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Guardian Metal Resources plc

('Guardian Metal' or the 'Company')

Novel Paper Published on Tungsten Needs for Nuclear Fusion

Significant Future Tungsten Demand by Fusion Technology Confirmed

Guardian Metal Resources plc (LON:GMETOTCQX:GMTLF), a strategic development and mineral exploration company focused on tungsten in Nevada, USA, is very pleased to announce the publication of a study titled 'Supply and Demand of Tungsten in a Fleet of Fusion Power Plants' in the *Fusion Engineering and Design* journal.

This study is the first scientific paper to directly quantify the amount of tungsten that is expected to be required in nuclear fusion technology in the context of a tungsten supply chain. The study predicts, in the scenarios analysed, if global tungsten production stays stagnant for the roll out of 500MWth and 2000MWth scale fusion reactors, the fusion industry will require 100% of global production by 2056 and the global tungsten production would need to grow by 10 to 16 times from its current level by the end of the century. For context, over its full 40-year lifespan, a single 2,000 MWth ARIES-ST reactor would need approximately 2.6 times the tungsten currently consumed in the U.S. every year for all use cases. The results strongly underpin the need for new mined sources of the metal to meet the growing future demand from fusion technology.

The study was co-funded partially by Guardian Metal with technical method and analysis conducted by the Company's partners Oxford Sigma Ltd ("Oxford Sigma"). Oxford Sigma is a Fusion Technology company with a vision to tackle energy security and climate change by accelerating the commercialisation of fusion energy. Their mission is to deliver materials technology, materials solutions, and fusion design services. Oxford Sigma aims to produce advanced materials technologies, agnostic to fusion approach, for the materials ecosystem. Their fusion core materials are engineered to enable longer term operations for fusion pilot plants, with the aim of roll out to the first-of-a-kind commercial power stations. Oxford Sigma is internationally recognised as a key fusion materials and technological leader.

Oliver Friesen, CEO of Guardian Metal, commented:

"The demand outlook for tungsten has significantly changed as of today and our investment case at Guardian Metal, as a leader in U.S.-focussed tungsten exploration and development, has grown much stronger. With billions of dollars being invested globally across the fusion space during just this year alone, we hope that the results of this study will serve as a wakeup call in regards to the supply chain implications - specifically for tungsten - posed by this ground breaking technology. Simply put, current global tungsten output is vastly insufficient to meet growing future demand from fusion technology and as a result, significant investment will be required across the entire tungsten supply chain."

"We at Guardian Metal are delighted that tungsten availability will be a cornerstone consideration for this ground-breaking technology, and our goal is to be a western world producer of this critical metal for fusion and defence, as well as a wide array of other important industries that require this metal."

Study Highlights:

- Tungsten is a leading candidate for both plasma facing and shielding in both spherical and D-shaped tokamaks, given its core properties including high melting point, high thermal conductivity, high neutron shielding and low sputtering yield (loss of material when hit with energetic particles).
- To enable the widespread adoption of nuclear fusion power plants, a reliable tungsten supply chain is essential. The tungsten industry is required to grow by an order of magnitude or more under the role out of reactors assumptions in the study.

- **Two specific reactor designs were studied, the results of which have concluded that:**
 - **ARIES-ST reactor over 40fpy (full power-years) at 500MWth (megawatt thermal) consumed 4,231 tonnes of tungsten and 29,034 tonnes at 2,000MWth.**
 - **EU-DEM01 reactor over 40fpy at 500MWth consumed 3,945 tonnes of tungsten and 9,554 tonnes at 2,000MWth.**
- **If the UK or US were to develop and operate fusion power fleets without domestic tungsten sources, their supply would likely fall drastically short of requirements for reactors alone, not counting existing essential industry and military uses, without heavy investment and expansion of mined tungsten capacity.**
- **Given that current global consumption is approximately 100,000 tonnes per annum, the study models that global tungsten supply is a founding cornerstone issue for a future fleet of fusion power plants.**

The full study can be found at:

E. Day-San, G.C. Blackett, M. Dornhofer, A.K. Manduku, M.D. Anderton, L. Tanure, T.P. Davis, 'Supply and demand of tungsten in a fleet of fusion power plants', Fusion Engineering and Design,

<https://doi.org/10.1016/j.fusengdes.2025.114881>

Guardian Metal Resource has two leading advancing tungsten projects in the USA and has the objective to be the leading company to re-establish tungsten production in the USA. The Company also is acknowledged in the paper above as follows:

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