WESTERN HEMISPHERE READINESS SERIES

HRS RESILIENCE FOUNDATION

SECTOR READINESS ASSESSMENT 04

Rare Earths & Western Hemisphere Mineral Security

Strategic Resources, Industrial Resilience and Hemispheric Security

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About this series. This assessment extends the HRS Readiness Cycle into critical-mineral security, following the institutional logic used across HRS Research Outputs: strategic dependency → readiness → resilience → continuity → long-horizon adaptation. Sector Readiness Assessment 04 follows Sector Readiness Assessment 03 — Critical Minerals & Strategic Materials in the HRS Resilience Foundation's Western Hemisphere Readiness Series, and is intended to be read alongside it.

EXECUTIVE SUMMARY

Rare Earths & Western Hemisphere Mineral Security

Rare earth elements (REEs) occupy a disproportionate position in modern industrial and defense systems. They are used in permanent magnets, electronics, optical systems, communications, advanced motors and other high-performance applications. The strategic problem is not geological scarcity alone; it is the concentration of economically viable extraction, separation, refining and magnet manufacturing capacity. The role of Brazil, Canada, the United States and Latin America in building diversified rare-earth supply chains will matter for the next 50–100 years.

HRS CENTRAL PROPOSITION

Rare-earth security is not simply a mining question. It is a supply-chain question spanning geology, extraction, separation, refining, metals, alloys, permanent magnets, recycling, technology, infrastructure, finance and qualified industrial capacity.

The 2026 USGS Mineral Commodity Summaries reports world rare-earth mine production of approximately 390,000 metric tons REO equivalent in 2025. China accounted for 270,000 tons REO equivalent; the United States produced 51,000 tons and Brazil 2,000 tons. USGS lists Brazil with 21 million tons of reserves, the United States with 1.9 million tons, and Canada with 830,000 tons. These figures show the difference between geological potential and operational production capacity.

Canada separately reports more than 15.2 million tonnes of rare-earth oxide resources in 2024 and identifies permanent magnets as the largest global use of REEs, representing 48% of demand in 2024. Canada also states that China accounted for approximately 69% of mined REEs and 90% of refined REEs in 2024.

The United States has treated rare-earth supply-chain resilience as a national-security and defense-industrial issue. The Department of Defense has pursued a mine-to-magnet strategy, while the White House in 2025 and 2026 issued measures addressing processed critical minerals, national security and recoverable rare-earth materials.

For the Western Hemisphere, the strategic opportunity is therefore to connect complementary capabilities: U.S. industrial demand, technology, capital and defense requirements; Canadian resources, processing development and allied supply-chain capacity; Brazilian geological resources and emerging production; and complementary Latin American mineral, logistics, industrial and investment capabilities.

CENTRAL FINDING

The hemisphere does not need a single-country rare-earth supply chain. It needs a diversified Western Hemisphere network in which mining, separation, refining, metals, magnets, recycling and industrial demand are distributed across multiple sovereign jurisdictions and remain substitutable when a node fails.

SECTION 01

Rare Earths as Strategic Infrastructure

Rare earths should be assessed as strategic infrastructure because a relatively small quantity of material can determine the availability and performance of high-value systems. The relevant unit of analysis is not the mine; it is the complete industrial chain from resource to qualified end product.

SYSTEM	STRATEGIC FUNCTION	EXAMPLES OF EXPOSURE
Permanent magnets	High-performance motors and actuators	Defense systems, aircraft, vehicles, robotics, industrial motors
Electronics	Specialized material properties	Sensors, displays, communications and control systems
Defense	Performance, weight and miniaturization	Aircraft, missiles, naval systems, unmanned systems, radar
Energy	Efficient generators and motors	Wind generation, electric-drive systems, grid technologies
Transport	High power density	Electric vehicles, aerospace and advanced mobility
Communications	Optical and electronic applications	Fiber optics, satellites and communications systems
Industrial automation	Motors, sensors and precision systems	Robotics, manufacturing and advanced machinery

The Department of Defense states that rare-earth permanent magnets are essential to multiple defense capabilities and has invested in separation, refining, metals and magnet manufacturing to establish a domestic mine-to-magnet supply chain.[3,4]

The White House's 2025 Section 232 action describes processed critical minerals, including rare earth elements, as essential inputs for economic and national security and emphasizes the risk created by overreliance on a small number of geographic regions.[6]

The implication for HRS is straightforward: readiness must be measured by continuity of the full chain, not by the existence of mineral deposits alone.

SECTION 02

From Mine to Magnet: The Real Supply Chain

A rare-earth strategy that stops at mining can create a false sense of security. Between geological resource and strategic end-use lie several technically difficult stages, each capable of becoming a single point of failure.

STAGE	CAPABILITY REQUIRED	READINESS QUESTION
1. Exploration	Geological mapping, drilling, resource definition	Are resources sufficiently characterized for investment?
2. Mining	Extraction and ore handling	Can production operate reliably at commercial scale?
3. Beneficiation	Concentration and mineral recovery	Can ore be upgraded economically?
4. Separation	Chemical separation of individual REEs	Is separation capacity available and qualified?
5. Refining	High-purity oxides / compounds	Can strategic grades be produced consistently?
6. Metal / alloy	Conversion to usable metals and alloys	Can downstream feedstock be produced domestically or within the hemisphere?
7. Magnet production	NdFeB and other qualified magnets	Can magnets be manufactured and qualified?
8. Component mfg.	Motors, actuators and advanced components	Can industrial customers obtain reliable components?
9. Recycling	Recovery from end-of-life products and waste	Can secondary supply reduce primary dependence?
10. Qualification	Testing, standards and industrial certification	Can material enter sensitive defense/commercial supply chains?

HRS SUPPLY-CHAIN PRINCIPLE

A mineral is strategically secure only when the critical downstream stages required by its end-use are also secure, qualified, replaceable and economically sustainable.

SECTION 03

The Global Concentration Problem

The strategic vulnerability is concentration. USGS reports China at approximately 270,000 metric tons REO equivalent in 2025 versus 390,000 metric tons REO equivalent worldwide. Canada reports China at approximately 90% of refined production in 2024. These are different measures, but together they demonstrate that downstream processing remains more concentrated than geological resources alone would suggest.

INDICATOR	2025 / 2024 POSITION	STRATEGIC INTERPRETATION
China mine production	270,000 t REO eq.	Largest producer; approximately 69% of world mine output
China refined production	Approx. 90% in 2024 (NRCan)	Processing concentration materially exceeds mining concentration
Brazil reserves	21.0 million t (USGS)	Very large geological base relative to current production
Brazil mine production	2,000 t REO eq. (USGS)	Large gap between reserves and operational output
Canada resources	>15.2 million t REO (NRCan, 2024)	Large resource base with developing projects
U.S. mine production	51,000 t REO eq. (USGS)	Significant production but downstream capacity remains strategic

The strategic lesson is not that China should be excluded from all mineral trade. Rather, a resilient system should avoid dependence on a single external processing center for materials that are essential to defense and critical infrastructure.

The G7 Critical Minerals Action Plan similarly emphasizes diversification, transparency, security, reliability and resilient supply chains, including rare earth elements needed for magnets.[12]

SECTION 04

Brazil: A Strategic Western Hemisphere Asset

Brazil is unusually important because its rare-earth position combines a large geological base with continental scale, an established mining sector, Atlantic logistics, industrial capacity and proximity to major agricultural, energy and manufacturing systems.

USGS lists 21 million metric tons of rare-earth reserves for Brazil in 2025, compared with 2,000 tons of mine production. The difference is strategically important: Brazil's opportunity is not simply to mine more, but to build a competitive, technically qualified and diversified value chain.

Brazil's Ministry of Mines and Energy began technical work in January 2026 to support a National Rare Earths Strategy, including targets and methodologies for developing the domestic rare-earth chain. The National Mining Agency defines critical and strategic minerals in terms that include economic and national-security considerations, supply concentration, external dependence, geopolitical instability and technological limitations.[9,10]

BRAZIL OPPORTUNITY	STRATEGIC OBJECTIVE	HRS READINESS LENS
Resource development	Convert geological potential into reliable production	Bankability, resource definition, permitting, infrastructure
Separation / refining	Retain more value within the hemisphere	Technical qualification and scale
Heavy REEs	Develop capabilities where deposits support them	Tb/Dy availability and downstream demand
Magnet ecosystem	Connect refined materials to industrial customers	Metals → alloys → magnets → components
Logistics	Connect inland projects to ports and industrial centers	Redundant transport and power
Research	Build technical workforce and process capability	Universities, laboratories and industry
Market access	Avoid dependence on one buyer	Multiple qualified offtakers and financing sources

BRAZILIAN STRATEGIC ROLE

Brazil can become a major Western Hemisphere source of rare-earth feedstock and, if economically viable, a platform for higher-value processing — but geological abundance alone does not create supply-chain security.

SECTION 05

Canada: Northern Hemisphere Supply-Chain Depth

Canada provides a complementary role. Natural Resources Canada reports more than 15.2 million tonnes of rare-earth oxide resources in 2024 and identifies multiple advanced projects across the country. Canada is not yet a commercial rare-earth producer at scale, but it has an established critical-minerals policy, processing research and a large mining ecosystem.

Canada's current strategy emphasizes domestic production and processing, protection of economic resilience and sovereign value-chain security, while partnering with Indigenous groups, industry and allies. Its 2026–27 departmental plan reports a major federal initiative for critical minerals and more than $3.86 billion allocated across the Canadian Critical Minerals Strategy initiative over its program period.

CANADIAN CAPABILITY	HEMISPHERIC CONTRIBUTION
Resource base	Diversified northern source of rare-earth feedstock
Processing development	Separation and refining capabilities under development
Mining expertise	Large domestic mining and exploration ecosystem
Infrastructure	Ports, rail, power and northern development capabilities
Research	Materials science, processing and recycling
Allied integration	Existing U.S.–Canada critical-minerals cooperation
Recycling	Secondary recovery and circular supply development

Canada's strategic role should therefore be treated as system depth: resources + processing + technology + logistics + allied integration, rather than simply another mine source.[2,11]

SECTION 06

United States: Industrial and Defense Readiness

The United States is simultaneously a producer, consumer, technology center and defense-industrial customer. The strategic objective is not simply to increase mine output; it is to establish sufficient capacity across the mine-to-magnet chain to support defense and critical infrastructure under stress.

DoD has stated that rare-earth permanent magnets are used in systems including the F-35, Virginia and Columbia class submarines, unmanned vehicles, missiles and radar systems. DoD reported more than $439 million invested since 2020 in domestic rare-earth supply chains, including separation, refining, metals and magnet manufacturing.[3]

In August 2025, the Department of Defense announced a $150 million loan through its Office of Strategic Capital to expand heavy rare-earth separation at Mountain Pass. In January 2025, DoD also awarded $5.1 million for recovery of rare earths from electronic waste.[5,4]

In July 2026, the White House issued a presidential determination concerning recoverable critical minerals and materials, including rare-earth permanent magnets, finding that inadequate supply creates national-defense and security risks and authorizing action under the Defense Production Act.[7,8]

U.S. READINESS PRINCIPLE

Domestic capability and hemispheric diversification are complementary. A secure U.S. supply chain can be strengthened further by reliable partner-country sources that reduce the probability of a single external point of failure.

SECTION 07

Latin America: Complementary Strategic Roles

Latin America should not be treated as a homogeneous mineral bloc. Different countries offer different combinations of geology, infrastructure, industrial capacity, trade access, energy, finance and regulatory readiness. The objective should be a network of complementary capabilities rather than a single regional supplier.

COUNTRY / SUBREGION	POTENTIAL STRATEGIC ROLE	ASSESSMENT DISCIPLINE
Brazil	Principal rare-earth resource and emerging production anchor	Focus on resource-to-processing conversion
Argentina	Critical-mineral and energy-transition partner; exploration potential	Do not infer REE scale without project-level evidence
Chile	Pacific logistics and major critical-mineral ecosystem	Rare-earth role should be project-specific; leverage logistics integration
Peru	Pacific mining/logistics and copper-heavy critical-mineral base	Potential corridor partner; REE projects require verification
Colombia	Caribbean/Pacific logistics and diversified mining base	Potential regional connector; REE capacity requires evidence
Mexico	North American manufacturing and logistics integration	Potential downstream and supply-chain connector
Guyana / Suriname	Atlantic/Amazon regional logistics and resource potential	Project-specific assessment required

This assessment intentionally does not assign unverified rare-earth reserves or production volumes to Latin American countries where authoritative evidence reviewed for this publication does not support a precise figure. Strategic potential should not be confused with proven commercial supply.

The broader critical-minerals landscape nevertheless makes Latin America strategically important. CSIS has argued that the region's large mineral base and China's dominant processing position create an opportunity for more resilient hemispheric value chains, provided investment, processing, technology and infrastructure are developed.[13,14]

SECTION 08

Why the Hemisphere Matters

The Western Hemisphere has a structural advantage: it contains major mineral resources, two highly developed economies, established financial markets, advanced technology, significant industrial demand, and extensive Atlantic and Pacific logistics. The challenge is to connect these assets without creating new dependencies.

HEMISPHERIC ASSET	CONTRIBUTION TO RARE-EARTH SECURITY
United States	Demand, defense, technology, capital, qualification and manufacturing
Canada	Resources, mining expertise, processing, research and allied integration
Brazil	Large reserves, emerging production, industrial scale and Atlantic access
Mexico	Manufacturing integration and North American logistics
Southern Cone	Critical-mineral ecosystems, energy and Pacific/Atlantic connections
Andean region	Mining expertise, Pacific ports and complementary mineral supply
Caribbean / Atlantic	Maritime connectivity and regional logistics
Research institutions	Materials science, separation, recycling and workforce development

A resilient architecture should permit material to move through multiple routes and processing centers. This does not require every country to perform every stage. Specialization is compatible with resilience when there are credible alternatives.

HRS HEMISPHERIC PRINCIPLE

The strategic objective is not hemispheric autarky. It is resilient interdependence: diversified sovereign production and processing connected by multiple commercial, technological and logistical pathways.

SECTION 09

The 50–100 Year Strategic Horizon

Rare-earth strategy must outlast individual technologies and political cycles. A magnet chemistry, vehicle architecture or defense platform may change within decades; the need for strategic material access, qualified processing and industrial adaptability is likely to persist.

HORIZON	STRATEGIC PRIORITY	READINESS OBJECTIVE
2026–2035	Build missing mine-to-magnet nodes	Separation, refining, metals, magnets, recycling and qualification
2035–2050	Scale hemispheric production and processing	Multiple commercial sources and processing centers
2050–2075	Adapt to technology substitution and new demand	Flexible plants, R&D, recycling and material substitution
2075–2126	Preserve strategic option value	Institutional knowledge, resource stewardship, technology interoperability and diversified industrial capacity

The long-horizon objective is optionality. Countries and companies should retain the ability to change suppliers, processing routes, technologies and end-use designs when markets or geopolitical conditions change.

This is why recycling and substitution matter alongside mining. USGS notes that substitutes exist for many rare-earth applications but are generally less effective. The strategic objective is therefore not to eliminate demand for rare earths, but to ensure that critical applications are not exposed to an irreplaceable single source.

SECTION 10

HRS Rare-Earth Readiness Framework

HRS CYCLE	RARE-EARTH APPLICATION
Detect	Monitor resource development, production, export controls, processing capacity, inventories, prices and project disruptions.
Assess	Map mine-to-magnet dependencies by element, jurisdiction, company, technology and end use.
Decide	Identify critical nodes requiring redundancy, reserves, investment or alternative technology.
Coordinate	Connect governments, miners, processors, manufacturers, financiers, research institutions and end users.
Deploy	Advance bankable projects, processing facilities, recycling, logistics and workforce programs.
Sustain	Maintain qualified production, inventories, maintenance, finance and replacement capacity.
Learn	Exercise disruption scenarios and convert results into new investment and industrial policy.

The framework should be applied separately to light and heavy rare earths, because their geological occurrence, processing complexity and strategic applications differ. Particular attention should be paid to neodymium, praseodymium, dysprosium and terbium where permanent-magnet applications create strategic importance.

HRS READINESS TEST

For every critical rare-earth dependency, ask five questions: Where is it mined? Where is it separated? Where is it refined? Where is the qualified end product manufactured? What happens if the principal node becomes unavailable?

SECTION 11

Proposed Western Hemisphere Rare-Earth Resilience Architecture

LAYER	PROPOSED CAPABILITY	POTENTIAL LEAD NODES
Resource layer	Geological mapping and project pipeline	Brazil, Canada, U.S., selected Latin American projects
Mining layer	Diversified commercial extraction	Brazil, U.S., Canada, qualified partners
Processing layer	Separation and refining capacity	U.S., Canada, Brazil; additional qualified nodes as viable
Materials layer	Metals, alloys and magnet feedstock	U.S./Canada with Brazilian and other feedstock
Magnet layer	Qualified permanent-magnet manufacturing	U.S., Canada, Mexico and other viable industrial locations
Recycling layer	Recovery from end-of-life magnets and e-waste	U.S., Canada, Brazil and regional hubs
Logistics layer	Atlantic/Pacific corridors and redundant transport	North America, Brazil, Andean/Pacific and Caribbean nodes
Finance layer	Project finance, offtake, insurance and strategic capital	U.S./Canadian institutions + private capital
Knowledge layer	R&D, testing, qualification and workforce	Universities, national laboratories, industry

The architecture deliberately avoids requiring one country to control the complete chain. Its resilience comes from distributed capability plus tested interoperability.

SECTION 12

Sovereignty, Economic Security and Investment Discipline

Critical-mineral development can strengthen sovereignty when it increases national options. It can weaken resilience when one foreign investor, buyer, processor, technology platform or financing source becomes indispensable. The same principle applies to U.S., Canadian and Latin American jurisdictions.

RISK	RESILIENCE SAFEGUARD
Single foreign buyer	Multiple qualified offtakers and transparent market access
Single foreign processor	Domestic or allied alternative processing capacity
Technology lock-in	Interoperability and technology substitution plans
Infrastructure bottleneck	Redundant transport, power and port capacity
Capital concentration	Multiple financing sources and transparent ownership
Opaque ownership	Beneficial-ownership and investment due diligence
Export-control shock	Scenario planning and alternative suppliers
Price volatility	Long-term contracts, strategic inventories and bankability mechanisms
Environmental / social disruption	Early technical studies, transparent engagement and project governance

Foreign investment is not treated as inherently problematic. The relevant question is whether a transaction increases or decreases the host country's ability to retain strategic choice under stress.

This approach is consistent with Canada's current critical-minerals strategy, which explicitly links value-chain security, economic resilience and protection against geopolitical and foreign-control risks.[11]

SECTION 13

Conclusion

Rare earths are not merely another category of mined commodities. Their strategic importance arises from the combination of specialized material properties, concentrated processing capacity, high-value downstream applications and the difficulty of rapidly rebuilding qualified industrial capacity after a disruption.

The Western Hemisphere begins from a position of considerable strength. The United States possesses industrial demand, technology, capital and defense requirements. Canada has major resources, mining expertise and a growing processing ecosystem. Brazil has one of the world's largest reported rare-earth reserve bases and is beginning to develop a national strategy for the sector. Other Latin American countries can contribute through complementary mineral, industrial, logistical and manufacturing capabilities.

The principal strategic gap is not geology. It is the distance between resource and resilient industrial capability. Closing that gap requires separation, refining, metals, alloys, magnets, recycling, logistics, qualification, finance and skilled personnel.

CENTRAL CONCLUSION

Western Hemisphere rare-earth security should be built as a distributed industrial network: multiple sovereign sources, multiple processing nodes, multiple logistics pathways, qualified downstream manufacturing, recycling and continuous technological adaptation.

For the HRS Resilience Foundation, the strategic research question is therefore not “Who owns the rare earths?” It is: “Can the hemisphere maintain access to the materials and components required for critical civilian and defense systems when a major supply-chain node becomes unavailable?”

Detect → Assess → Decide → Coordinate → Deploy → Sustain → Learn

METHODOLOGY, RESEARCH INTEGRITY AND LIMITATIONS

Methodology, Research Integrity and Limitations

This assessment is an original HRS Resilience Foundation synthesis based primarily on official U.S. Geological Survey, U.S. Department of Defense, White House, U.S. Department of Energy, Natural Resources Canada, Government of Brazil and G7 materials, supplemented by strategic analysis from CSIS.

USGS 2026 data are used for 2025 world mine production and reserves. Natural Resources Canada figures are used where they distinguish resources from reserves or provide processing and demand context. These categories are not interchangeable and are deliberately labeled as such.

Country-level strategic roles are analytical judgments. Where authoritative evidence reviewed for this publication did not support a precise rare-earth reserve or production figure, the document does not assign one. Strategic potential is not treated as proven commercial supply.

The assessment does not claim that any country intends to weaponize rare earths. It analyzes the security consequences of concentration, export restrictions, processing dependency, market disruption and lack of substitutability.

This is a public-source sector readiness assessment. It is not a classified intelligence estimate, engineering audit, legal opinion, procurement recommendation, investment recommendation or certification.

RESEARCH INTEGRITY

Sovereignty is a starting premise. The purpose of resilience analysis is to expand the range of choices available to sovereign institutions and industrial partners, not to prescribe which foreign investor, supplier, technology or jurisdiction they must select.

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