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2025 Draft List of Critical Minerals, MS–913
U.S. Geological Survey
12201 Sunrise Valley Dr.
Reston, VA 20192

RE: Comments on the USGS 2025 Draft Critical Minerals List

I. Introduction and Comments Overview

The Society for Mining Metallurgy & Exploration (SME) appreciates this opportunity to provide comments on the U.S. Geological Survey's (USGS') 2025 Draft Critical Minerals List published on August 26, 2025 in the Federal Register (Vol. 90, No. 163). SME agrees with and supports the addition of copper, silver, potash, rhenium, silicon, and lead to the 2025 Critical Minerals List (2025 CML). These minerals are essential to our economy and national defense, are subjected to supply chain disruptions, and therefore fit the critical minerals definition. SME's comments focus on the following issues:

- Why copper is an important addition to the 2025 CML;
- Why uranium, metallurgical coal, and gold should be added to the 2025 CML;
- Why construction aggregates should be considered as a critical material and/or mineral;
- Why the critical minerals list should be updated annually; and
- Policy implications and economic and technological challenges associated with processing byproduct critical minerals from primary production host minerals.

About SME

SME is a professional society comprised of more than 14,000 mining industry professionals who work in over 100 countries as engineers, geologists, metallurgists, mineral economists, educators, students, and researchers. As a nonprofit 501(c)(3) corporation, our mission is to advance the worldwide mining and underground construction community through information exchange, education, and professional development. In supporting responsible mining, SME seeks to educate lawmakers, policymakers, and the general public on the complex technical issues associated with mineral development through technical briefing papers, studies, and scientific and engineering articles.

Many SME members have expertise with critical minerals geology, mineral processing technologies for recovering specific critical minerals, and evaluating the economic viability of domestic and international critical minerals mining projects, making us well qualified to provide comments on the CML. Additionally, as mining professionals, SME members are keenly aware of our Nation's dangerous reliance on imported minerals and how price volatility contributes to this reliance by creating variable and multiple uncertainties that delay proposed domestic critical minerals mining projects. SME members have first-hand experience with how these uncertainties chill the significant long-term capital investment required to support the U.S. minerals exploration, mining, processing, and manufacturing sectors.

II. Copper is Clearly a Critical Mineral that Should be on the CML

President Trump's July 30, 2025 Proclamation, *Adjusting Imports of Copper Into the United States*[1] describes the Secretary of Commerce's (Secretary's) investigation pursuant to Section 232 of the Trade Expansion Act of 1962 into the national security implications of the current level of importing all forms of copper (e.g., copper ores and concentrates, refined copper, copper alloys, copper scrap, and derivative copper products. The Secretary's key findings include:

> ...copper is being imported into the United States in such quantities and under such circumstances as to threaten to impair the national security of the United States.
>
> ...copper is essential to the manufacturing foundation on which United States national and economic security depend. Copper is the second most widely used material by the Department of Defense and is a necessary input in a range of defense systems, including aircraft, ground vehicles, ships, submarines, missiles, and ammunition. Copper also plays a central role in the broader United States industrial base. The metal's exceptional electrical conductivity and durability also make it indispensable to critical infrastructure sectors that support the American economy, national security, and public health. Alternatives to copper are insufficient substitutes for these vital industries and products in many circumstances.
>
> ...the United States was a world leader across the value chain of copper production (mining, refining, semi-finished goods, and finished goods containing copper) for most of the 20th century. But despite copper being a crucial material in manufacturing and for the national and economic security of the United States, United States copper production has plummeted. Today, a single foreign country dominates global copper smelting and refining, controlling over 50 percent of global smelting capacity and holding four of the top five largest refining facilities.
>
> ...unfair trade practices abroad, exacerbated by overly burdensome environmental regulations at home, have hollowed out United States copper refining and smelting, caused the United States to be overly reliant on foreign copper imports, and prevent a path forward

[1] https://www.whitehouse.gov/presidential-actions/2025/07/adjusting-imports-of-copper-into-the-united-states/

> without strong corrective action. Foreign competitors leverage state subsidies and overproduction to flood international markets with artificially low-priced copper products, driving United States producers out of business. The United States is now dangerously dependent on foreign imports of semi-finished copper, intensive copper derivative products, and copper-containing products, and imbalances in the global markets make domestic investment increasingly unviable.
>
> ...United States dependency on foreign sources of copper is a national security vulnerability that could be exploited by foreign countries, weakens United States industrial resilience, exposes the American people to supply chain disruptions, economic instability, and strategic vulnerabilities, and jeopardizes the United States defense industrial base.

SME believes the findings of the Secretary's report provide compelling reasons to designate copper a critical mineral.

Additionally, projected forecasts of copper demand in the coming decades present another persuasive reason to add copper to the 2025 CML. Abundant copper supplies will be needed to respond to projected copper demands for military uses as noted in the President's proclamation, and its equally indispensable uses in a broad range of industries, renewable and conventional energy systems, electric vehicles, and for Artificial Intelligence (AI) and data centers. Estimates of the level of increased future copper demand vary between various experts. However, there is widespread agreement that future copper demands will outstrip supply. For example, BHP, the world's second largest copper-producing company[2] has provided the following copper demand and supply forecasts:[3]

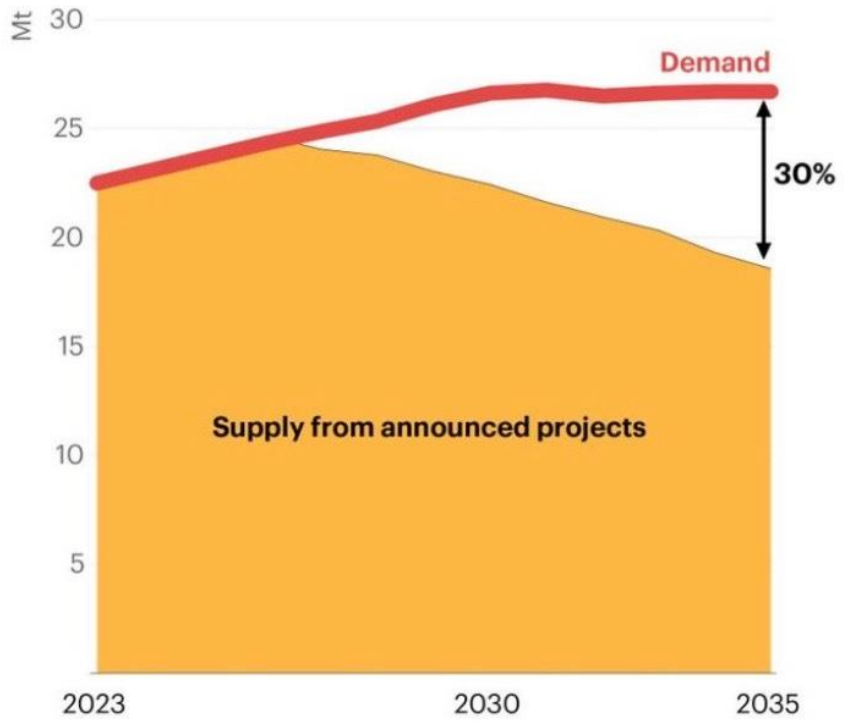
- ...global copper demand will grow by over 70% to over 50 million tonnes (Mt) by 2050 – and average growth rate of 2% per year.
- The world will need about 10 Mt per year of new mined copper supply in the next ten years.
- Major copper discoveries are becoming less common and getting deeper.
- There is a looming global copper supply challenge as existing copper mines age, with the pipeline of potential projects less healthy than in previous cycles.
- Both brownfield and greenfield projects are expected to face cost and stakeholder challenges. There is a shortage of "easy" projects to replace existing supply and meet this growing copper demand.

[2] https://en.wikipedia.org/wiki/Largest_copper_companies
[3] https://www.bhp.com/news/bhp-insights/2024/09/how-copper-will-shape-our-future

In 2022, S&P Global[4] labeled copper "the metal of electrification" and forecasted that copper demand will double by 2050, which will create a large supply gap, with shortfalls beginning in 2025:

> Copper scarcity may also jeopardize international security. Projected annual shortfalls will place unprecedented strain on supply chains. The challenges this poses — reminiscent of the 20th-century scramble for oil — may be accentuated by an even higher geographic concentration for copper resources and downstream industry to refine it into products.

The International Energy Agency's (IEA's) 2025 Global Critical Minerals Outlook[5] predicts that a major copper supply deficit will develop starting later in this decade. As shown in the graph below, which IEA's Executive Director, Fatih Birol, published on LinkedIn in January 2025,[6] a 30 percent copper deficit will develop as soon as 2035.



Consistent with BHP's findings, the IEA states that declining ore grades, rising costs, and fewer resource discoveries are driving the copper supply deficit.

[4] https://www.spglobal.com/market-intelligence/en/news-insights/research/growing-appetite-copper-threatens-energy-transition-climate

[5] https://iea.blob.core.windows.net/assets/ef5e9b70-3374-4caa-ba9d-19c72253bfc4/GlobalCriticalMineralsOutlook2025.pdf

[6] https://substackcdn.com/image/fetch/$s_!Qoaw!,f_auto,q_auto:good,fl_progressive:steep/https%3A%2F%2Fsubstack-post-media.s3.amazonaws.com%2Fpublic%2Fimages%2F6371f601-b8db-488b-82ea-45e7a7312f3d_706x596.jpeg

The copper forecasts presented above, coupled with the findings discussed in President Trump's proclamation that "copper is being imported into the United States in such quantities and under such circumstances as to threaten to impair the national security of the United States," clearly justify adding copper to the 2025 CML.

III. Uranium Should be Added to the CML

A. Uranium Should Not Have been Removed from the 2021 CML

In 2018, the Department of the Interior defined uranium as a critical mineral "essential to the economic and national security of the U.S., the supply chain of which is vulnerable to disruption, and that serves an essential function in the manufacturing of a product, the absence of which would have significant consequences for the economy or national security."[7] However, in 2021, the USGS removed uranium from the CML apparently due to the fact that the 1970 Mining and Minerals Policy Act at 30 U.S.C. 21a defines uranium as a "mineral fuel"[8] and the 2020 Energy Act at 30 U.S.C. § 1606(a)(3)(B) explicitly excludes fuel minerals like uranium from the definition of a critical mineral. However, in removing uranium from the CML, USGS apparently overlooked uranium's essential non-fuel uses that clearly qualify it for inclusion on the CML.

Uranium is designated as a fuel mineral because one of its isotopes, U^{235}, is fissionable, yielding energy in the form of heat. Controlled fission in nuclear power reactors generates heat to produce steam which is, in turn, converted to electrical energy. Natural uranium consists of three radioactive isotopes: U^{238}, U^{235}, and U^{234}. The isotope U^{238} constitutes about 99.3 percent of all natural uranium but is not readily fissionable. The isotope U^{235} makes up almost all of the remaining uranium, about 0.7 percent of the total.[9]

Uranium is the exclusive nuclear fuel for approximately 20 percent of the U.S. electric grid, which is the world's largest civilian nuclear power program. But beyond its importance as an energy mineral/mineral fuel for civilian purposes, uranium is critical for energy and non-energy defense purposes, including the Navy's nuclear-powered fleet of aircraft carriers and submarines and global nuclear deterrence. In April, 2020, the Nuclear Fuel Working Group determined that "America is on the brink of losing its ability to provide U.S.-origin nuclear fuel, threatening our national interest and national security."[10]

B. The U.S. is Dangerously Reliant on Foreign Uranium

The U.S. currently obtains much of its uranium from foreign countries including Canada, Kazakhstan, Russia, Uzbekistan, and Australia. However, the U.S. was once a global leader in

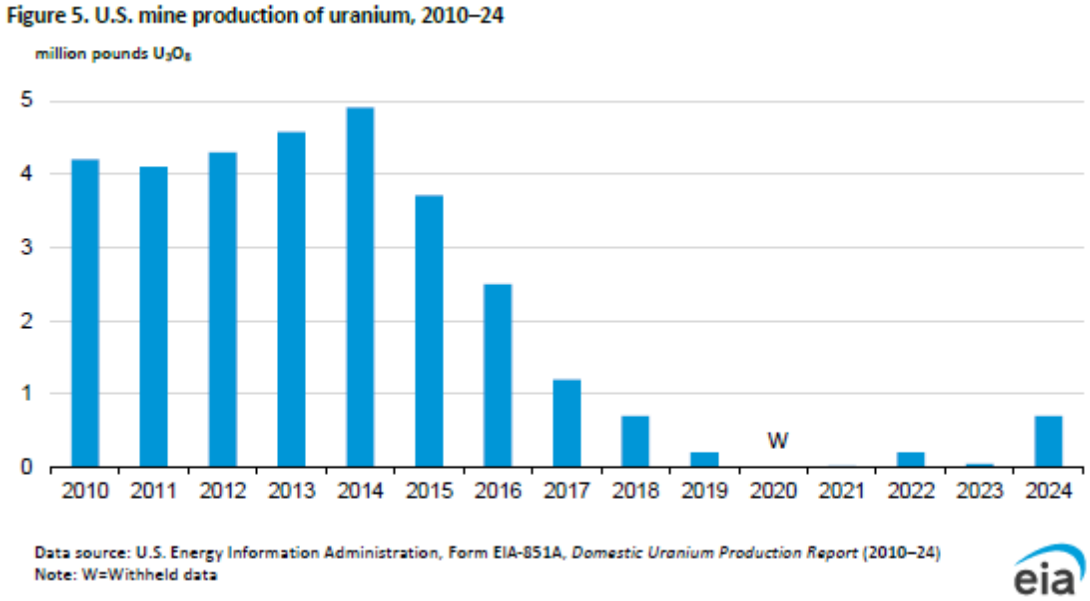
[7] Draft List of Critical Minerals, Federal Register, Vol. 83, No. 33, Department of Interior, Office of the Secretary, February 16, 2018

[8] Four of the five mineral fuels listed in the Mining Mineral Policy Act: oil, gas, coal, and oil shale, are leasable minerals subject to the Minerals Leasing Act of 1920. Uranium, on the other hand, is a locatable mineral governed by the U.S. Mining Law of 1872.

[9] *See* Section 1.02 [5] [c] of the American Law of Mining, 2nd Edition.

[10] Restoring America's Competitive Nuclear Energy Advantage: A strategy to assure U.S. National Security (Department of Energy, April 23, 2020).

uranium production, producing more than 40 million pounds annually in the early 1980s when the domestic industry employed more than 21,000 Americans. That picture has changed radically as documented in the Energy Information Administration's ("EIA's") annual reports., which show that starting in 1989, the U.S. has become increasingly dependent on imports of foreign uranium to fuel civilian nuclear reactors. As shown in the EIA figure below, since 2015, U.S. domestic nuclear fuel production has atrophied, which is mainly due to due to foreign State Owned Enterprises (SOE) that are engaged in predatory market tactics to cement their hold on the U.S. uranium and nuclear fuel market.



Foreign SOE, particularly Russia's Rosatom and its subsidiaries, have spent years undercutting the uranium market, accumulating market share, and creating dependence among U.S. and other nations' utilities while simultaneously driving U.S. domestic production nearly out of existence. America's uranium producers could be cost-competitive globally but for the SOE's price undercutting tactics. Without the SOE's interference, America's uranium industry would have the capacity to produce significant quantities of cost-competitive uranium.

Although domestic uranium production has increased, the SOE's continued influence threatens this progress and undermines the taxpayer dollars appropriated to recapitalize the fuel cycle. Russia has seemingly made efforts to circumvent the U.S. import ban by selling enriched uranium to other countries like China that, in turn, sell their enriched uranium to U.S. utilities at below-market prices. Import data show a sudden increase in Chinese imports since Congress enacted Russia Ban legislation.[11] According to the World Nuclear Association, enrichment capacity in China is only sufficient to cover the demand for its growing nuclear fleet, and since the Russia ban, Chinese customs report a significant increase in Russian enriched uranium imported into China while over the same period, there is a likewise increase in imports of Chinese enriched

[11] The Prohibiting Russian Uranium Imports Act, which was signed into law by President Joe Biden on May 13, 2024 and went into effect on August 11, 2024, bans imports of low-enriched uranium (LEU) from Russia. The legislation aims to diminish U.S. reliance on Russian nuclear materials and reduce a source of revenue for Russia.

uranium into the U.S. The Commerce Department should investigate this as a potential displacement swap that is prohibited by the Russian Suspension Agreement and the Russian Uranium Import Ban.

Chinese SOE are actively increasing their presence in the U.S. nuclear market, according to U.S. and Chinese Customs data. Chinese entities own large inventories and subsidize large uranium mines in China, Kazakhstan, and Namibia that are expanding production despite having costs that are far above the current market price of uranium. The Chinese have invested heavily in uranium mining operations in Central Asia and Africa while also dramatically expanding their own uranium enrichment capabilities. This represents a new threat to American producer competitiveness in much the same way as Russia has, and risks shifting our dependence from one geopolitical adversary to another for our most critical energy and national defense needs.

C. The Department of Commerce Found that Importing Uranium Threatens National Security

In 2019, the Department of Commerce (DOC) investigated uranium imports under Section 232 of the Trade Expansion Act of 1962 and concluded that continued imports of foreign uranium in all forms impaired U.S. national security. Based on this investigation's findings and the Secretary of Commerce's recommendation, President Trump formed the Nuclear Fuel Working Group (NFWG) to conduct an interagency assessment of vulnerabilities in America's nuclear fuel supply chain and to provide a report to the President with recommended future actions.[12] The NFWG's assessment and report found that the U.S. does not have the means today to produce the unobligated, U.S.-origin uranium necessary for national security needs. America is currently solely dependent on a dwindling inventory of highly enriched uranium to supply our nuclear navy and our strategic nuclear forces.

The DOC's report also found that U.S. policy, and restrictions in international agreements pertaining to imported uranium, dictate that domestic uranium must be available to satisfy the U.S. Department of Defense (DoD) requirements for maintaining effective military capabilities. International treaties, including the Nuclear Non-Proliferation Treaty, require DOD to obtain domestic uranium that is not obligated by or subject to international controls to maintain effective military capabilities for the U.S. Navy's fleet of nuclear-powered aircraft carriers and submarines and to provide source material for nuclear weapons, tritium production, depleted uranium for ammunition, and other functions.[13] Currently, there is no commercial source of unobligated enriched uranium for U.S. defense needs, the supply of which is limited solely to a "stockpile" of highly enriched uranium (HEU) that was accumulated over decades at great expense to the U.S. taxpayer. This stockpile is "finite and diminishing" as it is being used to fuel America's naval reactors, AUKUS submarine reactors, fuel for research reactors, other defense mission needs, and for high assay low enrichment uranium (HALEU) for prototype small modular reactors.[14] Without

[12] Memorandum on the Effect of Uranium Imports on the Security and Establishment of the United States Nuclear Fuel Working Group, Presidential Memoranda, July 12, 2019

[13] The Effect of Imports of Uranium on the National Security, An Investigation conducted under Section 232 of the Trade Expansion Act of 1962, as amended, U.S. Department of Commerce, Bureau of Industry and Security Office of Technology Evaluation, April 14, 2019

[14] https://docs.house.gov/meetings/IF/IF03/20180522/108339/HHRG-115-IF03-Wstate-McGinnisE-20180522.pdf

a strong and stable domestic uranium industry across the entire fuel cycle, America's nuclear infrastructure is at risk.

D. Essential Non-Energy Uses of Uranium Clearly Make it a Critical Minerals

Uranium has many non-fuel uses that make it an important critical mineral. As discussed below, uranium's essential role in defense, energy technology, and healthcare clearly qualify it for re-inclusion on the CML.

Defense

Domestic uranium production is essential for weaponry, the naval propulsion program, and nuclear deterrence. These indispensable national defense uses of uranium are urgent reasons to reclassify uranium as a critical mineral and to put it back on the CML. The small modular reactors in Navy aircraft carriers and submarines that have defended our interests safely, efficiently, and reliably for decades must be fueled by domestically produced uranium that is free from any foreign controls or obligations. The U.S. must retain the ability to independently refuel the Navy's fleet. The production of tritium at the Tennessee Valley Authority (TVA) also requires U.S.-origin uranium.

Defense requirements for uranium are likely to increase in the future given the projected need for small modular reactors and microreactors that the U.S. military is evaluating as more secure and resilient power sources for military facilities. While the U.S. government has been able to rely on stockpiles from the Atomic Energy Comission days of U.S.-origin uranium, U.S. Department of Energy (DOE) officials have stated that these stockpiles are finite and diminishing, which is a cause of major concern as we witness the erosion of the domestic uranium industrial base.

Non-fuel defense uses of uranium include high-density penetrators. This ammunition consists of depleted uranium (DU) alloyed with 1–2% other elements, such as titanium or molybdenum.[15] At high impact speed, the density, hardness, and pyrophoricity of the projectile enable the destruction of heavily armored targets. Tank armor and other removable vehicle armor can also be hardened with depleted uranium plates.

Depleted uranium is also used as a shielding material in some containers used to store and transport radioactive materials. While the metal itself is radioactive, its high density makes it more effective than lead in halting radiation from strong sources such as radium.[16] Other uses of depleted uranium include counterweights for aircraft control surfaces, as ballast for missile re-entry vehicles and as a shielding material. [17] Due to its high density, this material is found in inertial guidance systems and in gyroscopic compasses. Depleted uranium is preferred over similarly dense metals due to its ability to be easily machined and cast as well as its relatively low cost.

[15] "Development of DU Munitions". Depleted Uranium in the Gulf (II). Gulflink, official website of Force Health Protection & Readiness. 2000.
[16] "Uranium". The McGraw-Hill Science and Technology Encyclopedia (5th ed.). The McGraw-Hill Companies, Inc. 2005. ISBN 978-0-07-142957-3.
[17] Hammond, C. R. (2000). The Elements, in Handbook of Chemistry and Physics (PDF) (81st ed.). CRC press. ISBN 978-0-8493-0481-1.

Energy Technology

On January 20, 2025, President Trump established that it is in the national interest to unleash America's affordable and reliable energy and natural resources.[18] Further, on May 23, 2025, President Trump issued four Executive Orders describing plans to modernize nuclear regulation, streamline nuclear reactor testing, deploy nuclear reactors for national security, and reinvigorate the nuclear industrial base.[19] Implementation of these plans is expected to drive the development and deployment of advanced nuclear reactors that would result in 10 new large reactors with complete designs under construction by 2030, and the addition of 300 GW of new nuclear electricity generation by 2050. All of the currently planned advanced nuclear reactors that would be built under this plan will require uranium as their only fuel.

Healthcare-Related Applications

Uranium is a key component in the production of medical isotopes. The U.S. is currently almost totally dependent on foreign-sourced medical isotopes, with 90 percent of medical isotopes currently coming from abroad. About 75 percent of medical procedures require these isotopes. The pandemic exposed our lack of domestic supply of these critical medical components. These isotopes are used to detect cancer and specifically locate where the cancer cells have metastasized in the patient. Medical isotopes are also used in a variety of treatments.

The Uranium-Rare Earth Elements Connection

In his March 20, 2025 Executive Order 14241, *Immediate Measures to Increase Domestic Mineral Production,* President Trump specifically recognized the importance of critical minerals, including rare earths, as an essential part of defense, high-tech, and other products. Rare earths are vital to the development of electric motors. Notably, rare earth elements are often co-located in minerals with uranium and other radionuclides. Rare earth elements require processing, which involves the handling of slightly radioactive material. The uranium industry has the safety and regulatory expertise and infrastructure for handling such materials. The last fully licensed and operating conventional uranium mill, Energy Fuel's White Mesa Mill in Utah, recently announced that in addition to producing U3O8 from uranium ore as the material start of the nuclear fuel cycle, it has also commenced production of separated rare earth products from a mineral called monazite. According to Energy Fuel's website:[20]

> The Mill is a key link in the U.S. rare earth supply chain processing monazite, a low-cost byproduct of heavy mineral sands, to produce rare earth oxides for use in electric mobility, robotics, drones and defense technologies. It has completed its first commercial run of 'on-spec' neodymium-praseodymium oxide (NdPr), considered a "light" rare earth. The team is currently piloting the "heavy" rare earths of dysprosium (Dy) and Terbium (Tb).

[18] Executive Order 14154 – "Unleashing American Energy", Office of the President, January 20, 2025
[19] "9 Key Takeaways from President Trump's Executive Orders on Nuclear Energy | Department of Energy", Office of Nuclear Energy, Department of Energy, June 10, 2025,
[20] https://www.energyfuels.com/white-mesa-mill/

Research is underway to determine if the thorium in the wastes produced by processing rare earth minerals could be used as a nuclear reactor fuel source.

Vanadium is another listed critical mineral that is a byproduct of uranium mining. Most sandstone-hosted uranium deposits are a source of identified critical minerals including vanadium, heavy rare earth elements, and others. The host deposit relationship that uranium has with these other critical minerals highlights the need for the USGS to restore uranium as a critical mineral, rather than inappropriately dismissing uranium because it is also a fuel mineral.

E. Uranium Should be Re-Designated as Critical Mineral

Removing uranium from the 2021 CML apparently ignored the essential non-fuel uses of uranium. In addition to its important uses as a carbon-free energy source that currently supplies about 20 percent of the Nation's electrical grid, it also has numerous and essential non-fuel defense and medical uses that must have reliable domestic sources of uranium. For the reasons outlined above, SME strongly urges the USGS to put uranium back on the CML. Doing so would be responsive to EO 14241, Section 9, which directs the DOI Secretary to consider adding uranium to the CML.

From a broader policy perspective, Congress should reconsider uranium's exceptional positions as: 1) an important civilian fuel; 2) an absolutely essential defense fuel; and 3) an equally indispensable defense material for building bombs and munitions. These crucial uses make uranium unique – and certainly distinguish it from the other fuel minerals listed in the definition of critical mineral in the Energy Act of 2020 (e.g., oil, gas, coal and oil shale). Unfortunately, the exclusion of fuel minerals from the definition critical minerals in this statute, at 30 U.S.C. § 1606(a)(3)(B)(i), complicates the consideration of uranium's designation as a critical mineral. Congress may wish to amend this definition to clarify that uranium is not excluded from being designated a critical mineral based on its use as a fuel mineral.

IV. Metallurgical Coal Should be Added to the 2025 CML

The Federal Register CML notice specifically requests comments on whether metallurgical coal (met coal) should be added to the 2025 CML. SME strongly concurs with Energy Secretary, Chris Wright's, May 23, 2025 statement below explaining his decision to designate metallurgical coal as a critical material:

> "Metallurgical coal is more than a fuel—it is a cornerstone of our industrial base," said Secretary Wright. "By designating metallurgical coal as a critical material, we are ensuring that American steel, generated by American coal, remains the backbone of our manufacturing sector."[21]

Beyond its use as a fuel, the U.S. cannot make steel without metallurgical coal. As described in the Department of Energy's (DOE's) May 2025 announcement, metallurgical coal is a critical

[21] https://www.energy.gov/articles/energy-department-designates-coal-used-steelmaking-critical-material-strengthening-us

material because it possesses unique properties necessary for producing coke, the fuel and reactant required for steel production using the blast furnace–basic oxygen furnace steel production method. Anthracite coal, a type of metallurgical coal sourced mainly from the Appalachian region, plays a key role in the electric arc furnaces, which account for approximately 70% of domestic steel production.

DOE's announcement notes that the shared infrastructure and workforce supporting both thermal and metallurgical coal production are under strain from declining investment and operational capacity. Without intervention, this erosion will jeopardize domestic steel dominance, which underscores the importance of designating metallurgical coal as a critical material to minimize the multiple threats facing the U.S. steel sector, including foreign anti-competitive practices, unreliable supply chains, and underinvestment in critical upstream materials.

For the same reasons expressed by DOE in May 2025, DOI and the USGS should deem metallurgical coal as a critical mineral and add it to the 2025 CML given its role in manufacturing steel and building defense systems and equipment, infrastructure, renewable and conventional energy equipment, transmission grids, and buildings and housing – just about everything that modern society requires. As explained above for uranium, the definition of coal as an energy mineral should not deter the USGS from adding it to the 2025 CML because it has essential uses other than electrical power generation.

Table 1 summarizes the reasons why SME recommends that metallurgical coal should be added to the 2025 CML.

Table 1
Reasons Why Metallurgical Coal Should be Added to the 2025 CML

Reasons for Adding Met Coal To USGS' 2025 CML	Discussion
Strategic Industrial Relevance	• Met coal is essential for steel production, which underpins defense, infrastructure, energy, and manufacturing. • No scalable substitute exists for blast furnace-grade coke in high-strength steelmaking.
Supply Chain Vulnerability	• The U.S. remains dependent on imports for certain grades of met coal and coke, especially from Australia and Canada. • Disruptions—whether geopolitical, logistical, or environmental—could cripple domestic steel output.
National Security Implications	• Steel is critical to defense systems, transportation, and energy infrastructure. • Without secure access to met coal, the U.S. risks strategic exposure in wartime or global competition.
Economic Impact	• The steel sector contributes hundreds of billions to U.S. GDP and supports thousands of jobs.

Reasons for Adding Met Coal To USGS' 2025 CML	Discussion
	• Met coal's exclusion overlooks its multiplier effect across industrial supply chains.
Alignment with List Criteria	• Met coal meets the definition of a critical mineral • Essential to economic and national security • Supply chain vulnerable to disruption • No viable substitutes for key applications
Substitutability in Blast Furnace Steelmaking	• Met coal is uniquely suited for producing metallurgical coke, which provides both the heat and chemical reduction needed to convert iron ore into steel. • Alternative steelmaking methods (like electric arc furnaces) rely on scrap metal and cannot replace the role of met coal in producing virgin steel from iron ore.
High-Temperature Performance	• Met coal-derived coke must withstand temperatures exceeding 2,000°F without degrading, making it irreplaceable in high-strength steel applications such as: military-grade armor, bridge and rail infrastructure, energy transmission towers, and AI data center construction
Global Strategic Leverage	• China and India are rapidly expanding met coal production and steel output, using it as a lever for economic and geopolitical influence. • Recognizing met coal as critical would allow the U.S. to counterbalance foreign dominance in steel supply chains.
Role in Clean Steel Innovation	• Emerging technologies like carbon capture in blast furnaces and hydrogen-enriched coke still rely on met coal as a base material. • Including met coal supports low-emission pathways for steelmaking without sacrificing performance or reliability.

V. Gold

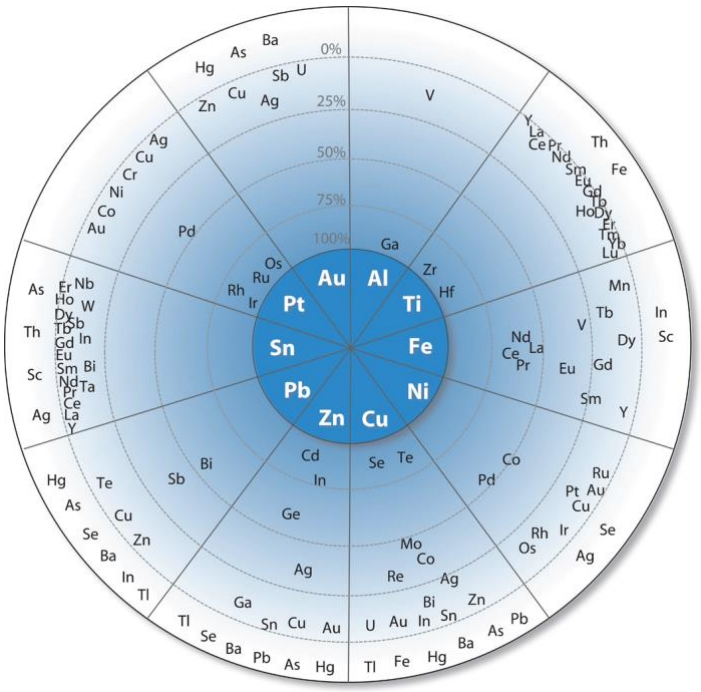
Section 40206(b)(2) of the Infrastructure Investment and Jobs Act/Bipartisan Infrastructure Law of 2021 recognizes that "many critical minerals are only economic to recover when combined with the production of a host mineral." The 2025 Draft CML published in the August 26, 2025 Federal Register corroborates this statement because 33 of the 54 listed critical minerals are byproducts produced from a host mineral deposit.

SME recommends adding gold to the CML because it is shown as the host mineral for two byproduct critical minerals – antimony and silver, as noted in the table on page 41592 of the

Federal Register. The Federal Register notice explains that the USGS considered adding gold (and other minerals) to the CML and that "the Secretary, consistent with statutory authority, can include these listed mineral commodities and others on the 2025 final List of Critical Minerals."

The Wheel of Metals Companionality shown below illustrates there are many primary metal deposits that have significant potential to produce important critical minerals as by-products or co-products.

Wheel of Metals Companionality[22]



Explanation: The darkest blue inner circle shows principal host metals. Companion elements appear in the outer circles at distances proportional to the percentage of their primary production (from 100 to 0 percent) of the host metal indicated. The companion elements in the white region of the outer circle are elements for which the percentage of their production from the host metal indicated has not been determined.

Development of a primary host-mineral deposit is typically the economic driver that enables private-sector, co-production or by-product production of critical minerals. In many cases, producing the critical mineral as a stand-alone operation is not economically feasible. The antimony that will be produced as a co-product of gold production at Perpetua Resources' Stibnite Mine in Idaho is a good example of how the economics of host-mineral production facilitates critical minerals production. In a December 19, 2020 news release announcing a $24.8 million critical minerals award to Perpetua Resources, the DOD described the Stibnite Mine as "the sole

[22] https://advances.sciencemag.org/content/1/3/e1400180

domestic geologic reserve of antimony that can meet Department of Defense (DoD) requirements. only currently known domestic source of antimony that meets DOD specifications" and described this award as an "investment [that] is essential to ensure the timely development of a domestic source of antimony trisulfide for the manufacture of small arms and medium caliber cartridges, as well as many other missile and munition items..[23]

At the September 19, 2025 ribbon cutting ceremony celebrating the reopening of this mine, a Pentagon official stated that the antimony to be produced from the Stibnite Gold Mine will bring the U.S. "one step closer to establishing a complete domestic supply chain."[24] At this ceremony, the Pentagon enumerated the many essential military applications for antimony as including armor piercing bullets, night vision goggles, infrared sensors, precision optics, laser sighting, explosive formulations, hardened lead for bullets and shrapnel, ammunition primers, tracer ammunition, nuclear weapons and production, tritium production, flares, military clothing, and communication equipment.

Given gold's role as a key host mineral for byproduct antimony, the essential military uses of antimony for munitions, and our import reliance on China, Belgium, India, and Bolivia for 85 percent of the antimony we need,[25] SME recommends that gold be added to the 2025 CML for the purpose of stimulating exploration and development of antimony-bearing gold deposits.

VI. Construction Aggregates are the Foundation for Critical Minerals Development

Because critical minerals projects cannot be built without construction aggregates, SME recommends the USGS consider the close nexus between construction aggregates and the development and application of critical minerals as qualifying construction aggregates for classification as a critical material, a critical mineral, or both. Mines, processing plants, transportation networks, and waste management facilities all require aggregates for site preparation, foundations, access roads, tailings dams, and ongoing maintenance. In this way, aggregates are indispensable inputs to the entire critical mineral supply chain. The absence of construction aggregates would severely directly hinder the nation's ability to develop and secure supplies of the minerals included in the 2025 CML.

Construction aggregates (e.g., sand, gravel, and crushed stone) play an essential role as the physical foundation for our infrastructure. Every highway, bridge, rail line, runway, levee, and dam depends on a reliable and proximate supply of aggregate. The absence of this material would have significant adverse consequences for the U.S. economy, halting the construction and maintenance of critical systems that enable commerce, defense readiness, and emergency response.

[23] https://www.war.gov/News/Releases/Release/Article/3249350/dod-issues-248m-critical-minerals-award-to-perpetua-resources/

[24] https://www.forbes.com/sites/davidblackmon/2025/09/21/pentagon-hails-restart-of-critical-minerals-mine-in-idaho/

[25] USGS 2025 Mineral Commodity Summaries, page 7.

Although abundant in nature, aggregates face supply risks which would cause significant supply chain vulnerabilities. Because communities and industries cannot rely on distant sources due to high transportation costs, construction aggregates must be obtained from proximal sources. However, supply is increasingly constrained by land-use conflicts, permitting barriers, and logistical bottlenecks. Regional mismatches between supply and demand already delay infrastructure projects across the country, underscoring their vulnerability to disruption.

Construction aggregates are essential for national security and resilient defense systems. From military bases and training facilities to energy infrastructure and disaster recovery, rapid access to local aggregate resources is necessary to ensure readiness, response, and continuity. These functions directly reflect the economic and national security priorities embedded in the critical mineral definition.

Although a strict reading of the statutory definitions in the Energy Act of 2020 for critical materials versus critical minerals could suggest that construction aggregates fall more closely into the critical materials category, a broader interpretation could place them on both the critical materials and the critical minerals lists because the critical minerals definition includes materials. SME acknowledges that the definition of critical minerals at 30 U.S.C. § 1606(a)(3)(B) excludes "common varieties of sand, gravel, stone pumice, cinders, and clay." However, just as we suggest above for uranium, we suggest again that Congress may wish to amend the critical minerals definition due to the central connection between critical minerals and construction aggregates and the inescapable fact that the U.S. cannot develop critical minerals without having reliable sources of construction aggregates.

VII. Annual Updates to the CML

SME recommends annual reviews and updates to the CML The supply and demand for minerals in general is rapidly changing. The development of new and currently unforeseen technologies has the potential to create a compelling need for one or more minerals that are not currently on anyone's radar screen as a critical mineral. World events such as the on-going conflicts in the Mideast and the war between Ukraine and the Soviet Union also have the potential to disrupt the supply, production, and shipping of minerals and refined mineral products. Also, climatic and natural events such as floods, wildfires, storms, earthquakes, etc. may locally affect the mining and processing of some critical minerals, which has the potential to disrupt supply chains. Therefore, annually evaluating and updating the CML is essential to keep up with world-wide supply chain changes in minerals supply and demand and new technological developments.

Lithium is a prime example of how technology development can strongly influence demand for a mineral. According to the USGS 1996 Minerals Commodities Summary, The use of lithium compounds in ceramics, glass, and primary aluminum production represented more than 60percent of estimated domestic consumption. Other major end uses for lithium were in the manufacture of lubricants and greases and synthetic rubber production. Lithium for lithium ion batteries was not yet a listed major use. But that was about to change.

Between 2000 and 2010, lithium consumption in batteries increased by an average of 20 percent each year. In the following decade, lithium consumption for batteries jumped to 107 percent per

year, with annual overall average lithium consumption growing 27 percent. In 2010, batteries consumed roughly 23 percent of the lithium produced that year. By 2022, lithium consumption for batteries had soared to 74 percent of total lithium production.[26]

VIII. Policy Issues and Economic and Technical Challenges Pertaining to Byproduct Critical Minerals

As noted in Section V, the August 26, 2025 Federal Register notice announcing the 2025 CML includes a table that shows that 33 of the 54 listed critical minerals (61 percent) occur as a byproduct of a primary mineral, and also shows the primary host commodity(ies) for each byproduct critical mineral. Generally speaking, mining companies do not recover byproduct minerals because it is not profitable to do so. Consequently, without an economic driver to produce many of the byproduct minerals on the CML, the private sector is unlikely to be able to provide these minerals. In fact, it is not uncommon for a mine operator to consider the presence of one or more byproduct critical mineral as a problem rather than as a resource because these minerals can create processing headaches and recovering them would require adding costly but otherwise unnecessary circuits to their milling facilities.

Another salient fact about some of the byproduct critical minerals on the 2025 CML is that the global volumetric demand for many of them is quite limited. Some of these critical minerals could be characterized as "mini" and "micro" critical minerals. These mini and micro critical minerals are must-have essential components for many high-tech and military applications, which means that not having a reliable supply has an outsized, unacceptably adverse impact to the economy, technology, and national defense. Appendix A in the Hoover History Lab's August 11, 2025 working paper entitled *A Multilateral Commercial Stockpile for Critical Minerals*[27] includes a table listing critical minerals and their annual U.S. total consumption, the market value for each mineral, and the percentage that is processed in other countries. Table 2 is a compilation from this working paper for several mini and micro high-priority critical minerals that have a small annual U.S. total consumption and market value.

Table 2

U.S. Annual Consumption and Market Value for Some Mini and Micro Critical Minerals

(modified after the Hoover History Lab's August 11, 2025 working paper)[28]

Mini and Micro Byproduct Critical Minerals	U.S. Annual Consumption	Market Value
• Bismuth:	760 tons	$5.99 million
• Dysprosium:	14 tons	$4.92 million
• Erbium:	7 tons	$300,000

[26] https://www.vvcresources.com/lithium-consumption-has-nearly-quadrupled-since-2010#:~:text=The%20Impact%20of%20EV%20Batteries,growing%2027%25%20annually%20on%20average.&text=Back%20in%202010%2C%20the%20single,and%20gas%20and%20air%20treatment.

[27] https://www.hoover.org/research/multilateral-commercial-stockpile-critical-minerals

[28] Hoover, *ibid.*

Mini and Micro Byproduct Critical Minerals	U.S. Annual Consumption	Market Value
• Europium:	6 tons	$170,000
• Gadolinium:	49 tons	$2.45 million
• Neodymium:	100 tons	$8.91 million
• Praseodymium:	70 tons	$6.06 million
• Samarium:	185 tons	$460,000
• Terbium:	2 tons	$2.76 million
• Yttrium:	500 tons	$4.38 million

Nyrstar's consideration of adding a germanium and gallium recovery circuit to their Clarksville, Tennessee zinc smelter (the only primary U.S. zinc producer) is a good example of a mining company's deliberations about whether to expend corporate resources to add a critical minerals recovery circuit to an existing milling operation. As shown in Table 1, germanium is a byproduct of zinc and coal fly ash primary production and gallium is a byproduct of bauxite and zinc primary production. Nyrstar's website states:[29]

> "Nyrstar is currently assessing a proposed project to build a state-of-the-art germanium and gallium recovery and processing facility at its Clarksville zinc smelter in Tennessee. We estimate that the facility would produce as much as 80% of annual US Germanium and Gallium demand, enhancing US national security, supporting the green transition, and stimulating domestic supply of products currently imported from China. In addition, the project would increase the recovery and production of zinc. We are currently discussing the potential development with relevant government entities in order to finalise the business case and move forward with this investment as soon as practically possible."

Because there may be no or limited economic incentives for the private sector to provide many of the byproduct critical minerals on the 2025 CML – especially the mini and micro critical minerals – the federal government will likely have to get involved with public-private partnerships to support and subsidize future production of these minerals. The price floor and guaranteed minerals purchase agreement in the recent transaction between the U.S. Department of Defense and MP Materials at the Mountain Pass rare earths operation in California may be a useful model for the government's future involvement with other critical mineral producers.

There are significant metallurgical challenges associated with recovering many of the byproduct minerals include in the CML. This is especially true for rare earth minerals. Because recovering many of the listed byproduct minerals is not financially remunerative, it is unlikely that the private sector will undertake the mineral processing research and development (R&D) work that needs to be done to develop metallurgical methods capable of recovering these minerals – both at active mining operations and from legacy mine wastes. The federal government will most likely need to

[29] https://www.nyrstar.com/operations/metals-processing/nyrstar-clarksville

take the lead in developing byproduct recovery technologies for many of the byproduct minerals on the CML – especially for the mini and micro critical minerals. As discussed above, the private sector cannot justify the investments needed to perform the mineral processing R&D and then build the processing facilities, that typically cost many hundreds of millions of dollars or more.

Prior to 1995, when Congress stopped funding the U.S. Bureau of Mines (USBM), this is the type of mineral processing R&D that the USBM would have conducted. The 30-year gap in federal mining and mineral processing R&D is currently creating a technical expertise gap that must be immediately filled to respond to the urgent need to recover the byproduct critical minerals on the USGS' 2025 CML. Three decades of very limited federal mining and mineral processing expertise is partly responsible for the steady decline in U.S. mineral production and the concomitant increased reliance on imported minerals. As discussed in the Society for Mining, Metallurgy, & Exploration's (SME's) September 2024 concept paper, *Why the U.S. Needs a National Materials and Minerals Council*, (attached hereto as Appendix 1), Congress should take immediate action to reestablish the country's mining and mineral processing R&D capabilities. Developing this expertise is an essential component of responding to the national minerals emergency.

IX. Conclusions

SME very much appreciates this opportunity to provide comments on the 2025 CML. Addressing the country's minerals emergency and our dangerous reliance on foreign minerals elevates the importance of developing a comprehensive CML that captures the breadth of the looming threats to our economy and national security stemming from China's and other foreign adversaries' hegemony over mineral production and processing. This argues for an expansive rather than a more limited list. Consequently, SME strongly supports the addition of copper, silver, potash, rhenium, silicon, and lead to the 2025 CML.

As outlined above, we also suggest the list be expanded to include uranium, gold, metallurgical coal and construction aggregates. Given the economic and technological challenges associated with recovering byproduct critical minerals from primary production mines and legacy mine wastes, SME believes the federal government urgently needs to increase its mining and mineral processing R&D capabilities by restoring funding to a group of mining and mineral processing experts modelled after the R&D group at the former U.S. Bureau of Mines. SME can help the federal government identify private sector and academic individuals and groups with this expertise.

Please do not hesitate to contact me at kanagy@smenet.org for additional information.

Sincerely,

David L. Kanagy
Executive Director and CEO

APPENDIX 1

September 2024 SME Concept Paper
Why the U.S. Needs a National Materials and Minerals Council

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CONCEPT PAPER

Why the U.S. Needs a National Materials and Minerals Council

Based on the Recommendations of the May 30, 2024 Roundtable Discussion of Mining Technical and Policy Experts

September 2024

Table of Contents

Executive Summary

As summarized below, a group of mining technical and policy experts (Experts) participated in a May 30, 2024 roundtable discussion (Roundtable) hosted by the Society for Mining, Metallurgy & Exploration (SME) at its headquarters in Englewood, CO. The discussion focused on why the federal government needs a new Executive Branch entity to provide advice and coordination on minerals and mining issues, suggested the best place for this entity within the Executive Branch, highlighted the compelling public interests in creating this new entity, and identified the following reasons for a new entity within the Executive Branch:

- The U.S. has no centralized federal department or agency with the requisite mining and mineral processing expertise to assist the Executive Branch and Congress in developing coordinated mining policies responsive to the country's mineral needs.

- A new centralized minerals entity is urgently needed to coordinate existing federal mineral programs, which are scattered throughout several executive branch departments and agencies, to identify and fill the gaps in the country's current mineral and mineral processing research and development (R&D) programs, and to increase domestic mining and mineral processing in order to reduce our dependency on imported minerals.

- Establishing a Director of Minerals (Director) to lead a new entity called the "National Materials and Minerals Council" (NMMC) within the Executive Office of the President's (EOP's) National Economic Council (NEC) would achieve a whole-of-government approach to providing policy and technical input on issues pertaining to the broad array of materials and minerals that are indispensable to our economy and national security.
    - NMMC and its Director would function as an executive-level, unbiased, and fact-based advisor to help Congress and Executive Branch officials develop internally consistent U.S. mineral policies and programs in coordination with all cabinet-level executive offices and their respective departments and agencies.

- NMMC would also be tasked with coordinating a federal minerals research program focused on strengthening U.S. mineral supply chains in order to reduce our dangerous reliance on foreign minerals and to meet the skyrocketing mineral demands projected for the next several decades to support the objectives to transition to a clean energy economy.
    - NMMC's research functions would help manage and coordinate third-party research programs currently underway operating with federal grants and loans and, as funding allows, new in-house research on broad materials and minerals issues with widespread applications that the private sector is unlikely to undertake.

- Since Congress stopped funding the U.S. Bureau of Mines (USBM) in 1996, U.S. reliance on foreign minerals has increased dramatically, which can be readily seen by comparing the U.S. Geological Survey's (USGS) 1995 and 2023 mineral import reliance charts.
    - Today, the U.S. imports many minerals from adversarial nations, including China and Russia, and is between 50 and 100 percent reliant on foreign sources for 49 critical

minerals. In 1995, the U.S. was similarly dependent on foreign countries for just 24 minerals.

  - The demise of the USBM is one of the reasons for the country's unsustainable dependency on foreign countries for the minerals needed to address the skyrocketing demand for minerals to support national defense and energy transition goals.

- Between 1910, when Congress created the USBM, and 1996, the USBM was the primary federal agency conducting and coordinating scientific research and disseminating information on the extraction, processing, use, conservation, and recycling of mineral resources. The USBM effectively conducted innovative and transformative R&D in a manner beyond the capability of any single private company to improve extraction techniques, environmental sustainability, and worker safety.

- The U.S. currently lacks adequate federal mining and mineral expertise and research capabilities because many of the former USBM's technical and research functions were not assigned to other federal agencies.
  - Although some USBM functions and equipment were transferred to the Department of Energy (DOE), Congress has not appropriated sufficient funding over the past three decades to support the country's mineral needs.

- The September 2023 Interagency Working Group Report, *Recommendations to Improve Mining on Public Lands*, says a USBM is "needed to revitalize domestic mining," noting that in the late 20th century, the U.S. lost its position as the global leader in mining production and as the main developer of cutting-edge mining technology.

- The absence of a federal minerals entity makes the U.S. less competitive on the world's stage because most nations have a Minister of Mines or a centralized mining authority charged with developing mineral policies to ensure these countries have robust mining industries.

- Mining education has declined significantly since the demise of the USBM, with only 14 U.S. universities currently offering undergraduate programs in mining and metallurgy compared to 20 in 1995 and 25 in 1982.

- Congress has recently appropriated trillions of dollars in the 2021 Bipartisan Infrastructure Law (BIL), the 2022 Inflation Reduction Act and in the 2022 Chips and Science Act to support critical minerals programs and R&D, but these efforts are not well coordinated and lack strong central leadership.
  - The DOE, the Department of Defense (DOD), the National Science Foundation, the Department of the Interior (DOI), and other agencies have ongoing mineral R&D programs that are largely uncoordinated.

  - Some of the R&D funding is outsourced to academia and the private-sector without having the necessary federal expertise to oversee how this money is being spent, to coordinate these research efforts to achieve maximum synergies, to provide technical

input and guidance to enhance research outcomes, or to disseminate information about successful research and transfer technology.

  - Very few critical minerals R&D resources are earmarked for upstream critical minerals activities (e.g., exploration and mining).

- The Energy Act of 2020 defines and distinguishes between critical materials and critical minerals, making the DOE responsible for critical materials and development of a critical materials list and the DOI responsible for critical minerals and development of a critical minerals list.

- The Director's responsibilities and the NMMC's charter must include both critical materials and critical minerals as well as materials and minerals not currently included on either list due to the dynamic nature of criticality.
  - Given the breadth of materials and minerals activities across the federal government, the Director and NMMC need to operate out of the EOP rather than being headquartered in either the DOE or the DOI given these departments have specific jurisdictions that distinguish between critical materials and critical minerals.

- Putting the Director and the NMMC in the EOP's NEC would be the best way to achieve inter-departmental synergies and facilitate the participation of other cabinet-level executive offices like the Departments of Defense, Commerce, and State, and agencies involved with materials and minerals issues.
  - This placement makes sense as mining is at the front end of every supply chain overseen by the NEC including infrastructure, manufacturing, housing, and technology and innovation.

- Section 40210 of the Bipartisan Infrastructure Law of 2021 establishes the Interagency Subcommittee on Critical Minerals and describes many research functions that are similar to the mining and mineral processing research mission of the former USBM.

- Congress could amend Section 40210 to:
  - Rename the Interagency Subcommittee on Critical Minerals the NMMC;
  - Authorize the Director and NMMC to take a whole-of-government perspective on materials and minerals policy issues;
  - Add the NMMC and its Director as a new core element of the NEC;
  - Designate the Director and NMMC as the federal materials and mineral policy clearinghouse; and
  - Appropriate funds to operate the NMMC to:
    - Provide mineral policy advice to the President, Executive Branch Departments, and Congress; particularly on policies necessary to secure materials and minerals supply chains, ensure consistency across multiple departments and agencies, and eliminate barriers to mineral development;
    - Coordinate existing DOE, DOD, DOI and other materials and minerals R&D programs;

- Conduct NMMC-led materials and minerals research programs comprised of both in-house R&D and supervision and coordination of outsourced materials and minerals R&D programs and loans;
- Develop Mineral Land Assessments to evaluate the potential for economic mineral development on lands being proposed for mineral withdrawal;
- Perform resource evaluations on other public lands to assess their potential for economic mineral development; and
- Assist federal regulatory agencies evaluate technical issues associated with permit applications for mining and mineral processing operations.

1. Introduction

This concept paper discusses the need for a Director of Minerals (Director) and the National Materials and Minerals Council (NMMC) to be located within the Executive Office of the President (EOP) and staffed with policy and mining technical experts recruited from the private sector, federal agencies and departments, and academia. The Director and NMMC would be charged with taking a whole-of-government approach to performing the following materials and minerals functions:

- Provide policy advice and technical input on domestic materials and minerals to Congress, the President, and to Executive Branch agencies and departments and to assist Congress in fulfilling its oversight duties to ensure that taxpayer monies on minerals projects are being wisely spent;

- Serve as the clearinghouse that coordinates the efforts of the numerous federal agencies and departments that are involved with mineral issues to achieve more consistency, synergy, and efficiency; minimize inconsistencies, overlap, duplication; and remove barriers to mineral development;

- Perform in-house materials and minerals R&D to increase domestic mining and mineral processing to improve mineral recoveries, to enhance environmental protection and reduce environmental impacts, to ensure worker health and safety, and to optimize mine reclamation outcomes;

- Coordinate technical assistance and oversight on third-party critical materials and critical minerals R&D subsidized with federal grants and loans to capitalize on these investments of taxpayer dollars and to ensure timely technology transfer;

- Coordinate the evaluation of the economic mineral development potential of federal lands being considered for withdrawal from mining or subject to proposed federal land management designations that would limit mineral exploration and development;

- Help identify federal lands with high development potential for critical materials and minerals and make this information available to the public to stimulate private-sector exploration of these lands and to inform federal land management agencies' (e.g., the U.S. Bureau of Land Management's and the U.S. Forest Service's) land use and resource management plans; and

- Assist federal regulatory agencies (e.g., the U.S. Bureau of Land Management, the U.S. Forest Service, the U.S. Environmental Protection Agency, and the U.S. Army Corps of Engineers), evaluate technical issues associated with permit applications for mining and mineral processing operations and to help facilitate the permitting process.

On May 30, 2024, the Society for Mining, Metallurgy & Exploration (SME) convened a Roundtable with mining technical and policy experts (Experts) including representatives from industry, academia, government and non-government organizations including former U.S. Bureau of Mines (USBM) employees to discuss the possibility of reestablishing a government agency or office that would be responsible for many of the duties once performed by the USBM. The Experts

included mining engineers, metallurgists, environmental engineers, geologists, mineral economists, mine permitting and regulatory specialists, health and safety professionals, lawyers, and government affairs and policy specialists. This meeting highlighted many of the Nation's losses in the mining and mineral development sector due to the closure of the USBM and also noted many of the gains the country could achieve with a new minerals agency or office.

The Roundtable was influenced by the work of the Interagency Working Group (IWG) comprised of the Departments of the Interior, Agriculture, Commerce, Energy, and State, and the U.S. Environmental Protection Agency, the U.S. Fish and Wildlife Service, the Army Corps of Engineers, the Council on Environmental Quality, and the National Economic Council. The IWG published a report in September 2023, entitled *Recommendations to Improve Mining on Public Lands*.[1] This report cites the need for a USBM as "an issue needed to revitalize domestic mining:"

> "At the end of the 20th century, the U.S. lost its position as the global leader in mining, both in terms of total production and the development of cutting-edge mining technology .... The infrastructure necessary to restart the domestic mining industry has atrophied with the increased offshoring of mining .... (IWG Report, pages 90-91)

It is the objective of this concept paper to explain the need for a new federal materials, mining and minerals entity that would centralize the focus of the U.S. government's expertise and knowledge in materials, mining, and minerals and advocate for establishing such an entity in order to: increase domestic mining and mineral processing; strengthen domestic mineral supply chains; reduce the country's reliance on foreign minerals; and lead to more consistent and effective U.S. minerals policies.

For the remainder of this concept paper, the terms "materials" and "minerals" are used interchangeably without distinction and without regards to whether specific materials and minerals are included in DOE's current Critical Materials List or in DOI's current Critical Minerals List.

2. Background and Historical Overview of the USBM

The USBM was established in 1910 in response to several mining disasters. For the following 85 years, the USBM conducted essential research related to mining and mineral processing, metallurgy, environmental remediation, and mine worker safety and health. In 1995, the U.S. Congress voted to cease funding the USBM. Although some of its essential functions were transferred to other agencies, other functions were permanently terminated or have not been funded by Congress for decades. Consequently the federal government no longer benefits from the comprehensive approach to domestic minerals, mining, and mineral processing that the USBM used to provide. The resulting substantial decline in domestic mining and mineral processing makes the U.S. vulnerable to materials and minerals shortfalls, putting our national security and economy at risk.

In the nearly three decades since the closure of the USBM, the U.S.' dependence on foreign nations for minerals essential to the stability and security of the Nation's economic and national security

[1] https://www.doi.gov/sites/doi.gov/files/mriwg-report-final-508.pdf

has increased dramatically as shown in Figure 1 (all figures are at the end of this document), which compares the 1995 and 2023 USGS, mineral dependency charts. The U.S. currently lacks the ability to mine and process many of the 50 minerals deemed "critical" by the USGS and is 100 percent reliant on foreign sources for 15 of these minerals. In 1995, when the country still had a USBM, the U.S. was 100 percent reliant on foreign nations for just eight minerals. The substantial increase in the Nation's reliance on imported minerals is due in part to the demise of the USBM which provided federal support to conduct research that was essential to the health and viability of the domestic mining industry.[2]

Figure 2 from the July 2024 U.S. Government Accountability (GAO) Report entitled "Technology Assessment Critical Minerals Status, Challenges and Policy Options for Recovery from Nontraditional Sources,"[3] illustrates the widespread use of critical minerals in five key industry sectors: aerospace, defense, energy, telecommunications and electronics, and transportation. Figure 2 also shows the U.S. import reliance for each mineral and the countries that are the primary sources of these minerals. This comprehensive compilation of critical minerals information paints a compelling picture of the foundational role that minerals play in modern society and the U.S.' current dependency on foreign countries to supply these minerals.

The need for minerals in the defense sector is perhaps the most troubling aspect of our foreign minerals and materials reliance. In a 2023 report, the Department of Defense (DOD) estimated that in a national emergency scenario, which is defined as a conventional armed conflict with China, the military would face shortfalls for 69 minerals, 20 of which are primarily procured from China.[4]

The country's mineral demand shown in Figure 2 is just part of the story because minerals and materials are needed for all other industry sectors (e.g., manufacturing, technology, agriculture, etc.) The undisputably crucial need for minerals and materials underscores the urgent need for a Director and a federal entity like the NMMC to provide executive and legislative branch policymakers with accurate and timely minerals and materials information and advice, to perform and manage research efforts to increase and enhance domestic mining and mineral processing capabilities, and to help federal regulators with technical issues during the mine permitting process.

With an increasing number of technologies reliant on minerals, the demand for minerals has also increased exponentially as has the number of government agencies involved with mineral supply chains. The lack of a centralized agency has created confusion in a number of areas within the federal government. Figure 3 illustrates the many government agencies that have some touch point throughout the domestic critical minerals and minerals ecosystem. Given the crucial uses of the minerals shown in Figure 2 and the DOD's projected shortfall of minerals and materials the military needs to defend the Nation, it is risky and unwise to rely on this bureaucratic maze of

[2] Other factors contributing to the dramatic increase in the Nation's reliance on foreign minerals include: the amount of potentially mineralized lands that have been put off-limits to mining since 1995; the deterioration of the permitting process, which takes much longer and costs much more than in 1995; the increased frequency of litigation challenging agency permitting decisions, thereby increasing permitting risks; the steady decline in the number of mining professionals graduating from U.S. mining schools; and cyclical metal prices.

[3] https://www.gao.gov/products/gao-24-106395.

[4] Congressional Research Report, *Emergency Access to Critical and Strategic Materials: The National Defense Stockpile*, November 14, 2023, p. 9, https://crsreports.congress.gov/product/pdf/R/R47833, citing DOD, *Strategic and Critical Materials 2023 Biennial Report on Stockpile Requirements*, April 2023, p. 7.

departments and agencies to ensure the availability of minerals and materials. The NMMC is needed to forge a path through this maze to seek synergy, consistency, and efficiency and to minimize inconsistent policies, duplication of efforts and obstacles to mineral development.

The absence of federal research in the areas of mining and mineral processing has also had far reaching implications to the mining industry's workforce and its education stream. There are currently just 14 universities that offer undergraduate programs in mining and metallurgy in the U.S. compared to 20 in 1995 and 25 in 1982.

According to the Center for Strategic & International Studies, "More than half the current domestic mining workforce will need to be retired and replaced by 2029 (roughly 221,000 workers). This number stands in stark contrast to the total of just 327 degrees awarded in 2020 in mining and mineral engineering and a 39 percent net drop in graduations in the U.S. since 2016. University programs tasked with creating this workforce have also been decreasing, with the number of mining and mineral engineering programs in the U.S. dropping from 25 in 1982 to 14 in 2023. This is in stark contrast to China, which has over 38 mineral processing schools and upwards of 44 mining engineering programs. Central South University, China's largest mineral processing program, has 1,000 undergraduates and 500 graduate students alone ready to accomplish China's mineral ambitions.[5]

3. Why the U.S. Needs an Entity Coordinating Federal Minerals Research

Meeting the Skyrocketing Mineral Demand will Require Federal Minerals Research

Figure 4 shows SME's 2023 estimate that the U.S. must develop 359 new domestic mines to provide the minerals needed for electric vehicles, wind turbines, solar panels, transmission lines and the other infrastructure that must be built to achieve clean energy transition objectives. This transition will require a broad spectrum of minerals including copper, cobalt, lithium, and nickel. However, as shown on Figure 4, the U.S. imports 32 percent of the copper, 61 percent of the cobalt, 50 percent of the lithium, and 52 percent of the nickel that the U.S. needs. Some of these minerals are imported from adversarial countries like China and Russia or from countries like Indonesia where some mines do not use appropriate environmental or mine worker health and safety safeguards.

The absence of federal minerals research has caused the U.S. to fall behind the rest of the world during one of the most transformative times in human history. As the world looks to transition to a clean energy economy, global demand for minerals is set to skyrocket by 400 to 600 percent over the next several decades. For minerals such as lithium and graphite used in electric vehicle (EV) batteries, demand will increase by even more — as much as 4,000 percent.[6]

[5](https://www.csis.org/analysis/united-states-needs-more-mining-engineers-solve-its-critical-mineral-challenges#:~:text=More%20than%20half%20the%20current,the%20United%20States%20since%202016)

[6] Fact Sheet: Securing a Made in America Supply Chain for Critical Minerals (https://www.whitehouse.gov/briefing-room/statements-releases/2022/02/22/fact-sheet-securing-a-made-in-america-supply-chain-for-critical-minerals/)

According to the International Energy Agency (IEA), the demand for electricity to power artificial intelligence (AI) applications and for the information exchange will also continue to increase.

> "Electricity consumption from data centers, artificial intelligence (AI) and the cryptocurrency sector could double by 2026. Data centers are significant drivers of growth in electricity demand in many regions. After globally consuming an estimated 460 terawatt-hours (TWh) in 2022, data centers' total electricity consumption could reach more than 1,000 TWh in 2026. This demand is roughly equivalent to the electricity consumption of Japan. Updated regulations and technological improvements, including on efficiency, will be crucial to moderate the surge in energy consumption from data centers."[7]

The USBM's research duties that Congress established in 30 U.S.C § 3 are urgently needed today to address the country's dangerous reliance on foreign minerals:

> "It shall be the province and duty of the United States Bureau of Mines ... to conduct inquiries and scientific and technologic investigations concerning mining, and the preparation, treatment, and utilization of mineral substances with a view to improving health conditions, and increasing safety, efficiency, economic development, and conserving resources through the prevention of waste in the mining, quarrying, metallurgical, and other mineral industries; to inquire into the economic conditions affecting these industries; to investigate explosives and peat; and on behalf of the Government to investigate the mineral fuels and unfinished mineral products belonging to, or for the use of, the United States, with a view to their most efficient mining, preparation, treatment, and use; and to disseminate information concerning these subjects..."

Currently, many of the research topics listed in 30 U.S.C. § 3 are an unfunded mandate that Congress needs to address immediately in conjunction with its appropriations to support clean energy transition goals, including recovering minerals from legacy mine wastes, batteries, and recycled e-waste, all of which require mining, metallurgical, and mineral processing expertise. With appropriate funding, the NMMC could play a pivotal role in improving processes to recover minerals from mine wastes and enhance recycling of minerals from e-wastes. These are examples of broadly applicable, cutting-edge, and transformative research that individual companies are unlikely to undertake because private-sector research efforts are typically more narrowly tailored to focus on a specific project or e-waste stream.

Congress has Appropriated Trillions to Support Critical Minerals Projects

In the Bipartisan Infrastructure Law (BIL) of 2021, the Inflation Reduction Act of 2022, the Chips and Science Act of 2022, and the FY 2023 National Defense Authorization Act (NDAA), Congress has appropriated trillions of dollars of funding for critical minerals projects.[8] Examples of recent appropriations include:

[7] https://www.iea.org/reports/electricity-2024/executive-summary

[8] The BIL is the largest appropriation, totaling $1.2 trillion to address climate change, which includes the need for critical minerals. It is important to note that there is very little funding to support critical minerals exploration and mining projects.

- $858 billion in the FY 2023 NDAA for development of a Federal strategy to recycle and recover critical minerals from batteries used in the Federal electric vehicle fleet.

- $3 billion in Section 40704 of the BIL to "establish a program to inventory, assess, decommission, reclaim, respond to hazardous substance releases, and remediate abandoned hardrock mine land based on conditions including need, public health and safety, potential environmental harm, and other land use priorities," with 50 percent for grants to states and tribes with jurisdiction over reclaiming abandoned hardrock mine land and remediating impacted waters, and 50 percent to the Secretary of the Interior for use on federal lands.

- $100 million in the BIL Section 40210 grant program for each of fiscal years 2021 through 2024 for critical minerals mining and recycling research grants to academia and the private sector for pilot projects for processing or recycling domestic critical minerals and developing U.S. critical minerals and metals. These grants are to focus on secondary recovery of critical minerals and metals from discarded end-use products or from waste products produced during the metal refining and manufacturing process, including from mine waste piles, acid mine drainage sludge, or byproducts produced through legacy mining and metallurgy activities, and to advance critical mineral processing research activities to improve separation, alloying, manufacturing, or recycling techniques and technologies that can decrease the energy intensity, waste, potential environmental impact, and costs of those activities. (To date, Congress has not appropriated the funds to implement this grant program.)

- $5 billion in conditional loan commitments for domestic critical minerals projects authorized by DOE's Loan Program Office.[9]

- $6 billion in Section 40207 of the BIL to support grants for demonstration and commercial facilities associated with Battery Materials Processing and Battery Manufacturing.

Although there is some expertise in DOE, DOI, and DOD and other federal agencies on critical minerals and some cross-agency coordination, there is no centralized federal agency like the USBM with the expertise to provide the leadership necessary to effectively conduct, direct, and coordinate federally-funded critical minerals R&D projects. Consequently, Congress' recent critical minerals appropriations functionally outsource many mineral processing, recycling and other important critical minerals research topics to academia and the private sector with relatively little federal supervision and coordination. Additionally, there is no technical group that can readily help Congress fulfill its oversight obligations to ensure that expenditures of taxpayer monies on critical minerals projects are achieving their intended purposes.

4. Federal Minerals and Mining Research – Then and Now

During the SME Roundtable, the Experts agreed that in the absence of the USBM, Congress has had to rely on universities and companies to perform some of the mineral research functions for which the USBM was formerly responsible. Academic and private-sector research efforts could

[9] https://iea.blob.core.windows.net/assets/ee01701d-1d5c-4ba8-9df6-abeeac9de99a/GlobalCriticalMineralsOutlook2024.pdf, Page 228.

be greatly enhanced by technical input, guidance, and coordination from a reinvigorated federal minerals entity.

The USBM was the primary federal agency conducting scientific research and disseminating information on the extraction, processing, use, and conservation of mineral resources. The Roundtable Experts emphasized the importance of the USBM's technology transfer responsibilities and its role in stimulating new, enhanced, and safer mining and mineral processing operations. This stands in marked contrast to the current situation in which the recipients of federal critical minerals grants and loans are often conducting proprietary research that is not designed to quickly benefit other private-sector companies. Although the results of most federally-funded R&D projects (except for DOD-funded efforts) eventually go into the public domain, there is typically a one to five year waiting period before the research results are released to give academic entities the opportunity to publish their findings or to provide the companies that successfully develop new technologies a temporary proprietary advantage.

The USBM's substantial contributions to improving miner health and safety through its research programs was discussed during the Roundtable. When the USBM was defunded, its health and safety research functions were transferred to the National Institute for Occupational Health and Safety (NIOSH), which is part of the Centers for Disease Control and Prevention (CDC), in the Department of Health and Human Services (DHHS). Roundtable participants with first-hand experience with NIOSH stated that the CDC is not the optimal federal agency for mining health and safety research because of the unique workplace issues at surface and underground mines, and the much broader focus of the CDC. The group agreed that it is important for future mining health and safety research to be performed in an entity whose primary focus is on mining.

Another important aspect of the USBM discussed during the Roundtable was USBM's history of developing new mineral processing technologies that have made significant economic contributions. The Roundtable Experts with direct knowledge of some of these contributions pointed to the USBM's pivotal role in the late 1960s in developing the cyanide heap leach precious metals recovery technology that is now used globally to extract gold and silver from low-grade ores. In Nevada, the advent of heap leach technology built an entire gold mining industry that today has positioned Nevada as one of the world's top gold-producing regions. Using the USBM's research results, the world's first commercial-scale gold heap leach facility began operating at the Cortez Gold Mine in Lander County, NV in 1971.[10] Since then, gold mines in Nevada using heap leach technology have contributed many billions of dollars of tax revenues to federal, state and local governments, and have create many thousands of high-paying jobs.

The Experts focused on how similar applied research could evaluate techniques for recovering residual metals from tailings, waste rocks, and e-wastes and improve recoveries of certain minerals including but not limited to rare earths and lithium claystone deposits. For example, several Nevada-based companies seeking to develop lithium claystone deposits have either received or

[10] "In the 1960s the USBM was working on two parallel projects aimed at improving the recovery of lower-grade gold deposits. One trajectory was on the use of activated carbon as a cheaper alternative to the still-popular zinc dust recovery method, the latter commonly referred to as Merrill-Crowe. Another was on improved leaching, either in vats or in outdoor piles, called heaps." https://www.mininghistoryassociation.org/Journal/MHJ-v28-2021-McQueen%20Heap%20Leaching%20in%20NV.pdf

applied for DOE funding to build and test their mineral processing facilities. This is the type of research that a future NMMC could perform and/or coordinate with private-sector or academic researchers to develop processing technologies to optimize lithium recovery that could have broader applicability to this newly discovered type of lithium deposit compared to the current DOE-funded research efforts that are focusing on each company's project-specific deposit. The USBM's heap leach technology development and the need for lithium claystone processing optimization are examples of non-proprietary, high-risk/high-reward research projects that private-sector interests are unlikely to pursue without government-funded assistance.

DOE's Office of Fossil Energy and Carbon Management (FECM) has recently received some limited funding to develop new advances in critical mineral mining and extraction technologies, but support for this type of research needs to be greatly expanded. Ideally, in creating the NMMC, Congress should provide adequate funding for future NMMC-led mining and mineral processing research. However, recognizing that funding will probably be limited, the NMMC could at first focus on coordinating and performing oversight of federally funded, third-party research being performed by private companies, academia, and the national laboratories. Ultimately, the best outcome would be for the NMMC to have adequate funding to perform targeted in-house research with the objective of discovering breakthrough technologies that have the potential to substantially improve mining and mineral processing and recycling. There can be no doubt that the substantial and multi-decades long economic benefits resulting from USBM's heap leach technology development clearly demonstrate that federal investment in mining and mineral processing R&D can produce significant and long-term benefits for the public as well as for local, state, and federal governments. Besides creating positive economic and fiscal impacts, federal research to improve minerals mining, processing, and recycling methodologies would help achieve the National objective to increase domestic minerals production and reduce our reliance on foreign minerals.

5. The IWG Report Underscores the Need for a Federal Minerals Group

In its September 2023, report, the IWG found that:

> "In order to cultivate an environment conducive to rebuilding the U.S. mining sector, the federal government needs to promote a stream of consistent and widely available geologic data, technology, and support infrastructure, as well as dedicated funding for mining science, metallurgy, and mining education. In recognition of the need for additional data, technology, research, and consistency, several commenters [to the IWG] recommended that the U.S. Bureau of Mines (USBM), or a similar single agency, be reestablished."[11]

As described in the IWG Report, the USBM's mission included the following functions:

- Conducting scientific and technologic investigations concerning mining, and the preparation, treatment, and utilization of mineral substances with a view to improving health conditions, increasing safety, efficiency, economic development, and conserving

[11] 2023 IWG Report, *op .cit.*, page 90.

resources through the prevention of waste in the mining, quarrying, metallurgical and other mineral industries;

- Inquiring into the economic conditions affecting these industries and investigating explosives and peat;

- Investigating the mineral fuels and unfinished mineral products belonging to, or for the use of, the United States, with a view to their most efficient mining, preparation, treatment, and use;

- Disseminating information concerning these subjects; and

- Researching the scientific basis for technology to help meet the Nation's mineral and material needs and mitigate associated economic, human, and environmental costs.

A New Minerals Group Should be Responsible for Data Compilation and Management

The IWG Report describes the important role that the USBM played in compiling, distributing, and archiving mining and other technical data that are essential in identifying and developing the country's mineral resources:

> "The closure of the USBM resulted in the loss of a central Federal steward of USBM research and mining data repositories and inconsistent preservation and transfer of USBM data, maps, reports, and information (mostly in hardcopy or microfiche formats) to various successor agencies and the National Archives. The extent to which USBM data, maps, reports, and information have been preserved is unknown, which poses challenges to accessing USBM information. The USGS and a few other libraries are in the process of digitizing and placing online some historic USBM publications, most of which are not otherwise available except in physical copies and are at risk of being lost.[12]

The IWG Report states that: "Federal mining and mineral data are fragmented and incomplete" and specifically recommends building a federal database of mineral data that "is compiled in a unified format that is accessible and understandable to the public."[13] An important role for a future NMMC would be to fill this data collection and preservation gap. Although the IWG suggests that the BLM, the U.S. Forest Service, or the USGS could be charged with developing and maintaining this database, it would be more appropriate to assign this new function to a future NMMC given the USBM's former role in maintaining mineral and mining data. Assigning this function to the federal land management agencies (e.g., the BLM and the U.S. Forest Service) would not be optimal because geology, mining, and mineral processing are outside of these agencies' main areas of expertise. Similarly, the USGS is not the best choice for housing this database because its expertise mainly focuses on the geology of mineral deposits and does not extend to how to mine and process mineral deposits.

[12] *Ibid*, pages 90-91.
[13] 2023 IWG Report, *op .cit.*, page 137.

The IWG is not the only group that recognizes the country's current shortcomings in compiling and maintaining geologic and mining data. According to the American Association of State Geologists, the U.S. lacks an effective process for gathering, organizing, compiling, or publicly sharing geologic data that would help in the identification of valuable mineral deposits.[14]

A New Minerals Group is Needed to Provide Technical Expertise to Regulators During the Mine Permitting Process

The IWG Report states that federal regulatory agencies require more mining technical expertise during the federal mine permitting process. The report describes the need for "a sustained focus on hiring, training, and retaining agency mining experts to expedite the environmental analyses and permitting needed to increase domestic critical mineral supplies, protect the environment, and engage interested Tribes and stakeholders."[15] The report explains that mining expertise is lacking at all of the federal agencies that prepare Environmental Assessments and Environmental Impact Statements as required by the National Environmental Policy Act (NEPA) to evaluate proposed mining projects.[16]

The IWG Report discusses agency staffing shortages and limited mining expertise as a key factor in the protracted permitting process, referencing a GAO study that identified a shortage of agency resources, including "staff, staff expertise, funding, infrastructure, training, and/or computer technology," as the second most cited challenge affecting the hardrock mine plan review process. Similarly, the IWG Report also cites a 1999 National Research Council report that identified staffing shortages at some land management offices: "Offices responsible for regulating mine projects may not always have access to the trained and experienced personnel required."[17]

The IWG recommends that Congress provide sufficient support to Federal agencies to hire, train, and retain experts in mining, mining engineering, environmental science, environmental engineering, project permitting, and related fields, and that Federal experts in these areas be dedicated to evaluating and monitoring mineral exploration, mine plans, designs and operations, environmental analysis, reviewing environmental monitoring and remediation plans, and monitoring and overseeing compliance with mining and environmental requirements and permitting-related work.[18]

The Roundtable Experts recommend that this expertise should be developed in a new centralized mineral entity like the NMMC that could provide technical expertise as needed to federal regulatory agencies during the mine permitting process. Focusing this expertise in the NMMC rather than scattering it across departments and among the federal regulatory agencies would be the most cost effective way to provide high-caliber mining technical advice to federal regulators. Centralizing this expertise would have the added advantage of ensuring a consistent approach between the various federal regulatory agencies with jurisdiction over proposed mining projects.

[14] *Ibid*, page 93.
[15] *Ibid*, page 137.
[16] Mainly the BLM, the U.S. Forest Service, the EPA, and the U.S. Army Corps of Engineers.
[17] 2023 IWG Report, *op .cit.*, page 136.
[18] *Ibid*, page 135.

It would also give federal regulators located in areas with few mining projects and little familiarity with mining issues ready access to mining expertise.

The IWG Report Recommendations for Mining Research Topics

The IWG Report states that with the demise of the USBM, "Federal research and development support in fields such as mining, environmental science and technology, and minerals and materials sciences has been lost"[19] and recommends reestablishing these research efforts. Table 1 lists the IWG's recommendations for future research to improve mining and mineral processing and to minimize the environmental impacts associated with mining.

Table 1: The IWG's Recommended Mining Research Topics[20]
• Improve procedures to characterize potential acid rock drainage and metal leaching • Develop models for predicting impacts on water quality • Evaluate the interaction between groundwater flow and mining • Identify mining practices that reduce surface disturbance and greenhouse gas emissions • Improve water treatment • Improve yields from both mining and reprocessing • Develop new technologies that reduce production costs • Improve production efficiency • Enhance the quality of existing mineral commodities • Create opportunities to economically extract mineral commodities that are now considered technologically or economically inaccessible • Improve mine waste management, mine reclamation and remediation, and water and ecosystem restoration • Prevent, avoid, reduce, or minimize the environmental impacts of mining, milling, and mineral processing • Identify opportunities to beneficially reuse mined lands

As explained in the IWG Report, reestablishing the former USBM's role in technology transfer could improve the implementation of research into practice and advance improved technologies throughout the entire mining life cycle. Investments in both data collection and research will also allow for the professional development of a new generation of subject matter experts whose knowledge can support efforts to modernize the mining and permitting systems in the U.S.[21]

[19] 2023 IWG Report, *op. cit.*, pages 139. The IWG Report states that the DOE or DOI could be charged with performing future mining research. The Roundtable disagrees with this aspect of the IWG's findings due to the statutory distinction between critical materials, which are assigned to DOE, and critical minerals, which are assigned to DOI, as discussed in detail in Section 8 of this concept paper.

[20] 2023 IWG Report, *op. cit.*, pages 139 -140.

[21] *Ibid*, page 140

6. The Roundtable's Recommendations for NMMC Minerals Research

Research is needed to improve almost every aspect of the materials production cycle including: extracting minerals; enhancing materials performance; increasing mineral recoveries; reducing energy consumption in mining and mineral processing operations; pursuing waste management technologies and resource conservation; ensuring the health and safety of the workers in the Nation's mines and mineral processing plants; and minimizing and mitigating the environmental impacts of mining and mineral processing.

One of the key areas of research that the NMMC could pursue would be to develop technologies to improve mining and processing of lower grade ores. This is important because the average grades of most recent mineral discoveries has decreased compared to past discoveries. For example, the standard cutoff grade for a copper deposit in 1995 was about 2 percent. Today, it is roughly 0.1 percent.[22] This decrease in ore grades means that larger volumes of ore must be processed to recover the valuable metal, which increases costs due to increased energy consumption to mine and handle larger volumes of ore and waste rock and to process the lower grade ores.

Additionally, in many lower grade ore deposits, the target metal(s) are very fine-grained and may be encapsulated within gangue materials or embedded in the host rocks. These ores require more crushing, grinding, and separation (i.e.; comminution) than coarser ores. Because comminution costs amount to between 35 and 50 percent of total mine costs,[23] research on comminution technologies to reduce the amount of energy required to process fine-grained, lower grade ores could improve overall mine economics. Research to improve recoveries from low-grade deposits and to reduce mining costs could make more deposits economically viable to mine and play a significant role in helping meet the future demand for minerals. This research could also be applicable to recovering residual metals in legacy waste rocks and tailings, potentially reducing the environmental footprint of mining by reclaiming legacy sites that were mined prior to the enactment of modern environmental regulations and reclamation requirements.

The Experts agreed that many of the essential research functions of the USBM need to be refunded and that the NMMC should be responsible for:

- Serving as a trusted, unbiased and fact-based advisor to Congress and Executive Branch officials to help them develop U.S. mineral policies to reduce the Nation's reliance on imported minerals from adversarial countries and strengthen domestic mineral production and supply chains;

- Ore treatment research focused on the processing and subsequent handling of ore materials to find the most economically viable extraction processes and to identify any health and safety hazards associated with these processes;

[22] Michaux, S. P., *The Mining of Minerals and the Limits to Growth*, Geological Survey of Finland: Espoo, Finland (2021), Page 16.
[23] *Ibid*, page 18.

- Research programs to improve the metals security of America by researching technology that would promote efficient and profitable mining while improving environmental performance and worker health and safety;

- Testing and surveying areas with minerals of economic interest;

- Research to identify extractive metallurgical technologies to reduce environmental impacts from mine waste management facilities and to characterize and clean up old mine sites with metals contamination;

- Development of waste minimization and recycling technologies to recycle mineral processing operation byproducts including scrap, residues, and effluents;

- Research collaboration between the federal government, industry and academia;

- Elevating policymakers' and the general public's understanding of the importance of mining and minerals;

- Providing guidelines to streamline the permitting process;

- Reducing comminution energy demands;

- Improving sorting technology;

- Reducing energy consumption for comminution, autoclave smelting, and low-temperature autoclaves;

- Working with the DOE's FECM office on Carbon Capture Utilization and Sequestration technologies; and

- Mineral economics and forecasting.

7. The U.S. Needs a Federal Minerals Entity to Compete on the World's Stage

During the May 30th Roundtable, the contrast was drawn between the U.S., which does not have a governmental entity that serves as a "Minister of Mines," and the numerous other countries that do have such a position. The governments of Australia, Canada, and Mexico, three important sources of minerals for the U.S., have high-ranking mining departments and officials called "Ministers". According to Wikipedia, 29 countries have a Minister of Mines or an equivalent government official as listed in Table 2.[24]

[24] https://en.wikipedia.org/wiki/Category:Mining_ministers

Table 2: Wikipedia List of Countries with Ministers of Mines	
Afghanistan	Mauritania
Algeria	Mongolia
Benin	Myanmar
Bolivia	New Zealand
Burkina Faso	Niger
Canada	Peru
Chad	Qatar
Chili	Rwanda
Columbia	Senegal
Republic of the Congo	Solomon Islands
Gabon	Togo
Guinea	Ukraine
India	Uruguay
Lesoto	Zimbabwe
Mali	

An overlapping but different list of 34 countries is shown in Table 3 adapted from the Mineral Development Network Platform's website, which lists the countries as having a mining authority, Minister of Mines or the functional equivalent.[25]

Table 3 Partial List of Countries with Mining Authorities or Ministers of Mines		
European Union Member States		**Latin America**
• Austria • Belgium • Bulgaria • Croatia • Cyprus • Czech Republic • Denmark • Estonia • Finland • France • Germany • Greece • Hungary	• Ireland • Italy • Latvia • Lithuania • Luxembourg • Malta • Netherlands • Poland • Portugal • Romania • Slovakia • Slovenia • Spain • Sweden	• Argentina • Brazil • Chile • Columbia • Mexico • Peru • Uruguay

It is immediately obvious from Tables 2 and 3 that the U.S. is an anomaly because it does not have a centralized mining authority or Minister of Mines. There can be no doubt that not having such an entity puts the U.S. at a distinct disadvantage compared to many other countries. Given the soaring demand for minerals and the growing concerns about the Nation's dangerous reliance on

[25] https://www.mineralplatform.eu/investment/exploration-mining-opportunities/mining-ministries

foreign adversaries for many of the minerals we need for national defense, a strong economy, manufacturing, infrastructure, and the energy transition, it makes no sense to handicap our country by not having a federal entity like the proposed NMMC to make mining in the U.S. competitive with other countries. Additionally, the concept of "friendshoring" our mineral supplies from countries with which we have solid trade relationships is not a panacea because those nations need their minerals to support their economies, militaries, industries, and energy transition plans. Consequently, they may not always be in a position to sell their minerals to the U.S. when we need them.

8. Critical Materials and Critical Minerals Legislative History Overview

The National Materials and Minerals Policy, Research and Development Act of 1980

In order to evaluate options for creating the Director and the NMMC and ensuring that they will be responsible for both critical materials and critical minerals, it is important to understand the legislative histories and evolution of the terms "materials," "minerals," "critical materials," and "critical minerals." The National Materials and Minerals Policy, Research and Development Act of 1980 ("the 1980 Act")[26] establishes a national policy for materials in order to strengthen the materials research, development production capability and performance of the U.S. The 1980 Act's definition of materials includes minerals:

> "The term "materials" means substances, including minerals, of current or potential use that will be needed to supply the industrial, military, and essential civilian needs of the United States in the production of goods or services, including those which are primarily imported or for which there is a prospect of shortages or uncertain supply, or which present opportunities in terms of new physical properties, use, recycling, disposal or substitution, with the exclusion of food and of energy fuels used as such." 30 U.S.C. § 1601(b)(2)

Thus, since 1980, U.S. law has defined minerals as a subset of materials.

Definitions of Critical Materials and Critical Minerals

The Energy Act of 2020 amends the 1980 Act by adding Section 106, which defines *critical* materials and *critical* minerals, and splits the jurisdiction for the two between the DOE and the DOI. The DOE Secretary has jurisdiction over critical materials; the DOI Secretary is responsible for critical minerals. The Energy Act of 2020 establishes the following definitions for critical minerals and critical materials:

> Critical material is defined at 30 U.S.C. § 1606(a)(2) to mean:
> (A) any non-fuel mineral, element, substance, or material that the Secretary of Energy determines—
> (i) has a high risk of a supply chain disruption; and

[26] 30 U.S.C. §§ 1601 - 1605

(ii) serves an essential function in 1 or more energy technologies, including technologies that produce, transmit, store, and conserve energy; or

(B) a critical mineral.

Critical mineral is defined at 30 U.S.C. § 1606(a)(3) to mean:

(A) In general any mineral, element, substance or material designated as critical by the Secretary [of the Interior] under subsection (c)

(B) Exclusions – the term critical minerals does not include

(i) fuel minerals;

(ii) water, ice, or snow;

(iii) common varieties of sand, gravel, stone, pumice, cinders, and clay.

30 U.S.C. § 1606(c) directs the DOI Secretary, acting through the Director of the USGS, to develop a critical minerals list that includes critical minerals recovered as byproducts from a host mineral. The Energy Act of 2020 similarly authorizes the DOE Secretary to establish the Critical Materials Research, Development, Demonstration and Commercialization Program and to establish a Critical Materials List that focuses on the materials that are critical for clean energy technologies.[27] There is some overlap between DOI's Critical Minerals List and DOE's Critical Materials List.

The distinction between critical materials and critical minerals can become politically controversial as demonstrated during the recent legislative dialogue on H.R. 8446 to amend the Energy Act of 2020 to include critical materials in the definition of critical minerals. Congressman, Juan Ciscomani (R-AZ), introduced H.R. 8446. Congressmen Dan Newhouse (R-WA), and Elijah Crane (R-AZ) have cosponsored this bill. During the June 4, 2024 hearing before the House Subcommittee on Energy and Mineral Resources, several Democrats vociferously opposed H.R. 8446, alleging it was an attempt by the mining industry to benefit financially by making more minerals (specifically copper) eligible for DOE and DOD critical minerals grants and loans.[28]

Mr. Misael Cabrera's testimony in support of H.R. 8446 at this hearing explains the importance of placing equal emphasis on both critical materials and critical minerals: "H.R. 8466 ... recognizes that critical minerals and materials designations are complementary in nature and that federal funding should flow to support research, development, and deployment efforts across both domains. By doing so, the United States can strengthen its resilience to supply disruptions and continue to lead in energy innovation and environmental stewardship."[29]

9. Creating a National Minerals and Materials Council within the Executive Office of the President's National Economic Council

The statutorily bifurcated definitions of and jurisdictions for critical materials versus critical minerals is not optimal for addressing the universe of materials and minerals needed for all aspects of our economy, society, and national defense. The ongoing debate over excluding copper from

[27] https://www.energy.gov/sites/default/files/2023-07/doe-critical-material-assessment_07312023.pdf

[28] On June 12, 2024, the House Committee on Natural Resources discharged H.R. 8446 out of committee, making it ready for consideration on the House floor.

[29] https://naturalresources.house.gov/uploadedfiles/testimony_cabrera.pdf. Mr. Cabrera is the Director of the School of Mining & Mineral Resources at the University of Arizona.

the USGS' critical minerals list versus its inclusion in the DOE's critical materials list is a case in point. These distinctions and separations have the potential to create a turf war between DOI and DOE that can be avoided by placing the Director and the NMMC within the NEC in order to clearly give them responsibility for both critical materials and critical minerals. The NEC is the ideal location within the EOP to ensure equitable consideration of both critical materials and critical minerals and to coordinate directly with both DOE and DOI pursuant to the roles the Energy Act of 2020 establishes for both departments. Because mining is at the front end of every supply chain overseen by the NEC including infrastructure, manufacturing, housing, and technology and innovation, domiciling the Director and the NMMC in the NEC is the best place to achieve inter-departmental synergies and consistency, and facilitate the participation of other cabinet-level executive departments with a direct interest in materials and minerals supply chains including, but not limited, to the Departments of Defense, Commerce, and State.

To achieve its purpose, the NMMC needs to employ a wide range of policy and technical professionals with mining, mineral processing, mineral economics, geological, environmental, regulatory, health and safety, and legal expertise. These experts should be recruited from the private sector, federal agencies currently involved with mineral issues, and academia. Some of the recruits who are already employees of other federal agencies may be able to retain some of their existing duties with a dotted line position with the NMMC that allow them to split their times between their original agency and the NMMC.

The complex web of agencies and departments with some responsibility for critical minerals and materials shown in Figure 3 also illustrates why placing the NMMC in the NEC would be an effective way to rationalize and navigate through this maze. As part of the NEC, the Director and NMMC would be optimally positioned to take a whole-of-government approach that would go far beyond the DOI/Bureau of Land Management's role in managing the 700 million-acre federal subsurface mineral estate and the 254 million acres of the surface of public lands[30] or the DOE's involvement with the critical materials loan and grant programs authorized in the BIL.[31]

Although it is not possible at this point to know how much the NMMC would cost, the costs to establish and fund a future NMMC would obviously depend on the scope of work established for this new entity. A big factor in determining the level of funding needed would be whether the NMMC's portfolio includes performing in-house research and setting up or re-establishing one or more research facility similar to the USBM's regional research centers. As discussed above, the NMMC would ideally be provided with sufficient funding to support in-house research. To minimize costs, much of this research could be performed at national laboratories, universities, or at private-sector facilities rather than at new or re-established research centers. Another lower cost option would be for the NMMC to focus mainly on managing and evaluating DOE, DOD, and other federally funded research projects conducted by the national laboratories, academia, and the private sector.

As an order of magnitude estimate, it is useful to look at some available cost data for the former USBM. In 1994, the National Academy of Sciences (NAS) conducted a study of the USBM that

[30] https://www.blm.gov/about/what-we-manage/national
[31] Pub. L. 117-58, Division D, Title II, §§ 40207, 40208, 40209 and 40210.

includes the following information about the costs allocated to three of the USBM's functions for FY 1994:[32]

- Health, Safety and Mining Technology - $52 million
- Minerals and Materials Sciences - $25 million
- Environmental Technology - $21 million

According to J. Daniel Harrison's paper entitled "*The Circumstances, Events and Politics Leading to the Closure of the U.S. Bureau of Mines – Was it the Correct Decision"* published in the April 2010 edition of *Mining Engineering*,[33] Congress appropriated $152.4 million to fund the USBM in FY 1995.

10. The Bipartisan Infrastructure Law Already Authorizes Many of the Functions of the Former U.S. Bureau of Mines

The BIL could potentially be interpreted as creating the statutory basis for establishing the NMMC as a new federal entity charged with performing some of the R&D functions of the former USBM. Section 40210 of the BIL, entitled "Critical Minerals Mining and Recycling Research," describes research topics that align with many of the mining, mineral processing, and recycling R&D programs that the USBM used to perform.

The BIL Section 40210(b), "Critical Minerals Mining and Recycling Research and Development," establishes a competitive awards program that outsources minerals R&D to universities, the national laboratories, nonprofit organizations, and the private sector to "support basic research that will accelerate innovation to advance critical minerals mining, recycling and reclamation strategies and technologies...to make better use of domestic resources and to eliminate national reliance on mined minerals and mineral materials that are subject to supply disruptions."

Awards pursuant to Section 40210(b) are to be used to accomplish the following objectives:

- Advance mining research and development activities to develop new mapping and mining technologies and techniques, including advanced critical mineral extraction and production to:
    - Improve existing, or to develop new, supply chains of critical minerals; and
    - Yield more efficient, economical, and environmentally benign mining practices;

- Advance critical mineral processing research activities to improve separation, alloying, manufacturing, or recycling techniques and technologies that can decrease the energy intensity, waste, potential environmental impact, and costs of those activities;

[32] https://nap.nationalacademies.org/read/9206/chapter/4
[33] https://me.smenet.org/downloadItem.cfm?issueID=46

- Advance research and development of critical minerals mining and recycling technologies that take into account the potential end-uses and disposal of critical minerals, in order to improve end-to-end integration of mining and technological applications;

- Conduct long-term earth observation of reclaimed mine sites, including the study of the evolution of microbial diversity at those sites;

- Examine the application of artificial intelligence for geological exploration of critical minerals, including what size and diversity of data sets would be required;

- Examine the application of machine learning for detection and sorting of critical minerals, including what size and diversity of data sets would be required;

- Conduct detailed isotope studies of critical minerals and the development of more refined geologic models; and

- Provide training and research opportunities to undergraduate and graduate students to prepare the next generation of mining engineers and researchers.

Many if not all of the above-listed functions are similar to the mining and mineral processing R&D mission of the former USBM and include the types of research that the NMMC should undertake either directly and/or in collaboration with academia and the private sector. Similarly, many of these functions touch on worker health and safety, which was a primary focus of the USBM. This critically important function should be assigned to a mining-focused group rather than to the CDC whose primary mission does not include mine worker health and safety.

The BIL Section 40210(c) creates the Interagency Subcommittee on Critical Minerals (CMS), within the EOP as a multi-department entity within the National Science and Technology Council (NSTC) and co-chaired by the DOE, DOI, and the Office of Science and Technology Policy (OSTP). However, Section 40210(c) does not effectively overcome the distinction between critical materials and critical minerals created in Section 1606 of the Energy Act of 2020 because it only references critical minerals and does not mention critical materials. As discussed below, future legislation should change the name "CMS" to "NMMC," relocate the NMMC to the NEC, and explicitly state that the NMMC has responsibility for both critical minerals and critical materials.[34]

As described in Section 40210(c), the purpose and duties of the CMS are to:

- Support supply chain resiliency and coordinate Federal science and technology efforts to ensure secure and reliable supplies of critical minerals to the United States.

[34] Section 40210(c) specifically creates the Critical Minerals Subcommittee. It does not create the Critical Materials Subcommittee. However, DOE's "Federal Critical Minerals and Materials Ecosystem" matrix (Figure 3) shows both a Critical Minerals Subcommittee and a Critical Materials Subcommittee, which likely responds to the two different definitions for critical materials and critical minerals in the Energy Act of 2020.

- Advise and assist the NSTC, including the Committee on Homeland and National Security of the NTSC, on U.S. policies, procedures, and plans relating to critical minerals, including:
    - Federal research, development, and deployment efforts to optimize methods for extractions, concentration, separation, and purification of conventional, secondary, and unconventional sources of critical minerals, including research that prioritizes end-to-end integration of mining and recycling techniques and the end-use target for critical minerals;
    - Efficient use and reuse of critical minerals, including recycling technologies for critical minerals and the reclamation of critical minerals from components, such as spent batteries;
    - Addressing the technology transitions between research or lab-scale mining and recycling and commercialization of these technologies;
    - The critical minerals workforce of the United States; and
    - U.S. private industry investments in innovation and technology transfer from federally funded science and technology;
- Identify emerging opportunities, stimulate international cooperation, and foster the development of secure and reliable supply chains of critical minerals, including activities relating to the reuse of critical minerals via recycling;
- Ensure the transparency of information and data related to critical minerals; and
- Provide recommendations on coordination and collaboration among the research, development, and deployment programs and activities of Federal agencies to promote a secure and reliable supply of critical minerals necessary to maintain national security, economic well-being, and industrial production.

Sections 40210(c)(3) and (4) establish the following discretionary and mandatory responsibilities of the CMS:

Discretionary Responsibilities:

- Provide recommendations on how Federal agencies may improve the topographic, geologic, and geophysical mapping of the United States and improve the discoverability, accessibility, and usability of the resulting and existing data, to the extent permitted by law and subject to appropriate limitation for purposes of privacy and security;
- Assess the progress toward developing critical minerals recycling and reprocessing technologies;
- Assess the end-to-end lifecycle of critical minerals, including for mining, usage, recycling, and end-use material and technology requirements;
- Examine, and provide recommendations for, options for accessing and developing critical minerals through investment and trade with allies and partners of the United States;

- Evaluate and provide recommendations to incentivize the development and use of advances in science and technology in the private industry;
- Assess the need for, and make recommendations to address, the challenges the United States critical minerals supply chain workforce faces, including:
    - Aging and retiring personnel and faculty;
    - Public perceptions about the nature of mining and mineral processing; and
    - Foreign competition for United States talent;
- Develop, and update as necessary, a strategic plan to guide Federal programs and activities to enhance:
    - Scientific and technical capabilities across critical mineral supply chains, including a roadmap that identifies key research and development needs and coordinate ongoing activities for source diversification, more efficient use, recycling, and substitution for critical minerals; and
    - Cross-cutting mining science, data science techniques, materials science, manufacturing science and engineering, computational modeling, and environmental health and safety research and development; and
    - Report to the appropriate committees of Congress on activities and findings under this subsection.

Mandatory responsibilities

- Identify and evaluate Federal policies and regulations that restrict the mining of critical minerals.[35]

As an interagency subcommittee, the CMS has broad participation across the federal government, with the OSTP, DOE, and the USGS serving as the CMS co-chairs. The interagency/interdepartmental structure of the CMS clearly establishes CMS' whole-of-government charter that acknowledges the extensive footprint of material and mineral issues across the federal government. The CMS member agencies include the Departments of Agriculture, Commerce, Defense, Education, Energy, Homeland Security, Interior, and Labor.[36]

The activities page on the CMS website summarizes its key issues as follows:[37]

- Research and Development
- Strengthen Supply Chains
- International Engagement
- Map and Quantify Domestic Resources

[35] Fulfilling this mandatory responsibility could play an essential role in eliminating or at least minimizing permitting roadblocks. However, it does not appear that the current CMS is focusing on this responsibility.
[36] https://www.criticalminerals.gov/pages/member-agencies
[37] https://www.criticalminerals.gov/pages/activities

- Permitting and Standards
- Education and Workforce Development

Taken together, the R&D functions in Section 40210(b) and the responsibilities described in Section 40210(c) capture a significant portion of the former USBM's mission, with the notable exception and key issue of mine worker health and safety. In response to the current concerns about the Nation's dangerous dependency on mineral imports, Section 40210(c) also includes directives pertaining to permitting, reducing the Nation's reliance on foreign minerals, and strengthening domestic mineral supply chains. Therefore, a key question to ask is:

Could an advocacy campaign to reestablish many of the functions of the former USBM capitalize on Section 40210(c) of the BIL to assert that in establishing the CMS, Congress has already created the functional equivalent of the USBM but has not appropriated funds for it to operate?

Rather than starting from scratch to enact legislation to authorize "a new USBM," it may be more strategic to consider how Congress could amend Section 40210(c) of the BIL to accomplish the following objectives:

1. Clarify that the CMS was created to fulfill many of the research and advisory functions of the former USBM;

2. Elevate the status of the CMS by creating a Director the NMMC as part of the NEC because the cross-cutting and essential role of minerals across the federal government dictates that the NMMC must operate from a top-level EOP office like NEC rather than as part of the DOI where the former USBM was housed;

3. Make the NMMC explicitly responsible for materials in addition to minerals, as these terms are defined in the 1980 Act, and for critical materials and critical minerals, as defined in the Energy Policy Act of 2020; and

4. Create the process for adding an annual appropriation to the federal budget to fund the NMMC.[38]

11. Summary of the Roundtable's Findings

The Roundtable of 18 mining technical and policy experts convened by SME determined that the U.S. should establish a federal entity that provides technical input and policy advice on domestic minerals and materials to Congress and Executive Branch agencies and departments. As described in this concept paper, this Roundtable recommends that a National Materials and Minerals Council

[38] The Section 40210(b) grant program and the $100 million appropriation for Fiscal Years 2021 through 2024 for the grant program in Section 40210(d) are a four-year funding mechanism to outsource the kinds of R&D that the USBM used to perform. They do not provide direct funding for the CMS to operate. It is possible that the OSTP and NSTC are funded through the President's budget rather than a separate appropriation for each EOP office.

(NMMC), led by a Director of Minerals, be established within the Executive Office of the President's National Economic Council (NEC). The Director and the NMMC would be charged with providing a whole-of-government approach to the oversight of materials and minerals in coordination with all cabinet-level executive offices and their respective departments and agencies.

The NMMC would fill the void left by the 1996 Congressional action to defund the former U.S. Bureau of Mines. That decision has rendered the U.S. unable to mine or process many of the 50 minerals deemed "critical" by the U.S. Geological Survey (USGS). In 2023, the U.S. was 100 percent reliant on foreign sources for 15 of these minerals and 50 percent or more reliant on other countries for another 34 minerals (See Figure 1). Furthermore, as shown on Figure 2, the U.S. is dangerously dependent on China and other adversarial countries for minerals that are essential for the defense, energy, aerospace, electronics, telecommunications, and transportation sectors. For some minerals, the U.S. currently imports minerals from countries with inferior environmental protection and labor safety standards.

The Nation's current lack of a centralized federal entity to oversee mineral and mining policies has produced an inefficient proliferation of federal agencies involved with minerals, as shown in the bureaucratic maze on Figure 3. Consequently, the U.S. is in a distinct disadvantage compared to many other nations that have a centralized and dedicated minerals group. The proposed NMMC would help the U.S. become more competitive with other countries.

The current inefficiencies and the resulting increased reliance on foreign minerals come at a time of rapidly increasing demand for numerous minerals for electric vehicles, wind turbines, transmission lines and other infrastructure. As shown on Figure 4, the SME estimates that the U.S. must develop 359 new domestic mines to meet the projected mineral demand of the coming decades.

The U.S. government has recently recognized the need for more minerals. Since 2021, Congress has appropriated trillions of dollars to support critical minerals. The Bipartisan Infrastructure Law of 2021, the Inflation Reduction Act of 2022, the CHIPS and Science Act of 2022 and the FY 2023 National Defense Authorization Act have appropriated funding of domestic critical mineral projects. But because the U.S. lacks a centralized agency such as the proposed NMMC, these appropriations functionally outsource much of the mineral processing, recycling, and other important critical minerals research topics to academia and the private sector without much technical oversight or a well-coordinated structure to keep track of these activities.

As noted on Page 90 in the 2023 IWG Report "*Recommendations to Improve Mining on Public Lands*": "in order to cultivate an environment conducive to rebuilding the U.S. mining sector, the federal government needs to promote a stream of consistent and widely available geologic data, technology and support infrastructure, as well as dedicated funding for mining science, metallurgy and mining education."

As envisioned by the Roundtable, the NMMC would serve as a trusted, unbiased and fact-based advisor to Congress and Executive Branch officials to help them develop U.S. mineral policies to reduce the Nation's reliance on imported minerals from adversarial countries and to strengthen

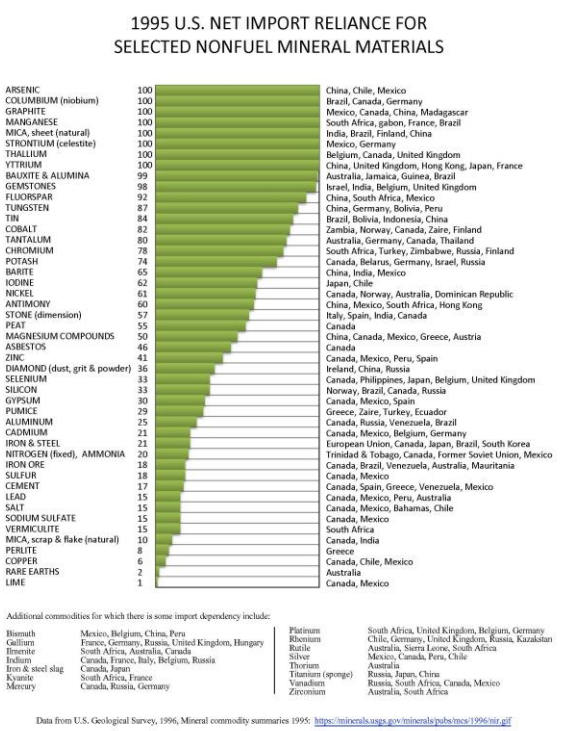
domestic mineral production and supply chains. The NMMC would also perform and supervise mineral research.

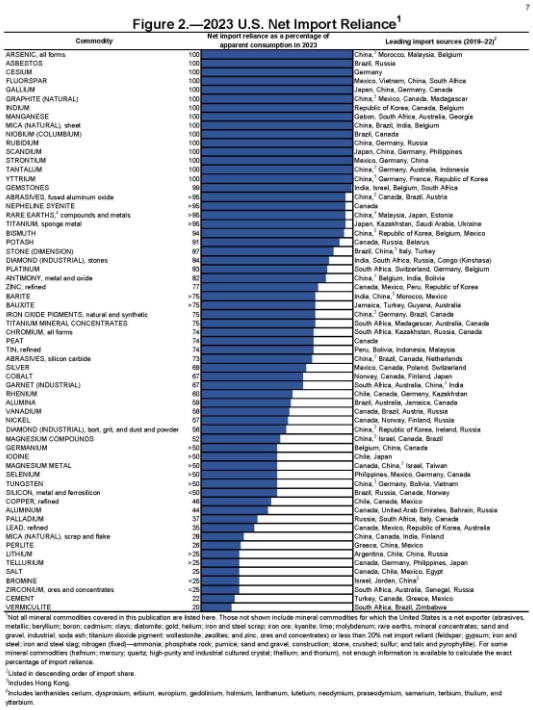
Placing the NMMC within the NEC reflects the importance of materials and minerals as the front-end supply chains for all sectors and governmental functions. As part of the NEC, the NMMC would be ideally situated to ensure consistency across multiple departments and agencies, reduce inefficiencies and duplication of efforts, and facilitate the participation of and coordination with cabinet-level executive departments with direct interest in materials and mineral supply chains including the Departments of Defense, Commerce, State and others. Ultimately, the NMMC would help minimize barriers to mineral development as a critical first step in restoring the country's former status as "the global leader in mining" as characterized in the IWG Report.

Figure 1
THE U.S. NEEDS A CRITICAL AND STRATEGIC MINERALS AGENCY TO IMPROVE MINERALS SECURITY AND REDUCE RELIANCE ON FOREIGN MINERALS

Congress stopped funding the U.S. Bureau of Mines (USBM) in 1995. The resulting demise of federal minerals and mining expertise has contributed to the Nation's steadily increasing and dangerous reliance on imported minerals from China and other adversaries

The Nation's Mineral Import Reliance Has Skyrocketed Since Congress Stopped Funding the U.S. Bureau of Mines





This Growing Dependency on Mineral Imports is Not Due to a Lack of Minerals – The US Has Many of the Minerals Essential to our Economy, National Security, and Achieving our Energy Goals

There is a serious gap in the federal government's mineral and mining expertise because important USBM mineral processing, metallurgy, and environmental remediation research was terminated

For more information please contact: sme@smenet.org or wearewmc@wmc-usa.org

Figure 2
Minerals are Essential to Key U.S. Industry Sectors [39]

Figure 2: The 2022 U.S. list of critical minerals, percentage of the U.S. supply imported in 2022, industries in which each is used, and primary import source

Mineral	Percentage from foreign sources[a]	Key Industries: Aerospace	Defense	Energy	Telecommunications and electronics	Transportation (non-aerospace)	Primary Import Source (2018–2021)[b]
Arsenic	100%		●	●	○		China: 57%
Cesium	100%	●	●	●	○		N/A
Fluorspar	100%			●	○		Mexico: 66%
Gallium	100%	●	●	●	○		China: 35%
Graphite	100%	●	●	●	○	●	China: 35%
Indium	100%	●	●	●	○		Republic of Korea: 35%
Manganese	100%	●	●	●		●	Gabon: 67%
Niobium	100%	●	●	●			Brazil: 66%
Rubidium	100%	●	●	●	○		N/A
Tantalum	100%	●	●	●	○		China: 24%
Bismuth	96%		●	●	○		China: 65%
Rare Earth Elements (Cerium, Dysprosium, Erbium, Europium, Gadolinium, Holmium, Lanthanum, Lutetium, Neodymium, Praseodymium, Samarium, Scandium, Terbium, Thulium, Ytterbium, Yttrium)	>95%	●	●	●	○	●	China: 74%
Titanium	>95%	●	●	●			Japan: 89%
Antimony	83%		●	●	○	●	China: 63%
Chromium	83%	●	●	●			South Africa: 37%
Tin	77%		●		○		Peru: 25% (refined Tin)
Cobalt	76%	●	●	●	○	●	Norway: 22%
Zinc	76%		●	●			Canada: 66%
Barite	>75%			●			China: 38%
Tellurium	>75%		●	●	○		Canada: 52%
Platinum[c]	66%	●		●	○	●	South Africa: 24%
Nickel	56%	●	●	●			Canada: 45%
Aluminum	54%	●	●	●		●	Canada: 50%
Vanadium	54%	●	●	●			Canada: 31%
Germanium	>50%	●	●	●	○		China: 54%
Magnesium	>50%	●	●	●	○	●	Canada: 21%
Tungsten	>50%	●	●	●	○		China: 29%
Zirconium	<50%	●	●	●			China: 89% (Zirconium unwrought, including powder)
Palladium[c]	26%	●		●	○	●	Russia: 34%
Lithium	>25%	●	●	●	○	●	Argentina: 51%
Beryllium	<20%	●	●	●	○		Kazakhstan: 43%
Hafnium	–	●	●	●			Germany: 36%
Iridium[c]	–	●		●	○	●	–
Rhodium[c]	–	●		●	○	●	–
Ruthenium[c]	–	●		●	○	●	–

Source: U.S. Geological Survey (USGS), *Mineral Commodity Summaries 2023* (Reston, Virginia: 2023). | GAO-24-106395

[a]U.S. net import reliance expressed as a percentage of apparent U.S. consumption in 2022, a metric developed and calculated by USGS using import data from the U.S. Census Bureau and consumption data from *USGS's Mineral Commodity Summaries 2023*.

[b]Import source percentage from 2018 through 2021, calculated by USGS using import data from the U.S. Census Bureau.

[c]This mineral is a part of the platinum group and the key industries shown are for the group.

Note: In Figure 2, rare earth elements are shown as one entry; Figure 1 lists each separate rare earth element.

[39] July 2024 GAO Report, *Op. cit.*, page 4.

Figure 3. The Federal Critical Minerals & Materials Ecosystem

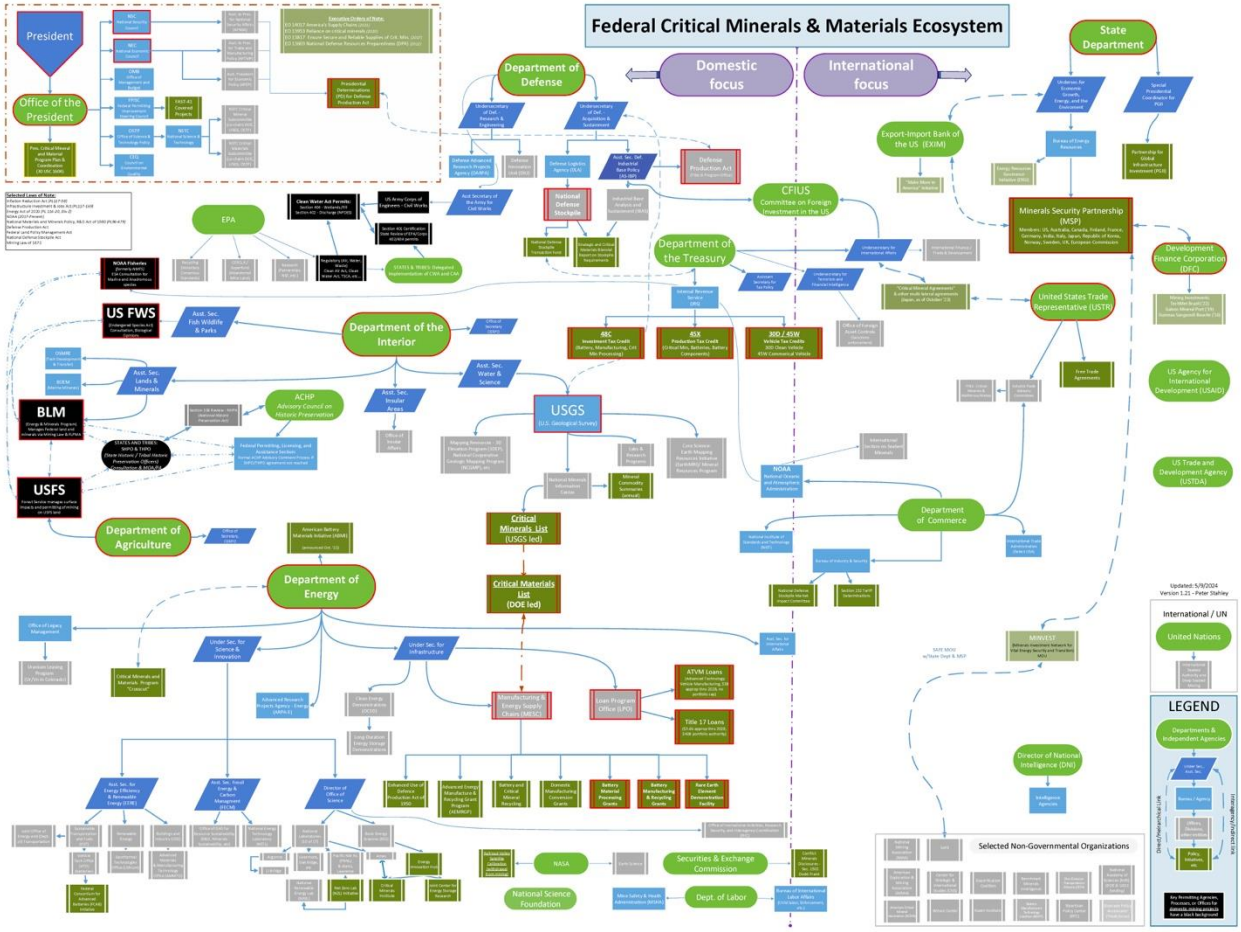
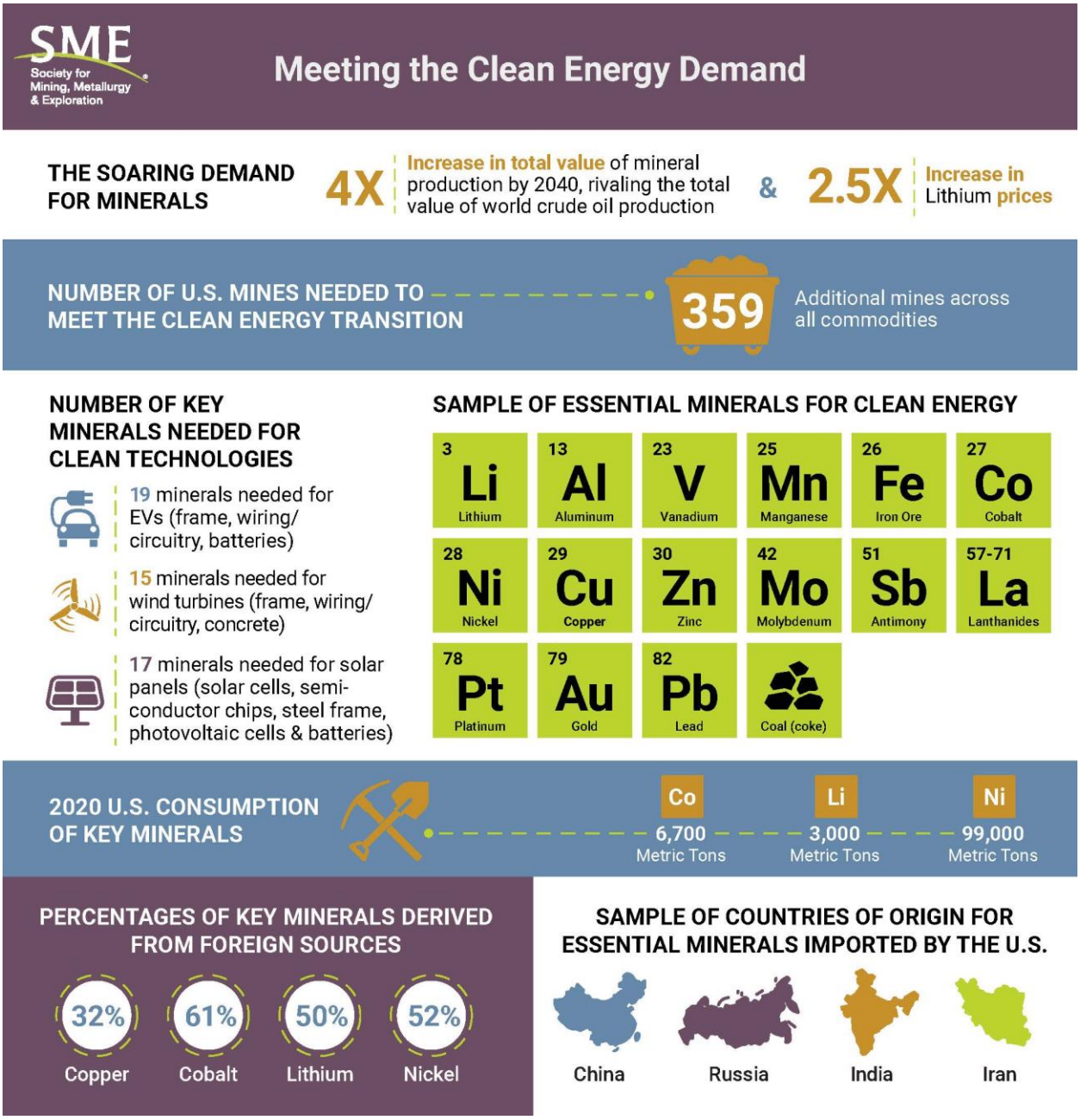


Figure 4


SME
Society for Mining, Metallurgy & Exploration
Meeting the Clean Energy Demand
THE SOARING DEMAND FOR MINERALS
4X
Increase in total value of mineral production by 2040, rivaling the total value of world crude oil production
&
2.5X
Increase in Lithium prices
NUMBER OF U.S. MINES NEEDED TO MEET THE CLEAN ENERGY TRANSITION
359
Additional mines across all commodities
NUMBER OF KEY MINERALS NEEDED FOR CLEAN TECHNOLOGIES
19 minerals needed for EVs (frame, wiring/ circuitry, batteries)
15 minerals needed for wind turbines (frame, wiring/ circuitry, concrete)
17 minerals needed for solar panels (solar cells, semi-conductor chips, steel frame, photovoltaic cells & batteries)
SAMPLE OF ESSENTIAL MINERALS FOR CLEAN ENERGY
3 Li Lithium
13 Al Aluminum
23 V Vanadium
25 Mn Manganese
26 Fe Iron Ore
27 Co Cobalt
28 Ni Nickel
29 Cu Copper
30 Zn Zinc
42 Mo Molybdenum
51 Sb Antimony
57-71 La Lanthanides
78 Pt Platinum
79 Au Gold
82 Pb Lead
Coal (coke)
2020 U.S. CONSUMPTION OF KEY MINERALS
Co 6,700 Metric Tons
Li 3,000 Metric Tons
Ni 99,000 Metric Tons
PERCENTAGES OF KEY MINERALS DERIVED FROM FOREIGN SOURCES
32% Copper
61% Cobalt
50% Lithium
52% Nickel
SAMPLE OF COUNTRIES OF ORIGIN FOR ESSENTIAL MINERALS IMPORTED BY THE U.S.
China
Russia
India
Iran