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April 28, 2021

Mr. Matthew D. Zolnowski
U.S. Department of Defense
Office of the Deputy Assistant Secretary of Defense for Industrial Policy

**RE: Notice of Request for Comments on Executive Order “America’s Supply Chains”
U.S. Department of Defense Docket ID: DoD–2021–OS–0022
Federal Register Vo. 86, No. 69, April 13, 2021, pp 19230-19231**

Dear Mr. Zolnowski:

I. Introduction

The Women’s Mining Coalition (WMC) supports the Biden Administration’s efforts to promote resilient, diverse, and secure supply chains as directed in the February 24, 2021 Executive Order (E.O.) 14017, “America’s Supply Chains.” We appreciate this opportunity to submit these comments in response to the Department of Defense’s (DOD’s) Request for Comments on E.O. 14017.

The points listed below summarize WMC’s suggestions for policies and actions DOD should take to strengthen the country’s critical minerals supply chains in response to President Biden’s America’s Supply Chains E.O. 14017.

- Prioritize developing domestic mining and mineral processing facilities in preference to importing critical minerals and processed mineral products from allied countries in order to minimize carbon emissions associated with global shipments of minerals from foreign mines, smelters, and refineries to U.S. manufacturers and mineral products consumers;
- Implement the Calls to Action in the 2019 Department of Commerce Report, “Federal Strategy to Ensure Secure and Reliable Supplies of Critical Minerals,” placing special emphasis on the need to increase our geologic knowledge of the country’s critical minerals resources, improve access to critical mineral deposits on federal lands, reduce the length of time it takes to permit a mine, and increase the critical minerals workforce;
- Stimulate and facilitate exploration and redevelopment of previously mined sites by working with other federal agencies and Congress to develop policies that reduce the CERCLA liability concerns that are currently chilling private-sector investment in producing critical

minerals from historic mines;

- Expand the scope of critical minerals initiatives to include the host metals in the Wheel of Metals Companionality shown in Figure 1 because even though these primary metals are not included in the USGS' critical minerals list, there is significant potential to produce important critical minerals as by-products or co-products from primary metals mines;
- Recognize that China's hegemony over the fields of mineral processing and extractive metallurgy poses a significant threat to the United States' ability to strengthen our critical minerals supply chains and develop a strategy to reduce our reliance on China as the principal place where U.S. mined minerals are processed and refined;
- Address the critical shortage of U.S. mineral processing and extractive metallurgy professionals and reduce China's dominance over the world's mineral processing and refining by funding U.S. educational and research programs to increase our intellectual capital and build a larger cadre of U.S. experts in these fields;
- Promote construction of new U.S. mineral processing and refining facilities and evaluate the feasibility of refurbishing idled facilities;
- Work with the Administration and Congressional leaders to increase their awareness of how the 30 by 30 Plan and bills to reduce and even eliminate mining on federal lands will thwart the Administration's simultaneous goal to strengthen America's critical minerals supply chains and exacerbate our reliance on foreign minerals; and
- Acknowledge that achieving the Nation's clean energy objectives will substantially increase the demand for many minerals, which should be sourced from domestic mines rather than from foreign countries.

II. Our Mineral Import Reliance and the Implications for Clean Energy

WMC has been concerned with the Nation's well-documented reliance on imported minerals for many years. The U.S. Geological Survey's (USGS') annual Mineral Commodity Summaries document the previous years' net mineral import reliance. In 2020¹, the U.S. imported 100 percent of 17 minerals, 14 of which are included in the USGS' 2018 critical minerals list². The U.S. also imported more than 50 percent of our apparent consumption of 46 other minerals. Comparing the 2020 and the 1996³ Mineral Commodity Summaries shows a rapid and shocking growth in the United States' reliance on foreign minerals. In 1996, we were 100 percent import reliant on only eight minerals and imported more than 50 percent of what we consumed for just 15 minerals.

The U.S. is fortunate to have a rich mineral endowment and could produce most of the minerals we need from U.S. mines. Our current inability to satisfy our mineral demands with minerals from domestic mines is mainly due to unfavorable policies that make securing permits for U.S. mining projects very difficult and time-consuming compared to other countries. In particular, the costs, delays, and uncertainties associated with National Environmental Policy Act (NEPA) environmental reviews impede mineral exploration and development and chill investment in the mineral sector. As discussed recently in the Wall Street Journal, mining investors have been slow

¹ <https://pubs.usgs.gov/periodicals/mcs2021/mcs2021.pdf>

² 83 FR 23295, May 18, 2018

³ <https://prd-wret.s3-us-west-2.amazonaws.com/assets/palladium/production/atoms/files/mcs-1996ocr.pdf>

to invest in battery metals and other critical minerals projects due to concerns that “...it can take too long for the mines to produce returns. Many mining projects can take 10 years from discovery to producing revenue...That is leaving early-stage projects scrambling.”⁴ Based on WMC’s direct experience, it is not unusual for mining projects to take more than a decade to permit.

All forms of clean energy technology and infrastructure require minerals. The May 2020 World Bank Group report, “Minerals for Climate Action: The Mineral Intensity of the Clean Energy Transition,”⁵ identifies the 17 minerals shown in Table 1 that are essential to low-carbon energy technologies and finds the need for battery storage minerals like lithium, cobalt, and graphite could increase by nearly 500 percent by 2050. This report also predicts that the demand for other clean energy minerals including copper, lead, iron, neodymium, and zinc will increase by 200 percent by 2050 to support widespread construction of clean energy systems.

Table 1. World Bank Group’s List of Minerals Essential to Clean Energy And U.S. Import Reliance for these Minerals⁶

	Wind	Solar photovoltaic	Concentrated solar power	Hydro	Geothermal	Energy Storage	Nuclear	Coal	Gas	Carbon capture and storage	Import Reliance	Exporting Countries
Aluminum*											> 75%	Jamaica, Brazil, Guinea, Guyana
Chromium											72%	Norway, Japan, China, Canada
Cobalt											78%	South Africa, Kazakhstan, Russia
Copper											35%	Chile, Canada, Mexico
Graphite											100%	China, Mexico, Canada, India
Indium											100%	China, Canada, Republic of Korea, Taiwan
Iron Ore											21%	Canada, Brazil, Republic of Korea
Lead											30%	Canada, Mexico, Republic of Korea, India
Lithium											>25%	Argentina, Chile, China
Manganese											100%	South Africa, Gabon, Australia, Georgia
Molybdenum											<20%	Peru, Chile, Canada, Mexico
Rare Earths**											100%	China, Estonia, Japan, Malaysia
Nickel											47%	Canada, Norway, Australia, Finland
Silver											68%	Mexico, Canada, Peru, Poland
Titanium											86%	Japan, Kazaksran, Ukraine, China, Russia
Vanadium											94%	Austria, Canada, Russia, Republic of Korea
Zinc											87%	Canada, Mexico, Australia, Peru
Total	10	8	2	8	6	11	11	9	8	6		

* Bauxite, ** Neodymium

⁴<https://www.wsj.com/articles/battery-metals-are-hot-but-these-miners-cant-get-investors-11619175601?st=8mstsvzx851e7y54>

⁵<http://pubdocs.worldbank.org/en/961711588875536384/Minerals-for-Climate-Action-The-Mineral-Intensity-of-the-Clean-Energy-Transition.pdf>

⁶ <https://pubs.usgs.gov/periodicals/mcs2020/mcs2020.pdf>

III. Critical Minerals as By-Products and Co-Products of Other Minerals

In assessing how to reduce the Nation’s reliance on foreign minerals and strengthen our critical minerals supply chains, it is important to understand that many critical minerals mainly occur in deposits of other more common minerals. A 2015 study from the Center for Industrial Ecology at Yale University⁷ discusses the occurrence of by-product minerals in primary mineral deposits and illustrates these occurrences in the “Wheel of Metals Companionality” shown on Figure 1. As described in this study, the principal host metals form the inner, darkest blue circle. 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.

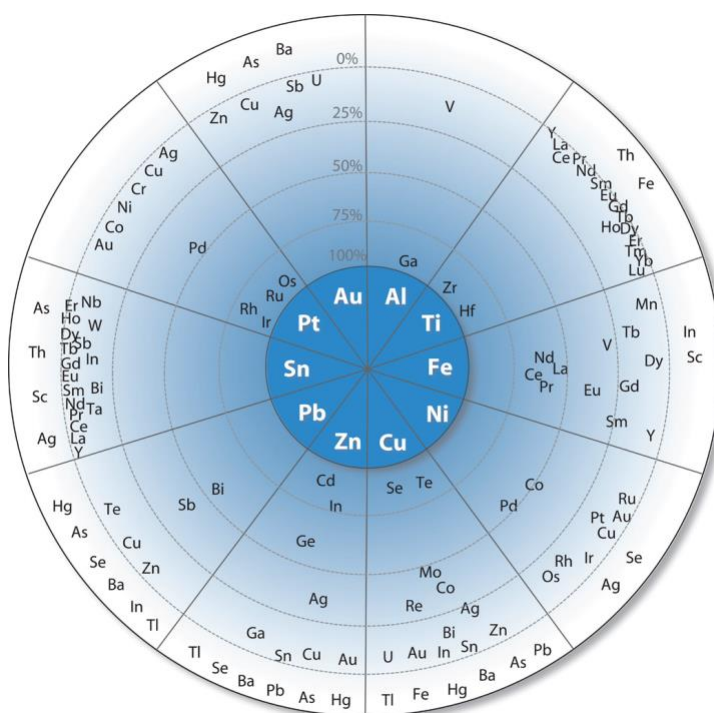


Figure 1. Wheel of Metals Companionality

The significance of the Wheel of Metals Companionality to DOD’s inquiry regarding diversifying sources of critical minerals is that it illustrates there are many primary metal deposits that have significant potential to produce important critical minerals as by-products or co-products. For example, antimony (Sb), is shown in association with primary (host) mineral deposits of gold, (Au), and lead (Pb). Copper (Cu) deposits are a host metal for several critical minerals including tellurium (Te), rhenium (Re), tin (Sn), cobalt (Co), bismuth (Bi), uranium (U), indium (In), barite (Ba), and arsenic (As).

Except for aluminum (Al), the United States has significant mineral deposits of all of the host metals shown in the inner, dark-blue circle of the wheel: titanium (Ti); iron (Fe); nickel (Ni);

⁷ <https://advances.sciencemag.org/content/1/3/e1400180>

copper (Cu); zinc (Zn); lead (Pb); tin (Sn); platinum (Pt); and gold (Au). Consequently, the United States' critical minerals and supply chain policies should emphasize developing critical minerals from domestic host mineral deposits in preference to obtaining critical minerals from foreign countries. Importing critical minerals from foreign allies should only occur if there are no viable domestic deposits.

IV. DOD Topic i: Increasing Transparency in Strategic and Critical Material Supply Chains

It seems obvious that obtaining critical minerals from U.S. mines would ensure transparency for the minerals produced domestically. Domestic mining of critical minerals would virtually eliminate any lack of transparency for the domestic portion of the minerals supply chains because U.S. financial reporting standards and requirements demand companies disclose accurate information about their mineral production.

V. DOD Topic ii: Diversifying sources of supply for strategic and critical materials, including domestic sources and foreign allies/partners

At the April 21st 2021 Climate Summit, President Biden pledged to reduce the nation's greenhouse gas emissions by 50 to 52 percent by 2030 compared to 2005 emission levels⁸. At this Summit, the President also committed to achieving economy-wide net zero emissions by no later than 2050.

These aggressive carbon reduction commitments clearly dictate that the U.S. must preferentially obtain critical minerals and other strategic materials from domestic sources rather than importing them from foreign allies and partners. Shipping critical minerals from foreign countries increases their carbon footprint compared to obtaining them from domestic mines. Responding to the President's newly established carbon emission reduction mandates means that we should avoid shipping minerals from foreign countries when we can produce the same minerals in the U.S. Therefore, efforts to diversify our critical minerals supplies must primarily focus on developing numerous domestic sources of critical minerals rather than sourcing these materials from foreign countries – even if these countries are allies and strategically aligned with U.S. policies.

Additionally, there are compelling national security reasons for prioritizing domestic mineral production rather than obtaining critical minerals from allied foreign countries. Shipments of foreign critical minerals are potentially vulnerable to trade embargoes and tariffs, shipping blockades and disruptions, economic disincentives, price manipulation, and other tactics that could interfere with obtaining critical minerals from our allies during times of conflict.

For example, during World War II, most of the free world's antimony supply came from the Stibnite Mine in Valley County, Idaho when the federal government operated this mine to produce the antimony and tungsten critical to the war effort. At that time, the other known major antimony deposits in China were under Japanese control and thus unavailable to the United States and its allies.

⁸ <https://www.whitehouse.gov/briefing-room/statements-releases/2021/04/22/fact-sheet-president-biden-sets-2030-greenhouse-gas-pollution-reduction-target-aimed-at-creating-good-paying-union-jobs-and-securing-u-s-leadership-on-clean-energy-technologies/>

Even during peacetime, relying on foreign sources of critical minerals potentially produces supply chain vulnerabilities due to shortages and delivery delays that adversely affect U.S. manufacturers and our economy. The current shortage of semiconductor chips is a case in point. The United States should increase domestic production of semiconductors to minimize the manufacturing constraints and economic challenges that this shortage is creating because this shortage is not expected to end soon⁹.

The recent accidental blockage of the Suez Canal that disrupted global shipping is another example. This incident will have a ripple effect that will last for months and illustrates the fragility of the world's shipping network that routinely relies on shipments through this chokepoint. The potentially severe global economic disruptions caused by this mishap highlight the weakness in our system for worldwide shipping of raw materials, components, and finished goods.¹⁰

Closer to home in California, shipments to the Port of Los Angeles and the Port of Long Beach have been backlogged since October 2020, leading to delays in offloading containers. As the nation's largest destinations for incoming Asian imports, bottlenecks at these ports adversely affect many retailers and consumers who must wait weeks for goods stuck on ships at sea or at the ports, hitting small and medium-size companies with lean operations particularly hard.¹¹

VI. DOD Topic iii: Diversifying production sources, such as primary extraction, co-production, and to include reclamation from mine, industrial, and end of life products

DOD's response to E.O. 14017 should focus on the findings of the June 2019 Department of Commerce report on the "Federal Strategy to Ensure Secure and Reliable Supplies of Critical Minerals"¹². This report includes 24 goals, 61 recommendations and the following "Calls to Action:"

- Advance Transformational Research, Development, and Deployment Across Critical Mineral Supply Chains;
- Strengthen America's Critical Mineral Supply Chains and Defense Industrial Base;
- Enhance International Trade and Cooperation Related to Critical Minerals;
- Improve Understanding of the Geology of Domestic Critical Mineral Resources;
- Improve Access to Domestic Critical Mineral Resources on Federal Lands and Reduce Federal Permitting Timeframes; and
- Grow the American Critical Minerals Workforce.

Each of the Calls to Action are essential to strengthening the United States' critical minerals supply chains and reducing our reliance on foreign minerals. WMC would like to emphasize the importance of improving our mineral resources knowledge base to support domestic mineral exploration and development. There is an urgent need to increase the level of mineral exploration and development in this country. Finding a mineral deposit is a time consuming and expensive

⁹<https://www.marketwatch.com/story/the-semiconductor-shortage-is-here-to-stay-but-it-will-affect-chip-companies-differently-11618678056>

¹⁰ <https://www.aljazeera.com/economy/2021/3/30/suez-crisis-creates-winners-and-losers-in-the-global-supply-chain>

¹¹ <https://www.wsj.com/articles/port-delays-leave-cargo-ships-stranded-off-u-s-pacific-gateways-11610574485>

¹²<https://www.commerce.gov/data-and-reports/reports/2019/06/federal-strategy-ensure-secure-and-reliable-supplies-critical-minerals>

task with daunting odds of being successful. In a 1999 study, the National Research Council/National Academy of Science found that roughly 1,000 mineral prospects need to be examined in order to discover one mineral deposit that can be developed into an economically viable mine.¹³

WMC also wants to highlight the need to maintain and improve access to mineral deposits on federal lands and to reduce the amount of time it takes to secure permits to explore for minerals and develop discovered mineral deposits into mines. As we applaud the Administration's commitment to strengthen domestic critical minerals supply chains and reduce our reliance on foreign countries for critical minerals, we must at the same time express strong concerns that the Administration and Congress are pursuing policies and legislation that will substantially thwart our country's ability to develop domestic critical minerals resources. For example, the Administration's commitment to conserve at least 30 percent of our lands and oceans by 2030,¹⁴ the so-called "30 by 30 Plan" will put lands that may contain important critical minerals deposits off limits to mining and other development.

At the Congressional level, bills considered in the 116th Congress to radically overhaul the General Mining Law (H.R. 2579 and S. 1386) would seriously impede the nation's abilities to develop domestic sources of critical minerals and reduce our reliance on imports of minerals from foreign and frequently hostile countries. These bills seek to substantially reduce mining on public lands by eliminating the security of land tenure necessary to develop minerals, establishing new and unworkable environmental standards for mining, and imposing confiscatory royalties and fees. They are at cross-purposes with the objective of responsibly developing our nation's critical mineral resources. It is highly likely that the 117th Congress will consider similar bills.

Another problematic bill introduced in the last Congress, H.R. 5598, would put important critical mineral deposits containing cobalt, nickel, and platinum located in Minnesota's Superior National Forest off limits to mining. These critical minerals occur in a world-class host metal deposit of copper. Development of this deposit would be a significant step in limiting our reliance on foreign countries for these important critical minerals. This bill is anticipated to be reintroduced in this session of Congress.

WMC requests that DOD become engaged in policy dialogues about the 30 by 30 Plan and bills in Congress to reduce and even eliminate mining to assist the Administration and Congressional leaders understand the far-reaching and perhaps unintended adverse consequences of these proposals. It makes absolutely no sense to develop policies seeking to reduce our reliance on foreign minerals and strengthen our domestic critical minerals supply chains while simultaneously pursuing policies that would make mining much more difficult and expensive, and even eliminate mining by putting certain public lands off limits to mining

WMC also recommends that DOD work with Congress, EPA, and the federal land management agencies (e.g., the U.S. Forest Service and the U.S. Bureau of Land Management) to develop and implement "Good Samaritan" policies that would eliminate or at least lessen the Comprehensive

¹³ <https://www.nap.edu/catalog/9682/hardrock-mining-on-federal-lands>

¹⁴ <https://www.whitehouse.gov/briefing-room/statements-releases/2021/01/27/fact-sheet-president-biden-takes-executive-actions-to-tackle-the-climate-crisis-at-home-and-abroad-create-jobs-and-restore-scientific-integrity-across-federal-government/>

Environmental Response, Compensation and Liability Act (CERCLA) and Clean Water Act (CWA) liability barriers to private-sector redevelopment of legacy mines with critical minerals resources. In many cases, such mines will be deposits of one or more of the host metals shown in Figure 1 with one or more by-product metals that can be economically co-produced with primary production of the host metal(s).

There are historic mine sites throughout the western United States where redeveloping these sites and reprocessing old mine wastes could potentially recover critical minerals and at the same time remove environmental contaminants and improve area water quality. Unfortunately, the specter of CERCLA and CWA liability hangs like a dark cloud over these legacy sites that could become viable sources of critical minerals were it not for this liability threat. It is not in the country's best interests for these sites to remain as untapped sources of critical minerals as well as unabated environmental problems and public safety hazards.

Currently, concerns about CERCLA and CWA liability exposure associated with exploring and developing previously mined areas are chilling private-sector interest in these sites. Consequently, existing policies are counterproductive because they deter redevelopment and restoration projects that could produce a critical mineral and at the same time substantially improve environmental conditions by integrating site restoration efforts with modern, highly regulated mining projects. Rather than discouraging private-sector investment in these sites, the federal government should be working on ways to minimize the private sector's liability exposure in order to stimulate investment in redeveloping historic mines with critical minerals.

Future projects at legacy sites must comply with stringent environmental protection regulations and could potentially include measures to remediate some of the environmental problems associated with historic mining activities. Consequently, increasing redevelopment of legacy mines with critical minerals would be a win for the environment and at the same time strengthen America's domestic supply chains for critical minerals, many of which are important to our national defense.

VII. DOD Topic iv: Promoting environmental, health and safety, labor, fair trade and a level playing field in global markets

Mining in the U.S. must comply with the country's framework of bedrock environmental laws, which ensures mining of all minerals, including critical minerals, is conducted under much more stringent environmental protection regimes than in other countries – including our allies. Companies with projects located on federal lands must submit mining Plans of Operations to either the U.S. Forest Service or the Bureau of Land Management (BLM).

In order to evaluate a Plan of Operations, the Forest Service or BLM must prepare a NEPA document, usually an Environmental Impact Statement (EIS), that responds to public comments about the proposed project, describes the environmental impacts associated with the project, identifies ways to mitigate those impacts, and provides detailed information about how the site will be reclaimed when mining is completed. Project proponents must provide substantial financial assurance (reclamation bonds) that guarantee federal land managers and state regulators will have the necessary financial resources to reclaim the mine if the mining company fails to do so.

The United States also has strong worker health and safety standards and minimum working age limits that prohibit child labor, and minimum wage requirements. In fact, mining salaries are well

above the national salary average for jobs in other sectors. Ziprecruiter shows that the average, nationwide mining salary is \$78,358 per year (\$38 per hour.)¹⁵

In contrast, some foreign countries where critical minerals are mined have few if any labor standards. It is estimated that 1 million children worldwide are involved in mining, often working in unsafe conditions and receiving minimal payments for their efforts. In 2019, roughly 70 percent of the world's cobalt¹⁶ was mined in the Democratic Republic of the Congo (DRC) where children work in largely unregulated, artisanal mines with appalling environmental and safety track records. Concern about these unethical practices has led some of the major electric vehicle manufactures to establish the Responsible Mining Initiative to find cobalt resources outside of the DRC.¹⁷

VIII. DOD Topic vii: Availability of material and manufacturing process substitutes for at risk strategic and critical materials

Although recycling and mineral substitutes can help increase supply chain diversity, responsible mining is necessary for certain minerals where there are few known substitutes and/or limited recycling capacity. Substituting one mineral for another is common during the manufacturing of certain products. However, some minerals are difficult to substitute and substitutions can often result in undesirable tradeoffs such as product performance or increased costs. Moreover, some mineral substitutes are also critical minerals that we import from other countries. Consequently, substituting one critical mineral for another will fail to address the key issue of import reliance.

There are timing and logistical constraints associated with recycling that may reduce the practicality of relying on sources of recycled metals – especially for materials with national security implications. In general, there are significant time delays in producing recycled metals because the end-use products cannot be recycled, and the critical minerals cannot be harvested until products reach the end of their useful life. Moreover, the few mineral processing facilities currently operating in the U.S. may not have the capacity or the right technologies to recover metals from recycled materials.

Although recycling and substitution can satisfy a portion of the nation's demand for a portion of some critical minerals, primary production of responsibly mined critical minerals will clearly be needed to meet the nation's critical minerals requirements.

IX. DOD Topic viii: The availability of skilled labor and other personnel to sustain a competitive strategic and critical materials ecosystem, including the domestic education and manufacturing workforce skills

In contrast to the country's mineral wealth, we have a serious shortage of mineral professionals – especially mineral processing and extractive metallurgical engineers. According to Dr. Corby Anderson, Harrison Western Professor at the Kroll Institute for Extractive Metallurgy at the Colorado School of Mines, the number of U.S. higher education institutions that teach mineral processing (i.e., crushing, grinding, leaching, etc.) and extractive metallurgy (i.e., smelting and

¹⁵ <https://www.ziprecruiter.com/Salaries/Mining-Industry-Salary>, (website visited on 4/23/2021).

¹⁶ Cobalt is a critical mineral used in batteries in electric vehicles and electronic equipment. The USGS reports that China is the world's leading importer of mined cobalt and exporter of refined cobalt. (See 2021 U.S. Geological Survey, pp. 22-23.)

¹⁷ <https://www.visualcapitalist.com/ethical-supply-the-search-for-cobalt-beyond-the-congo/>

refining) has shrunk dramatically over the years. Currently there are only eight schools that teach mineral processing and have research programs in this field. Only five institutes teach and have research programs in extractive metallurgy. There are no North American schools that offer specific degrees in either mineral processing or extractive metallurgy.¹⁸

Dr. Anderson notes some other troubling facts about the age of the U.S. mineral processing and metallurgical engineering workforce. Over half of these professionals will retire in less than ten years. Moreover, the average age of the faculties at the few remaining schools that teach these fields is well over fifty.

In what is an alarming contrast, China has an impressive capacity to educate the next generation of mineral processing and metallurgical engineers. According to Dr. Anderson, there are 38 Chinese schools that teach mineral processing. The largest of these schools is the Central South University in Changsa, China where there are roughly 1,000 undergraduate and 500 graduate students. Extractive metallurgy is a separate but equally large school. Based on these statistics, it is clear that China intends to dominate the future of mineral processing and extractive metallurgy, which will give them significant control over the world's mineral supply chains.

Rare earth minerals are a vivid example of China's mineral processing hegemony. As reported in a May 2019 article published in Reuter's Business News, "U.S. companies are years away from challenging Chinese dominance of rare earth minerals due to a lack of domestic processing facilities, ensuring the Asian nation will maintain its near-monopoly on refining and powerful leverage in trade talks."¹⁹ This same article cites increases in Chinese rare earth import tariffs from 10 percent to 25 percent, making Chinese processing of the rare earth minerals mined from the Mountain Pass Mine in California more expensive.

The United States' capacity to smelt and refine copper is another concerning example of the lack of sufficient domestic facilities to produce the refined copper we use. Although copper is not included in the USGS' list of 35 critical minerals, it really should be given its properties as an excellent conductor of heat and electricity and ability to withstand corrosion and its ubiquitous use in modern society – including electronic equipment and clean, low-carbon energy technologies and infrastructure.

According to the International Copper Study Group²⁰, China dominates the world's copper smelting and refining capabilities. In 2019, China accounted for 50 percent of world copper smelter production. China's smelting and refining capabilities dwarf other countries' capabilities. For example, Japan has the second highest smelter production totaling eight percent followed by Chile (five percent) and Russian Federation (five percent). That same year, smelters in the United States contributed only about three percent of the world's copper smelter production. None of the top 20 copper smelters are located in the United States. China has the largest smelter followed by India, Germany, and Japan. Eight of the top 20 smelters are located in China.

The picture is not much different for refined copper production. In 2019, China produced 41 percent of the world's refined copper. Chile was a distant second, producing 9 percent of the

¹⁸ <https://mmsa.net/Webinars/Critical%20Minerals%20as%20By-Products%20of%20Production.pdf>

¹⁹ <https://www.reuters.com/article/us-china-usa-rareearth-refining/china-set-to-control-rare-earth-supply-for-years-due-to-processing-dominance-idUSKCN1T004J>

²⁰ <https://www.icsg.org/index.php/component/jdownloads/finish/170/3046>

world's refined copper followed by Japan (6%). The United States is the fourth largest refined copper producer, contributing four percent to the world's total refined copper production. Eleven of the world's top 20 copper refineries are located in China. Two U.S. refineries, Grupo Mexico's Amarillo, TX refinery and Freeport-McMoran Copper and Gold Inc.'s El Paso, TX facility, are among the world's top 20 copper refineries. The Grupo Mexico facility ranks eighth; the Freeport-McMoran refinery ranks fifteenth.

In order to reduce China's control over worldwide mineral processing and refining, DOD should encourage expansion of U.S. mineral processing and refining capabilities. This could include constructing new domestic smelters and refineries and evaluating the feasibility of refurbishing or retrofitting facilities that are no longer operating.

In responding to Sections 4(c)(v)(G)(H) of E.O. 14017 pertaining to workforce skills, education, and research and development requirements, DOD should help the Administration understand the urgent need to increase the country's mineral processing and extractive metallurgy capabilities in order to reduce the country's reliance on foreign countries to refine the minerals we mine. The shortage of U.S. academic programs that teach mineral processing and extractive metallurgy means that we will soon lack the intellectual capital needed to strengthen domestic critical mineral supply chains. Mining critical minerals from domestic sources is only the beginning of the mineral lifecycle. These mined materials need to be processed and refined into the metals used in countless value-added products that are the underpinnings of our economy. Re-shoring our mineral processing and refining facilities is an essential component of strengthening our critical mineral supply chains.

X. Conclusions

WMC very much appreciates this opportunity to provide these comments. Please do not hesitate to contact us if you have any questions about our comments or if we can help in any way. WMC stands ready to work with DOD on this important effort to reduce the Nation's reliance on foreign minerals and to strengthen our critical minerals supply chains.

Sincerely yours,



Debra Struhsacker
WMC Co-Founder and Board Member

cc: House Critical Minerals Caucus
House Armed Services Committee
House Appropriations Committee/Defense Subcommittee
Senate Armed Services Committee
Senate Appropriations Committee/Defense Subcommittee

The Women's Mining Coalition is a non-profit organization advocating for today's modern mining industry, which is essential to our Nation.