GOVERNMENT OF INDIA
DEPARTMENT OF ATOMIC ENERGY
RAJYA SABHA
UNSTARRED QUESTION NO. 1286
TO BE ANSWERED ON 14.12.2023

Supply of rare earth minerals

1286 Shri Ayodhya Rami Reddy Alla:

Will the PRIME MINISTER be pleased to state:

(a) whether the geopolitical dynamics surrounding the global production and supply of rare earth minerals impact strategic considerations for countries heavily reliant on these resources, if so, the details thereof;

(b) the manner in which rare earth elements contribute to the performance and efficiency of modern electronics, and how emerging technologies can reduce dependence on these scarce resources;

(c) the details of the environmental challenges associated with rare earth mining and processing; and

(d) the potential sustainable practices to mitigate these issues?

ANSWER

THE MINISTER OF STATE FOR PERSONNEL, PUBLIC GRIEVANCES & PENSIONS AND PRIME MINISTER'S OFFICE (DR. JITENDRA SINGH):

(a) Yes Sir. Rare Earth Elements (REEs) are used in processors, advanced alloys, electric vehicles, consumer electronics and industrial machinery. They are also crucial to many strategic applications including missile navigation and sensor systems. The significance of rare earths makes it important to diversify their supply chains to avoid over-dependence on a single supplier, including by developing a domestic rare earth value chain.

(b) The following Rare Earth Elements (REE) find applications in modern electronics:

1. Europium, Yttrium and Terbium are used as fluorescence material for smart phone, desktop computer monitors, television monitors, stadium scoreboard and energy efficient Compact Fluorescent Lamps (CFLs) / white Light Emitting Diode (LEDs).
2. Yttrium, Lanthanum, Terbium, Europium, Gadolinium, Praseodymium and Dysprosium are used in OLEDs for colour emission and reduction in the ultraviolet light penetration. Yttrium is also used in lasers.
3. Erbium is used in fiber optic amplifiers for long distance fiber optic communication.
4. Neodymium & Dysprosium based magnets have high strength and offer high heat handling capability than conventional iron magnets. They are used in headphones, microphones, loudspeakers and hard disk drives, as well as electric motors for hybrid cars and wind turbines.
5. Lanthanum and Cerium, are used in nickel metal hydride batteries which are used in electric vehicle.
6. REEs are also used in the defense systems like guidance systems, lasers, radar and sonar systems.

R&D being carried out worldwide, to explore the alternatives for these REEs to reduce dependence on scarce resources, are mentioned below:

1. Transitioning from rare earth lighting products to light-emitting diode technology.
2. Iron-nitride: A powerful magnetic material which is theoretically more than twice as strong as rare earth magnets and also much cheaper than rare earth magnets.
3. High-temperature superconductor magnets: To replace neodymium based permanent magnets used in wind turbines.
4. Iron nickel alloys to replace neodymium and dysprosium demand.

Other potentially promising way to reduce dependence on the REEs is recycling which is in early stages of development. Worldwide, researchers are looking to augment the existing REE supply by incorporating recycling of REEs into the supply chains to create a closed loop process. This is particularly promising in wind turbine sector due to the

large size of the magnets and the standardization model employed by many turbine generators.

Although REE concentrations in most of the alternative resources are lower than current REE ores, some sources including marine sediments, coal ash, and industrial wastes, such as red mud, are emerging as promising source of REE.

(c) The environmental challenges are primarily due to the complex and often toxic nature of the ore body including various radioactive and non-radioactive impurities which require extensive use of water and chemicals/alkalis/acids for extracting the requisite material.

(d) In the Indian context, the resource of REE is occurring with radioactivity, making the extraction process long, complex and expensive. During the process some quantity of radioactive residue is generated which is stored in compliance with Atomic Energy Regulatory Board (AERB) guidelines. In industrial practice, low emission process/clean process with net zero objectives are recommended and industry is mandated to achieve it with defined timelines. The stringent implementation of environmental conditions prescribed in the Environmental Clearance (EC) and Coastal Regulation Zone (CRZ) clearance ensures long term sustainability of mining projects. Adherence to EC conditions is to be confirmed regularly by the project proponent as part of half yearly compliance report under the Environment Impact Assessment (EIA) Notification, 2006 and CRZ Notification, 2011/2019. Regulatory authorities of the Ministry of Environment Forest & Climate Change (MoEF&CC) viz. Regional Offices, Central Pollution Control Board and State Pollution Control Board also regularly review the compliance status through site inspection.

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