

ASX Announcement

18 November 2025

## Metallium Secures Binding Exclusive Rights over Heavy REE-Rich Harts Range Project Following Exceptional FJH Upgrade of Raw Ore

*Single-Step FJH Delivers 1.7% → 35% TREO and 53x/21x Dy–Tb Enrichment*

### KEY HIGHLIGHTS:

- **Exceptional Beneficiation Result:** FJH process increased TREO from 1.7% to 35.0% (~20x upgrade) in a single step flash, including 53x Dy enrichment and 21x Tb enrichment, with complete removal of detectable Fe, Si and Th from raw, un-beneficiated (no flotation, acid leaching or hydrometallurgical pre-conditioning) Harts Range ore.
- These results represent an **unprecedented beneficiation performance** for a raw Dy/Tb-bearing ore in a single, rapid, solvent-free reaction.
- **Binding Exclusive Project Rights:** Metallium granted exclusive, project-attached rights by NFM to apply FJH to all Harts Range ore and concentrates for at least 10 years, automatically extending through production. Contractually, any future potential owner of Harts Range must also use FJH process.
- **Binding Commercial Framework:** Metallium will earn a royalty on recovered product and a process licencing margin on all future Dy/Tb sales from Harts Range material.
- **Disruptive Business Model:** Metallium's operating model requires no mining capital, with revenue generated through licensing fees and royalties under an exclusive processing-rights structure.
- **Strategic Significance:** Initial surface sampling indicates that Harts Range hosts an unusually Dy/Tb-rich mineral system, with grade characteristics and mineralisation rarely encountered in other deposits worldwide. Early data underscores FJH's capability to unlock heavy rare earths directly from unprocessed ore.
- **Downstream Pathway:** In parallel with commissioning the Texas facility for e-waste processing, Metallium is assessing pathways to produce Dy/Tb-rich "super-concentrate" samples at its Texas Technology Campus for possible future qualification with U.S. magnet and defence customers.
- **Metallium's Core Strategic Focus:** This remains the commercialisation of FJH across both e-waste and mineral processing, with the Texas facility being commissioned primarily for e-waste feedstocks. The Harts Range agreement provides a low-risk extension of the technology into the strategically important heavy rare earth segment, the scarcest group within the U.S. Government's critical minerals list.

**Metallium Limited** ("Metallium" or the "Company") (ASX: **MTM**; OTCQX: **MTMCF**) announces a major step forward in establishing a Western heavy-rare-earth refining pathway through a new collaboration with New Frontier Minerals Ltd (ASX: NFM). Early testwork using Metallium's proprietary Flash Joule Heating (FJH) technology on material from NFM's Harts Range Project in the Northern Territory of Australia, delivered exceptional enrichment in dysprosium (Dy) and terbium (Tb), two of the rarest and most strategic rare-earth elements (REEs). Metallium has simultaneously secured exclusive, project-linked rights to apply FJH to all future Harts Range material, reinforcing the Company's leadership in advanced rare-earth refining technology.

This agreement complements Metallium's primary commercialisation pathway in e-waste processing and does not alter the Company's strategic priorities for the Texas Technology Campus.

**Metallium Managing Director & CEO Mr Walshe said:** "These results highlight the disruptive potential of Metallium's technology. To take an unprocessed rock sample and produce a Dy/Tb-rich concentrate in one rapid, solvent-free step is exceptional. It reinforces Metallium's position at the forefront of building a Western supply chain for the world's most strategic rare-earth metals. To achieve more than a 20-fold TREO upgrade and over 50-fold enrichment of dysprosium from a raw, un-beneficiated ore sample in a single flash is unprecedented in global heavy-rare-earth beneficiation.

"Through this agreement we've ensured that Metallium not only leads the technology side but also holds enduring commercial exposure to one of the rarest natural Dy/Tb-rich systems identified to date."

**STRATEGIC SIGNIFICANCE**

China and Myanmar currently supply **over 95% of global Dy/Tb** and China controls **~95% of refining capacity**, leaving the United States and its allies critically exposed on the heavy REE materials required for **fighter jets, missiles, submarines and high-temperature NdFeB magnets**. Even with all planned Western projects, China is still forecast to supply **~82% of Dy/Tb by 2030**, with market models showing **deficits from 2025–2029** and ex-China prices trading at **3-4x Chinese levels**<sup>1</sup>.

In this context, a Dy/Tb-rich Australian system that upgrades from 1.7% to 35% TREO in a single flash positions Harts Range as a potential high-impact, Western-aligned heavy-REE opportunity. Producing Dy/Tb-rich concentrate directly from raw ore lowers processing complexity and capital intensity, strengthening its appeal to U.S. defence and magnet supply chains.

**TEST RESULTS SUMMARY**

The sample from Harts Range (un-beneficiated ore, crushed) underwent FJH processing. Key Highlights:

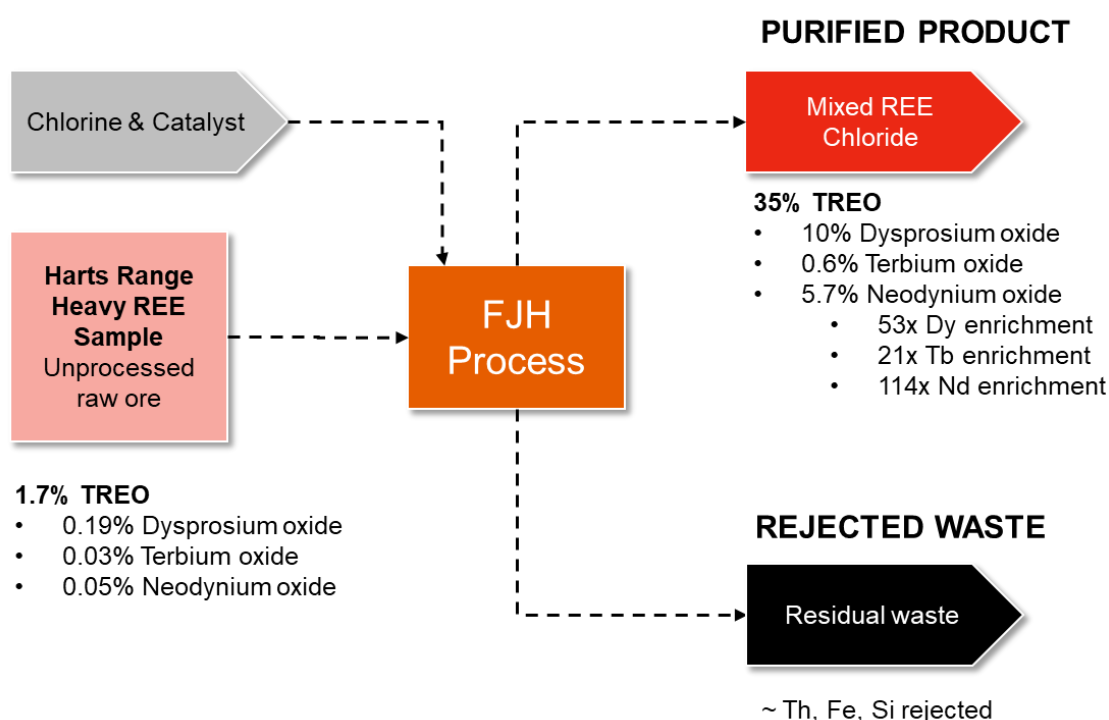
**SIMPLIFIED OVERVIEW – RAW ORE FEED INTO FJH ENRICHMENT PROCESS**


Fig 1. Single-step Flash Mass Balance Diagram

- Total rare-earth oxide (TREO) content increased from ~1.7 % to ~35 % in a single step, representing ~20x upgrade.
- Key heavy REEs Dy and Tb, and magnet REE Nd concentrations increased significantly.
  - **Dy<sub>2</sub>O<sub>3</sub> upgraded 53x (0.19% → 10.03%)** / **REO basket enrichment: 11% → 29%**
  - **Tb<sub>4</sub>O<sub>7</sub> upgraded 21x (0.03% → 0.64%)** / **REO basket enrichment: 1.7% → 1.8%**
  - **Nd<sub>2</sub>O<sub>3</sub> upgraded 114x (0.05% → 5.69%)** / **REO basket enrichment: 2.9% → 16.3%**
- Complete removal of detectable Fe<sub>2</sub>O<sub>3</sub>, SiO<sub>2</sub> and ThO<sub>2</sub>.
- Partial Y rejection, reducing Y<sub>2</sub>O<sub>3</sub> from 61% to 35% of the REO basket. Highly significant for downstream separation.
- No traditional acid-leach or reagent-heavy beneficiation route was applied pre-FJH, underscoring metallurgical simplicity and fast processing capability.
- Metallium is currently modelling the next phase of optimisation, including additional FJH treatment and post-sample processing for increased recoveries.
- Samples were analysed by Inductively Coupled Plasma Optical Emission Spectroscopy (ICP-OES) by an independent, accredited commercial laboratory.
- Note: The Harts Range sample programme remains at early exploration stage (surface samples only); no Mineral Resource has yet been defined at Harts Range.

<sup>1</sup> Canaccord Genuity 2025, 'Rare Earths: Opportunity Emerges as the Dust Settles'; Global Equity Research, 7 November 2025.

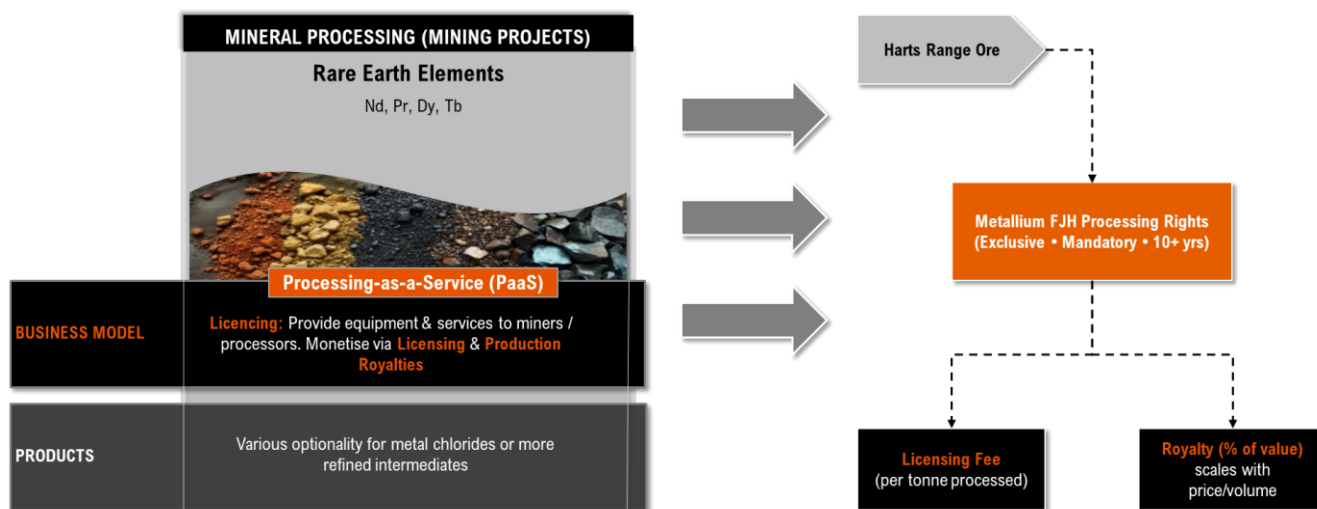
**Table 1: REE Recovery and Impurity Removal – Assay Before and After FJH Treatment & Enrichment Ratio**

	Element	Oxide	BEFORE	AFTER	Enrichment Ratio
			Raw Ore Assay, %wt	Product post FJH, %wt	
RARE EARTHS	Dysprosium	Dy2O3	0.19%	10.03%	53X
	Terbium	Tb4O7	0.03%	0.64%	21X
	Neodymium	Nd2O3	0.05%	5.69%	114X
	Praseodymium	Pr6O11	0.01%	0.00%	-
	Lutetium	Lu2O3	0.01%	0.25%	25X
	Gadolinium	Gd2O3	0.13%	2.04%	16X
	Erbium	Er2O3	0.07%	1.02%	15X
	Holmium	Ho2O3	0.03%	0.36%	12X
	Ytterbium	Yb2O3	0.06%	0.73%	12X
	Samarium	Sm2O3	0.06%	0.70%	12X
	Yttrium	Y2O3	1.04%	11.83%	11X
	Thulium	Tm2O3	0.01%	0.00%	-
	Cerium	CeO2	0.03%	0.85%	28X
	Lanthanum	La2O3	0.01%	0.43%	43X
	Europium	Eu2O3	0.00%	0.37%	-
	<b>Total Rare Earth Oxides</b>	<b>TREO</b>	<b>1.72%</b>	<b>34.96%</b>	<b>20X</b>
IMPURITIES	Iron	Fe2O3	2.77%	0.00%	Complete removal
	Silica	SiO2	75.75%	0.00%	Complete removal
	Thorium	ThO2	0.002%	0.00%	Complete removal

NOTE: Enrichment = (REE % in condensate) ÷ (REE % in original feed).



**Fig 2. FJH Test Units at the Anahuac Technology Campus, Chambers County, Texas.**

**BINDING COMMERCIAL FRAMEWORK**


**Fig 3. Metallium's indicative operating model: exclusive processing rights over Harts Range enable a "Processing-as-a-Service" structure, generating both per-tonne licensing fees & production royalties without mining or operating risk.**

- Metallium has secured binding, exclusive, project-linked rights to apply FJH (and derivative processing) to all ore, concentrate or other feed from the Harts Range Project for a minimum of 10 years, with automatic rollover into production. **These rights are exclusive, mandatory, and run with the project title: any future project owner must utilise Metallium's FJH process to generate Dy/Tb-rich product, subject to successful commercial scale-up.**
- While the agreement contains binding provisions in respect of the exclusive licence and royalty, it remains subject to entry into a formal licensing and royalty agreement.
- Upon commercial production of Dy/Tb-rich product, Metallium will earn:
  - **A royalty (e.g., 1.5% NSR equivalent) on NFM's attributable share of sales of finished product (85% for tenements EL32046 & EL32513, and 100% for EL34022, EL34109, EL34110 and EL34147); and**
  - **A process licencing margin for processing Harts Range feed through Metallium's facility.**
- The structure includes a buy-back right allowing the owner of the Harts Range Project (and any successive owner) to acquire a portion of the royalty for a fixed amount, enabling Metallium to crystallise value.
- Supply chain security: Metallium holds rights that travel with the project in the event of ownership change, ensuring the processing exclusivity remains intact.
- Metallium's Texas Technology Campus serves dual purpose: core waste-to-value facility (e-waste, PCBs, specialty metals) and demonstration/refinement hub for REE feedstocks and product qualification with U.S. / allied offtakers.
- This structure provides Metallium with a high-margin, low-risk commercial model: the Company is not required to fund or operate any mining activities, yet benefits from every tonne of Harts Range material that enters the market.
- This agreement does not cover the manufacture and supply of FJH processing equipment to NFM; any future integration of FJH units into the Harts Range flowsheet would be subject to separate commercial terms.

**STRATEGIC UPSIDE FOR METALLIUM / DISRUPTIVE BUSINESS MODEL**

- By securing **technology exclusivity** over one of the few known Dy/Tb-rich feedstocks globally, Metallium positions itself as a gatekeeper for heavy-rare-earth refining in the Western supply chain.
- The FJH process has now been demonstrated on raw ore rather than just scraps or concentrates, showing the broad versatility of the technology, widely increasing the potential addressable market.
- With downstream product qualification pathways (including U.S. magnet and defence supply chains), Metallium converts early upgrade results into commercial optionality, not just exploration upside.
- **Disruptive Business Model:** The royalty/toll structure allows Metallium to benefit from future production without bearing full mining or development risk. This means investors can view Metallium not just as a technology developer but potentially as a cash-flow oriented processor royalty business.
- Importantly, the Harts Range arrangement is an incremental application of FJH and does not alter Metallium's primary focus on commercialising e-waste recycling at scale.
- With Western governments accelerating rare-earth supply-chain policies, supported by U.S. DoW programs and tightening export-control regimes, the timing aligns with the heightened strategic importance of REE supply.

**NEXT STEPS**

- Ongoing FJH testing of the 25kg bulk sample from Harts Range into Metallium's Texas-based FJH testing facility.
- Further optimisation test programs including steps aiming to reduce the low value REEs (i.e. Ce, La) from the product.
- Generation of Dy/Tb-rich "super-concentrate" samples and delivery to prospective U.S. magnet/defence customers for qualification.
- Delivery of a commercial term-sheet for offtake or tolling by Q3-2026.
- Commissioning of the Texas Technology Campus for specialty-metals recovery (gallium / germanium) and demonstration of HREE pilot workflow early next year.

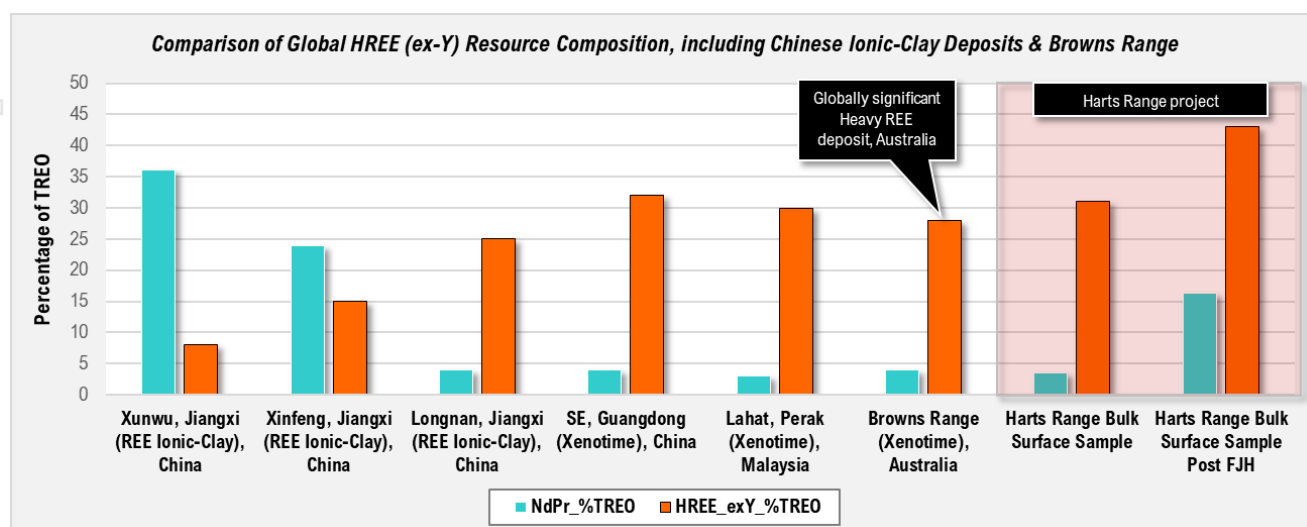
**GLOBAL CONTEXT & COMPARATIVE POSITIONING**

Across the world's six largest producing rare earth mines, Bayan Obo, Mt Weld, Maoniuping, Dechang, Mountain Pass and Weishan, the REE basket value is dominated by Nd-Pr, with heavy rare earth oxides (HREE, excluding Y) typically contributing **less than 2% of TREO**. Even the most advanced Western hard-rock projects with meaningful heavy-rare-earth content, such as Browns Range in Western Australia — generally report **only 10–12% HREE (ex-Y)** within their resource. These global mines are all LREE-dominant; by contrast, the world's major ionic-clay deposits in Jiangxi contain the highest natural HREE (ex-Y) ratios globally but are much lower in head REE grade<sup>2</sup>. This global comparison is shown in Figure 4.

Although based only on early-stage surface samples, the Harts Range material tested by Metallium contains **~31% HREE (ex-Y)** in its natural state, increasing to **~43% HREE (ex-Y)** after a single FJH flash. This may place Harts Range in a potentially different category compared to global LREE-dominant carbonatite and bastnasite deposits and matches or exceeds the heavy-rare-earth fraction of most xenotime-rich systems and sits within the range observed for China's premier ionic-clay deposits.

Yttrium is excluded from these comparisons because it is treated as a deleterious element in standard solvent-extraction circuits, adding cost without contributing meaningful value; industry benchmarks therefore focus on the value-bearing Dy-Tb-Ho-Er-Yb-Lu suite.

In practical terms, these early results suggest that Harts Range exhibits an **uncommon Dy-Tb-magnet-REE signature**, materially richer in heavy rare earths than any of the top global producers and stronger than leading Western HREE developments. This significantly enhances the strategic importance of Metallium's exclusive processing rights over the project. This comparison is illustrated in Fig. 4, which contrasts Harts Range with leading ionic-clay and xenotime-based HREE deposits globally.



**Fig 4.** Comparison of Global HREE (ex-Y) Resource Composition, including Chinese Ionic-Clay Deposits & Browns Range<sup>2</sup>.

Note: The Harts Range sample programme remains at early exploration stage (surface samples only); no Mineral Resource has yet been defined at Harts Range

<sup>2</sup> Jevons Global 2022, 'Australian Critical Minerals: Rare Earth Producers & Advanced Projects', Jevons Global Pty Ltd, Canberra.

This announcement has been authorised for release by the Board of Directors.

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**ABOUT METALLIUM LIMITED**

**Metallium Ltd** (ABN 27 645 885 463), is pioneering a low-carbon, high-efficiency approach to recovering critical and precious metals from mineral concentrates and high-grade waste streams. The company's patented **Flash Joule Heating (FJH)** technology enables the extraction of high-value materials, including **gallium, germanium, antimony, rare earth elements, and gold**, from feedstocks such as refinery scrap, e-waste, and monazite.

Aligned with U.S. strategic supply chain objectives, Metallium has recently secured its first commercial site in Texas via its wholly owned subsidiary, **Flash Metals USA Inc.**, marking a major step toward near-term production and revenue generation.

To learn more, visit:

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**APPENDIX - ADDITIONAL INFORMATION**

**Testwork Procedure Summary:** Preliminary testwork was conducted by Metallium in Houston, Texas, on a raw unbeneficiated bulk ore sample from the Harts Range project located in Northern Territory, Australia. The sample was subjected to Flash Joule Heating (FJH), a proprietary process that uses electrical energy to rapidly heat material in the presence of chlorine gas and proprietary catalysts. Separation of rare earth elements was achieved by exploiting differences in chlorination and volatilisation temperatures between REEs (e.g. Dy, Tb, Nd, Pr) and impurities such as Si & Fe. Post-reaction solids were analysed by ICP-OES, with results indicating a significant increase in the REE concentrations, confirming effective preliminary separation of target magnet and heavy REEs.

**REE Symbol / Abbreviation and Full Name / Oxide Conversion Factor from Elemental**

Symbol	Element Name	Standard Oxide	REO Conversion Factor
Y	Yttrium	Y <sub>2</sub> O <sub>3</sub>	1.2699
La	Lanthanum	La <sub>2</sub> O <sub>3</sub>	1.1728
Ce	Cerium	CeO <sub>2</sub>	1.2284
Pr	Praseodymium	Pr <sub>6</sub> O <sub>11</sub>	1.2082
Nd	Neodymium	Nd <sub>2</sub> O <sub>3</sub>	1.1664
Sm	Samarium	Sm <sub>2</sub> O <sub>3</sub>	1.1596
Eu	Europium	Eu <sub>2</sub> O <sub>3</sub>	1.1579
Gd	Gadolinium	Gd <sub>2</sub> O <sub>3</sub>	1.1526
Tb	Terbium	Tb <sub>4</sub> O <sub>7</sub>	1.1762
Dy	Dysprosium	Dy <sub>2</sub> O <sub>3</sub>	1.1477
Ho	Holmium	Ho <sub>2</sub> O <sub>3</sub>	1.1455
Er	Erbium	Er <sub>2</sub> O <sub>3</sub>	1.1435
Tm	Thulium	Tm <sub>2</sub> O <sub>3</sub>	1.1421
Yb	Ytterbium	Yb <sub>2</sub> O <sub>3</sub>	1.1387
Lu	Lutetium	Lu <sub>2</sub> O <sub>3</sub>	1.1371
	Magnet REE	Nd, Pr, Dy, Tb	
	Heavy REE	Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, Y	
	Heavy REE minus Y	Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu	
-	HREE / HREO	Heavy REE / Heavy REE Oxide	
-	HREE / HREO (ex-Y)	Heavy REE / Heavy REE Oxide minus Y	

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