollow.[17] By not using every tool at its disposal to bolster domestic mineral production, this administration is passively enabling our continued reliance on Russia and other adversaries for helium, uranium, and other mineral resources.

The relationship between national security and stable mineral supply chains is clearer now than ever as the world watches Eastern Europe continue to destabilize and the administration's response remains tepid. Careful selection of the mineral commodities included on DOI's Final List of Critical Minerals is an important aspect of ensuring a reliable supply of these necessary resources. As you continue your required consultations with the Secretaries of Defense, Commerce, Agriculture, and Energy and the U.S. Trade Representative, we urge you to bear in mind the troubling developments in Europe and the impacts of this administration's anemic foreign policy in your finalization of the 2022 List of Critical Minerals.

---

[9] 86 FR 62199.

[10] Bureau of Land Management, "BLM ANNOUNCES DISPOSAL PROCESS FOR FEDERAL HELIUM SYSTEM," Press Release, April 16, 2020, https://www.blm.gov/press-release/blm-announces-disposal-process-federal-helium-system#:~:text=In%20accordance%20with%20that%20law,follow%20its%20statutory%20disposal%20process.

[11] Phil Kornbluth, "Kornbluth: Latest Amur fire tightens helium supply for 2022," Gas World, January 17, 2022, https://www.gasworld.com/kornbluth-latest-amur-fire-tightens-helium-supply-for-2022/2022514.article.

[12] Vladimir Soldatkin, "Russia's Amur gas plant says a unit caught fire," Reuters, January 5, 2022, https://www.reuters.com/business/energy/russias-amur-gas-plant-says-unit-caught-fire-2022-01-05/.

[13] "Uranium sector monitors evolving Kazakh situation," World Nuclear News, January 7, 2022, https://www.world-nuclear-news.org/Articles/Uranium-sector-monitors-evolving-Kazakh-situation.

[14] U.S. Energy Information Administration, Uranium Marketing Annual Report, https://www.eia.gov/uranium/marketing/table3.php.

[15] Letter to Secretary Granholm from Rep. Henry Cuellar and Rep. Vincente Gonzalez. April 15, 2021.

[16] Volcovici, Valerie. U.S. House votes to protect 3 million acres of land from development. Reuters. February 26, 2021.

[17] Jessica Bursztynsky, "Secretary of State Blinken warns of severe response if a single Russian force enters Ukraine in an aggressive way," CNBC, January 23, 2022, https://www.cnbc.com/2022/01/23/secretary-of-state-blinken-warns-of-severe-response-if-a-single-russian-force-enters-ukraine-in-an-aggressive-way.html.

We appreciate your attention to this vital matter.

Sincerely,

Bruce Westerman, Ranking Member
House Committee on Natural Resources

Pete Stauber, Ranking Member
Subcommittee on Energy and Mineral Resources

Don Young, Ranking Member
Subcommittee for Indigenous Peoples of the United States

Russ Fulcher, Ranking Member
Subcommittee on National Parks, Forests, and Public Lands

Cliff Bentz, Ranking Member
Subcommittee on Water, Oceans, and Wildlife

Louie Gohmert
Member of Congress

Doug Lamborn
Member of Congress

Robert J. Wittman
Member of Congress

Garrett Graves
Member of Congress

Jody Hice
Member of Congress

Aumua Amata Coleman Radewagen
Member of Congress

Daniel Webster
Member of Congress

Jenniffer González-Colón
Member of Congress

Tom Tiffany
Member of Congress

Blake Moore
Member of Congress

Yvette Herrell
Member of Congress

Jay Obernolte
Member of Congress

---

Mr. WESTERMAN. So, what led USGS and its consulting agencies to change its mind about the importance of uranium's non-fuel uses, and choose to not evaluate it as a critical mineral for the recent list?

Dr. NASSAR. Thank you for that question. I think what has changed is that the Energy Act was passed, and the Energy Act defines critical minerals as non-fuel, and specifically excludes fuel minerals. Thus, USGS did not evaluate uranium.

Mr. WESTERMAN. That seems to have changed since 2019, because it has always had fuel and non-fuel uses. So, were there other factors involved?

Dr. NASSAR. No, sir. The uses maybe have not changed, but the definition of what uranium is labeled as, is it a fuel mineral or not, not its uses.

Mr. WESTERMAN. That just doesn't seem to make a lot of sense to me, why it would be taken off the list after such a strong argument for it being on the list. That is why it is important for us to have these hearings and to come up with better policy moving forward.

Mr. Somers, just yesterday the Department of the Interior released the report from the Interagency Working Group on Mining Reforms. I will say I was obviously very disappointed, but not surprised to hear of several extremely harmful recommendations to

change our domestic mining system, despite lip service about increasing mining for the Administration's renewable goals.

How harmful would these changes be to investment in a mining state with large amounts of Federal land such as yours?

Mr. SOMERS. It would be incredibly damaging, especially the idea of changing into a leasing system. And the idea of royalties, which, according to the proposal, would be among the highest in the world, would be absolutely devastating to the hardrock mining industry.

Mr. WESTERMAN. Yes, and we have seen what appears to be an attack on mining all around this country. At the same time, we see China dominating mining and mineral resources, and we also see policies that are making us more dependent on those minerals and elements that China produces.

As we talk about being more energy independent, as we talk about having more national security, it seems that reports like this one that came out yesterday fly right in the face of that. It is one thing to talk the talk, but we are not walking the walk in this Administration.

Mr. SOMERS. Yes, and I think you have seen that on a number of fronts. I mean, the latest report is one piece of evidence there. Mineral withdrawals that we have seen all around the country, these are things that are very problematic to enable us to develop the mineral resources that we have that can lessen our dependence on places like China.

Mr. WESTERMAN. Right. It just seems like it should be common sense.

Dr. Eggert, could you explain to your knowledge the real-world benefits, if any, of a commodity being designated as a critical mineral?

And how does this compare to being designated as a critical material by DOE?

Dr. EGGERT. In my view, designation as a critical mineral or material shines a spotlight on the material or mineral overall. In terms of policy implications, I think one needs to then ask the question more narrowly, what is the narrower context of that particular supply chain, the technologies and products it is used in, and what the various policy mechanisms are.

In terms of mineral versus material, I think it reflects, well, many people use the term synonymously. For those who focus on one or the other, I think it relates to the portion of the supply chain that is most prominent in a person's perspective. "Critical mineral" tends to be used by people who have an upstream focus more than downstream, relatively speaking, and vice versa.

So, to me, it is not surprising that the USGS activity is "critical mineral," whereas the Department of Energy activity is labeled "critical material." But to me, they are all part of the same thing, and they really mean the same thing to me.

Mr. WESTERMAN. Thank you.

I yield back, Mr. Chairman.

Dr. GOSAR. I thank the Chairman. I now recognize the gentleman from California, Mr. Mullin, for 5 minutes.

Mr. MULLIN. Thank you, Mr. Chair. Thank you to all of the witnesses for your time today.

My district in California, the San Francisco Bay Area, is home to many companies working on emerging technologies to advance the clean energy transition. The mineral supply chain will become increasingly important as they continue to work toward that transition. So, my question is for Dr. Mulvaney.

In your testimony, you discuss how advances in technology can help us create innovative sources of critical minerals. And apologies if you have touched on this already, maybe multiple times, but could you elaborate on some of the latest innovations and advancements in things like developing a circular economy, improving recycling and materials substitutions?

And then specifically, what can Congress do to help encourage these innovative approaches?

Dr. MULVANEY. Well, I will start with the second part to that, which piggybacks on my previous comment about setting up a takeback and collection system, because that really sends a signal to the recyclers and the innovators who are working with these materials that there is going to be a market for them to recover that material and sell it back to a new product. For example, having content requirements, having a certain percentage of recycled content as a law or policy can help drive innovation in those new, emerging sectors.

We are seeing, because of the European Union's Waste and Electronics and Electrical Equipment Directive, a takeback and collection system is leading to 95 percent of solar panels being recovered in Europe. They are getting silver out of them, they are innovating to get the silicon, which is very, very high energy intensity and the most carbon intensive part of the solar panel. They are recovering that. And in the United States, it is less than 10 percent. It is on the order of 5 percent because we don't have that takeback and collection system.

We are also innovating around battery materials. We are starting to see sodium batteries entering into cars in China. A very small car, a burgeoning industry. We don't know if sodium batteries will be the future, but that is part of, I think, what we have to be aware of is that sometimes these materials that we demand will change in the future.

Mr. MULLIN. Thank you, sir.

I yield back.

Dr. GOSAR. I thank the gentleman. The gentleman from Idaho, Mr. Russ Fulcher, is recognized for 5 minutes.

Mr. FULCHER. Thank you, Mr. Chairman.

And to the panel, thank you for being here and your participation. And you are probably aware of this, but in the wisdom of Congress we have multiple committees going on at the same time. So, if you see us coming and going, please, please forgive the scheduling on that. But thank you for being here.

A question for Mr. Nassar. This has to do with uranium. And I know that in your written testimony you touched on this, but I would like to just clarify and get your thoughts. Uranium is used, of course, for nuclear power plants. And that is a specific interest to me in my state. Idaho National Lab is instrumental in research for nuclear power. And our availability for that, our resources for that, are primarily outside of the United States.

So, I want to just have you talk for a minute about what are your concerns when it comes to domestic production, what are the issues there, and is there a reason why, from a policy standpoint, we don't have more of that domestic sourcing?

Dr. NASSAR. Thank you, Congressman, for that question.

As a science agency, I obviously wouldn't be able to comment on policy issues. But what we are concerned with and what our analysis draws upon are supply risks due to three factors that we look at: we look at the likelihood of a disruption; our exposure, meaning the United States' exposure to foreign supply disruptions; and our ability to weather the storm through our economic vulnerability to those disruptions. So, those are the factors that we look at.

And in terms of disruption potential, we are looking at whether or not the suppliers to the United States are reliable suppliers, whether there will be potential for disruption due to the simple fact that the production is concentrated either in one trading partner or in a geographic region. So, those are the things that concern us most.

Mr. FULCHER. Right now, how much of our current supply comes from domestic sources, can you tell me that?

Dr. NASSAR. It really depends by commodity. For some commodities like molybdenum, we are net exporters. For other commodities like gallium, we are importing 100 percent——

Mr. FULCHER. I am talking specifically about uranium in this case.

Dr. NASSAR. Uranium. Our center doesn't necessarily cover uranium production and consumption. But my understanding is that we are highly net import reliant. Most of our imports are coming in currently from Australia and a smaller degree from Canada.

Mr. FULCHER. That brings up another question. Why is uranium not of interest to you? When you say that is not covered by your jurisdiction, why not?

Dr. NASSAR. Sorry, I believe that is due to a statute that requires the Energy Information Administration to cover uranium and not the National Minerals Information Center at the U.S. Geological Survey.

Mr. FULCHER. OK. But your understanding is that we are highly reliant outside of the United States.

Dr. NASSAR. That is my understanding, yes.

Mr. FULCHER. OK. Mr. Eggert, I would like to talk to you for just a second, please. Idaho provides a significant amount of phosphate that is used for fertilizer and other products, and that is important for domestic food production and other uses. There are two phosphate mines in my state, in Idaho, and both of those are put at risk currently due to some lawsuits and other issues.

The Department of the Interior did not include phosphate on its list of critical minerals in 2022. It has been previously, but it wasn't as of 2022. So, if we lost domestic production of phosphate, do you think that would trigger that being put on a critical mineral list?

Dr. EGGERT. I would expect so. The phosphate clearly is essential for fertilizer and, in turn, agricultural production. The United States is currently a major producer of phosphate rock and

phosphorus for fertilizers. And if we lost domestic production capabilities, that would certainly elevate its ranking in any list or evaluation of material criticality.

Mr. FULCHER. So, we have about 35 percent of our dependence on that from a combination of China and Russia.

And then just the local stock is in danger of being shut down with current litigation standards. Have you tracked that? Do you see a danger of supply shock, given our susceptibility to those circumstances?

Dr. EGGERT. I don't have detailed knowledge of that particular circumstance. But it sounds worthy of evaluation.

Mr. FULCHER. Mr. Chairman, I would like to follow up with Mr. Eggert on that at a later point. I have used my time, so I yield back. Thank you.

Dr. GOSAR. Sounds good. The gentleman from Arizona, the Ranking Member for the Full Committee, is now recognized for 5 minutes.

Mr. GRIJALVA. Thank you, Mr. Chairman.

Before I forget, Mr. Somers, if I may, on the issue of royalties, and you commented on it, the Interagency Working Group recommended, I think, proposed a 4 to 8 percent royalty on net revenue from a mining operation. Do you still believe that that is an excessive amount?

Mr. SOMERS. Again, that would put us among the highest royalties in the world if that were to be implemented.

Mr. GRIJALVA. Interesting, because the state of Utah on their state land charges 4 to 10 percent on gross revenue, not the net revenue part of it, which I would suggest makes Utah the highest royalty charging government entity in the world other than the Federal Government. So, how do you reconcile that?

Is that fair for taxpayers from public lands, Federal lands cannot draw royalties from mining operations, regardless, and yet a state, Utah, Wyoming does the same thing, Arizona does the same thing, can charge royalties on state land. Do you think that that is fair?

Mr. SOMERS. Again, I am not sure exactly which royalty rate you are referring to, Mr. Grijalva. But in some cases——

Mr. GRIJALVA. Since there is none on Federal land, any royalty rate you want. Anyway, finish your response. I apologize.

Mr. SOMERS. Again, I am not sure exactly which royalty rate you are referring to. It does differ by commodity in Utah. And those are set by the State and Institutional Trust Lands Administration, which administers a trust on behalf of Utah's school children.

And I think that the issue here is not necessarily that the mining industry is opposed to any type of royalty rate. It is just a matter of how that royalty rate is applied and the overall rate, as well.

Mr. GRIJALVA. The fact we have none does open that conversation on many levels, from cleanup of abandoned mines to reclamation, to assurance for communities, and for tribes in the area in terms of the impact and effects of a particular mining operation after they leave, after 25 or 30 years. So, I think it is a legitimate point, which is part of the problem with the 150-year-old mining law.

The critical minerals list informs decisions across the Federal Government. In my district, the Permitting Council recently

announced the first-ever mining project approved for FAST-41, a process where these covered projects receive expedited permitting and review. The mine was chosen because the minerals are on the critical minerals list.

But my constituents have concerns. The critical mineral list may tell us all about the mineral's importance to the economy, but it doesn't capture the impacts of mining on our local communities, local economies, the environment, or cultural heritage.

And compound that with the constituents being concerned about the already extremely scarce water supplies that this mine would draw upon, and the huge water users would dry up. In fact, some parts of the state residential construction is being paused, stopped because there isn't enough groundwater to support the new developments.

My point being while there are critical minerals in this location, how do you balance and weigh water supplies, endangered species, cultural heritage, tribal consultation, and executing our trust responsibility to tribes?

Dr. Nassar, are any of these factors considered when you are looking at the critical minerals?

Dr. NASSAR. Thank you, Congressman. Those are not factors that we look at.

However, in our earth mapping resource initiatives, USGS follows Department of the Interior guidelines regarding tribal engagement, and only collects data over tribal lands with express written consent.

Mr. GRIJALVA. My point being, I mean, we are talking about the sovereignty part of it. But the consultation is any project that impacts, and I think that the answer is no.

And Dr. Mulvaney, going into the future of mine permitting, these factors need to be taken into account, from my perspective. Your response to that?

And there are other factors. I just mentioned those three.

Dr. MULVANEY. Could you repeat that one more time?

Mr. GRIJALVA. Yes. How do you think the future mine permitting should take these factors into account, going forward?

Dr. MULVANEY. First, that life cycle approach that I started with, it needs to be more holistic, there needs to be alternatives considered. And that could be even through the National Environmental Policy Act, sometimes there are alternatives considered there. And there also needs to be more cumulative impacts looked at because we are often permitting projects one by one, and we don't see the big picture. And that is what I meant when I said a holistic approach by understanding the cumulative impacts.

A mine might be proposed, it might say it is not going to impact groundwater, but we don't know what else is coming down the line, and we think it is important.

Mr. GRIJALVA. Mr. Chairman, thank you for allowing the witness to answer.

Dr. GOSAR. I thank the gentleman. I am going to recognize myself now for the next one.

Dr. Mulvaney, you made a comment to Mr. Tiffany in regards to power, in regards to recycling. I think you really need to check your information. It takes much more power to recycle something than

it does new. That is whether it be paper wood, whether it be minerals, all the way across the board.

And then second, can you name me a mine that you actually endorse and support?

Dr. MULVANEY. I will answer the second question first. I live next to a sand mine in Ben Lomond, California, and I support that——

Dr. GOSAR. How about a hardrock mine?

Dr. MULVANEY. I actually don't know of any hardrock mines where I have lived near, so I don't know.

Dr. GOSAR. It seems to me like you should be looking at that hardrock mine and getting familiar with it, if you are going to be an expert along these critical minerals because it is so very, very important.

Dr. Eggert, I have to tell you, thanks for Colorado School of Mines. My dad and my sister went there, so thank you very much for that excellent education we got.

I want to come back to uranium. I find it offensive that it was taken off the critical mineral list because now we are seeing, I was in Germany a couple of years back with Rob Bishop, and our military is supposed to have 24/7 baseload power. And they were going to use Nord Stream 2. So, my comment was, "Well, we are going to use this 24-hour baseload power coming from Russia. How does that work?" And here we are doing the same thing again, where almost everybody that talks about green energy says you can't do it without nuclear right now. Take a quantum leap in battery storage to get this taken care of.

So, we are going down this rat hole again about energy, and being dictated by adversaries. Would you consider Russia a friend, Dr. Eggert?

Dr. EGGERT. Under the current circumstances? No, I would not consider Russia an ally.

Dr. GOSAR. And how did that switch flip? Was it very quick, that geopolitical switch? Didn't it flip very quickly?

Dr. EGGERT. Oh, absolutely. I think for the last several decades we, generally speaking, have viewed engagement with Russia as a means of, over the longer term, fostering greater security through more interactions. And what has happened came as a surprise.

Dr. GOSAR. I just want to go back to Mr. Fulcher. He talked about helium. I thought I saw this, that it was Helium-4 that was used in a fusion experiment. Was that true, Dr. Eggert?

Dr. EGGERT. I believe so. I am not an expert on helium.

Dr. GOSAR. I guess, coming along those same lines as Mr. Fulcher to Dr. Nassar, this ought to be on the critical list because my understanding is Helium-4 just isn't everywhere.

Now, Dr. Eggert, when we are doing science discoveries and experiments, a critical element could be just anything that we need to have to place in there. But if you don't have it, you can't use it. Is that true? If you don't have that element, you can't use it.

Dr. EGGERT. If you don't have it, you cannot use it, correct.

Dr. GOSAR. Wow, it seems like all this technology is going down these roads with helium, nuclear, critical, and hardrock. It is just amazing how much things we have not taken into consideration here, very, very sad.

Mr. Somers, here is your answer to the gentleman from Arizona. In the multiple use doctrine, Congress gave the state the hardrock royalty as part of that aspect. Like in Arizona, the state is the last of jurisdiction because we were rejected the first time. The second time we were coming, they came back with Taft. Taft was the only President to go to the Supreme Court. He understood contracts. So, we were forced to take the multiple use or take the Federal doctrine of the Federal lands. But in lieu of that, we were given the multiple use doctrine that the Feds said they would get the maximum out of it to appease both sides. So, hardrock mining went to the state.

I find it very offensive that I look at my district, we just had the Ranking Member and the Interior Secretary come into my state and withdraw over a million acres, not for maintaining the landscape. It was to stop uranium production. And if you look at this, it is an unhealthy situation when you do not mine it. A collapsed breccia pipe is a low point in the geology.

I used to hate rocks, Dr. Eggert. Now I love rocks. They set you free.

So, water pools there and the air. And you are going to get contamination all the way across. It seems to me like what you would want to do is take out that uranium, clean it up, have sand and gravel put in there. It helps you through the caliche clays so you get sub-permeation of water. That was a mouthful. Sorry.

The gentlewoman from Colorado, Mrs. Boebert, is recognized for 5 minutes.

Mrs. BOEBERT. Thank you, Mr. Chairman, and thank you all for being here today and testifying before our Committee.

Mr. Blakemore, clearly China is dominating the entire world when it comes to mineral supply chains. But why is that? Why are we so desperately far behind the curve when it comes to China and these rare earth minerals?

Mr. BLAKEMORE. It is a combination of multiple factors. First and foremost, China embarked on an aggressive strategy of investing in upstream resources abroad. And those investments drew a lot of those resources domestically to China, where it was able to construct a pretty strong market share on the processing part of key supply chains, facilitated also by high subsidization and, in some cases, rather lax environmental regulation.

That has gotten us to the point now where China's market incumbency both puts it ahead of the United States in terms of certain supply chain resiliency efforts, but also makes reducing that market incumbency a little bit sticky, given the economics associated with those respective supply chains.

Mrs. BOEBERT. Do you think that the Trump administration, his Executive Orders in 2017 that were proposed steps to form a national strategy to strengthen our domestic supply chains, do you think that that would have helped in this, so we wouldn't be so far behind the curve?

Mr. BLAKEMORE. I think the efforts more broadly over the course of several administrations actually have advanced a more holistic approach to thinking about our supply chain resiliency.

The Trump administration, to its credit, did a lot of work to think specifically about upstream resiliency. However, upstream

resiliency alone is not a solution to supply chain resiliency. And I think as our thinking and strategic planning around supply chain resiliency matures, moving down the supply chain as well, and thinking about the ontake and offtake of various components of the supply chain to build that strategy is also necessary. So, I look at the Trump administration decision as one piece, a critical piece, but one piece of what I would call a healthy supply chain resiliency strategy.

Mrs. BOEBERT. Thank you. It sounds like we would agree that the way the United States determines what is considered a critical mineral and how we manage these supply chains and what production advantages, if any, listed critical minerals we receive over unlisted mineral commodities is of national importance.

Dr. Eggert, you have been involved in critical mineral and material assessments for decades, and it seems that these assessments have helped highlight some of the challenges that we are facing. But are we, as a nation, making headway in improving our situation with respect to critical minerals?

Dr. EGGERT. I think we are making improvements, but there is always room for more improvement. I think in terms of three specific areas where we should focus attention: first, research and development throughout the entire supply chain; second, workforce development, it takes workers to mine the minerals and do the various downstream processing activities, and we have lost much of that capability; and third, there is significant room for improvement in permitting and associated pre-production activities, not to minimize or reduce the importance of environmental protection or interaction with local communities, but in a way that gets us to yes or no and how, in terms of project development, sooner.

Mrs. BOEBERT. Thank you. Mr. Somers, to me it seems that this Administration says one thing about mining in America, but does something completely different. Has the critical materials list yielded any results in terms of creating jobs or economic development in your state?

We just heard that one improvement to the supply chain and this energy security would be to improve the workforce.

Mr. SOMERS. Yes, I do think that there is utility in highlighting the supply chain vulnerabilities that we have. But in terms of bringing specific investment or jobs to the state because a mineral is on the list or not on the list, we haven't seen that in Utah. And I think that the bigger issues are some of the other things that we have talked about.

I mean, it is what is the Federal Government's policy, especially in a public land state like Utah, what are the Federal Government's policies with regard to how you can open up, and permit, and develop a mine?

And then also, is the Federal Government going to come in and make the economics of a mining project more difficult because of royalty rates or other things that they might be contemplating?

So, I think that those are the more important issues as opposed to whether a mineral is on a list or not.

Mrs. BOEBERT. Thank you.

And Mr. Chairman, may I ask one yes-or-no question to Mr. Somers?

Mr. STAUBER [presiding]. Yes, go ahead.

Mrs. BOEBERT. Thank you.

Has the Biden administration's decision to leave out critical minerals like uranium and helium on the list had any adverse impacts on job creation or economic development?

And you can expand later, but maybe just for now yes or no.

Mr. SOMERS. I think that it has, yes.

Mrs. BOEBERT. OK, great. Thank you so much for all of you and your time here today.

I yield back.

Mr. STAUBER. Thank you very much. Next to question is Representative Collins.

You are up for 5 minutes.

Mr. COLLINS. I think that was pretty obvious there, Mr. Chairman. No, I am just joking.

I kind of want to point my questions in one direction, and listening for most of the questions and testimony, except for the time, obviously, you have been seeing us run in and out like Fulcher was talking about, but I have noticed that people have been asking about certain minerals and being on the list, off the list, on the list of critical minerals.

And then having gone all over the country with field hearings that we have been involved with to talk to people about how it is impacting their lives, their family's lives, and generational lives of people that mine, and I kind of want to, you may have answered it, I don't know. And maybe I just didn't get it. I have tried to take some notes. But Dr. Nassar, I just want to kind of go over a few things real quick to just get an idea in my simple little brain of process and methodology maybe.

How does the USGS determine a country's ability to supply mineral resources, and how did you decide on that methodology that you are using?

Dr. NASSAR. Thank you, Congressman, for that question. I think you are specifically asking regarding the country metrics.

Mr. COLLINS. Yes.

Dr. NASSAR. We look at two factors: a country's ability to continue to supply to the United States, and a country's willingness to continue to supply to the United States.

For the ability metric, we use the Fraser Institute's Policy Perception Index, which is a survey to mining executives around the world to rank countries and jurisdictions regarding how favorable are policies, how is the political situation, political stability of the country, access to labor, access to infrastructure, access to electricity, for example. So, that is the basis for the ability metric.

For the willingness metric, we look at three factors. How close a country is ideologically to the United States, do they have democratic practices or not? We look also at trade ties. How closely are the two countries, the country in question and the United States in terms of trade? And we also look at military cooperation. Is there a specific defense agreement for supplying the United States? So, those are the factors that we look at in terms of country metrics.

Mr. COLLINS. OK, and maybe that will help with this next question that I have for you then, because I understand you do consult

with other agencies, including the Department of Defense and the Department of State when you draft your critical minerals list.

How much weight do you give those consulting departments when you make your final decision?

Dr. NASSAR. Sorry. If I can get a clarification, are you asking how much weight do we give the——

Mr. COLLINS. Those departments, when you are making your final decision, when they have their input.

Dr. NASSAR. Right, so through the interagency process, through the National Science Technology Council's Critical Subcommittee, we formed a working group. They weighed in on the methodology throughout the process. They weighed in on the results at the end of it.

We also did an internal peer review within USGS and an external peer review with experts at a scientific journal.

Mr. COLLINS. So, how do you even put a value on the importance of their opinion when they have totally different priorities?

Dr. NASSAR. Well, I think we take in all the comments. This is an iterative process where we hear each other, we understand the issues of importance to them, and we weigh the factors together.

Mr. COLLINS. OK. The last——

Mr. STAUBER. Mr. Collins, can I follow up real quick? I will give you the time back.

Mr. COLLINS. Yes, sir.

Mr. STAUBER. Mr. Nassar, so you weigh other departments, their needs, and wants, and desires. So, does politics then enter it?

Dr. NASSAR. I apologize. Let me clarify. What I was saying is that we take input from people within the departments in terms of the methodology. Do they feel like this specific methodological input makes sense or not? They are part of the Interagency Working Group to help us define the methodology.

Mr. STAUBER. I yield back to the gentleman from Georgia, and I will give you your time back, as well. Thank you.

Mr. COLLINS. No, that is OK. I only have one other question I wanted to run by him.

Have you ever considered making subcategories of minerals on the list by sector or end use, such as defense or aeronautics? Similar to the way the critical minerals list at the DOE focuses on alternative energy.

Dr. NASSAR. Thank you for that question. I think it is an interesting proposal.

The way we see it is that it is important to look at the economy as a whole, because if you look at one individual industry sector or technology, then you might be missing compounding or second order effects that might impact each other. So, it is important for us to look at the economy as a whole.

And in our future development of the methodology, we are planning to use an economic model that is able to measure and quantify those impacts, not only on those directly consuming industries, but downstream industries again, and the economy as a whole.

Mr. COLLINS. All right. Thank you, Mr. Chairman. That is all I have.

Mr. STAUBER. Thank you, Mr. Collins. I want to thank the witnesses for their valuable testimony and the Members for their questions.

The members of the Subcommittee may have some additional questions for the witnesses, and we will ask you to respond to these in writing. Under Committee Rule 3, members of the Committee must submit questions to the Committee Clerk by 5 p.m. on Monday, September 18. The hearing record will be held open for 10 business days for these responses.

If there is no further business, without objection, the Committee stands adjourned.

[Whereupon, at 12:29 p.m., the Subcommittee was adjourned.]