GOVERNMENT OF INDIA
DEPARTMENT OF ATOMIC ENERGY
LOK SABHA
UNSTARRED QUESTION NO.2494
TO BE ANSWERED ON 01.08.2018

THORIUM RESERVES

2494. SHRIMATI VEENA DEVI:

Will the PRIME MINISTER be pleased to state:

(a) whether shifting over to the use of thorium as a nuclear fuel is likely to help end the dependence on imports of atomic fuel;

(b) if so, the details thereof and the steps taken by the Government in this regard; and

(c) the quantum of thorium reserves estimated to be present in the country at present, State/UT-wise along with the extraction potential of the same, State/UT-wise?

ANSWER

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

(a) No, Madam. Shifting over to the use of thorium as a nuclear fuel would not end the dependence on imports of nuclear fuel.

(b) Imported fuel (natural uranium) contains fissile isotope (Uranium-235), which undergoes nuclear fission in a reactor to produce energy. It is not possible to build a nuclear reactor using thorium (Thorium-232) alone due to its physics characteristics. Thorium has to be converted to Uranium-233 in a reactor before it can be used as fuel. With this in view, a three-stage nuclear power programme, based on a closed nuclear fuel cycle has been chalked out to use thorium as a viable and sustainable option, right at the inception of India's nuclear power programme. The three stage nuclear power programme aims to multiply the domestically available fissile resource through the use of natural uranium in Pressurised Heavy Water Reactors, followed by use of plutonium obtained from the spent fuel of Pressurised Heavy Water Reactors in Fast Breeder Reactors. Large scale use of Thorium will subsequently follow making use of the Uranium-233 that will be bred in Reactors. Efforts towards technology development and demonstration are being made now, so that a mature technology is available in time.

Steps taken by Department of Atomic Energy for the utilisation of Thorium in different types of reactors. Some important activities are mentioned below:

i) Thorium Oxide (Thoria) pellets contained in bundles have been used in the initial cores of our operating Pressurised Heavy Water Reactors (PHWRs) and valuable experience has been generated in operation and re-use of this irradiated thorium fuel. Thoria based fuels have also been irradiated in the research reactors of Bhabha Atomic Research Centre (BARC). After such irradiation these fuel elements have been examined in the laboratories at BARC, yielding excellent results.

ii) The irradiated thoria pins of research reactors have been reprocessed to obtain Uranium-233. The recovered Uranium-233 has been fabricated as fuel for the 30 kW (thermal) Kalpakkam Mini Reactor (KAMINI), which is in operation at Indira Gandhi Centre for Atomic Research (IGCAR) at Kalpakkam. This is the only reactor in the world operating with Uranium- 233 fuel.

iii) Technologies for fabrication of Thoria based fuel pellets, carrying Uranium-233, have been established.

iv) A Critical Facility for Advanced Heavy Water Reactor was commissioned in 2008 at BARC and is being used since then for carrying out experiments to further validate the physics design features of Advanced Heavy Water Reactor (AHWR).

(c) Thorium-bearing mineral monazite occurs in association with other Beach Sand Minerals (BSM) such as ilmenite, rutile, zircon, garnet and sillimanite in unconsolidated form along the coastal and inland placer sands of the country. Atomic Minerals Directorate for Exploration and Research (AMD), a constituent unit of Department of Atomic Energy (DAE) has identified and evaluated 128 BSM deposits in the coastal beach placer sands in parts of Kerala, Tamil Nadu, Odisha, Andhra Pradesh, Maharashtra and Gujarat and in the inland riverine placer sands in parts of Jharkhand and West Bengal.

The total resource of monazite contained in these 128 deposits is 12.467 million tonne (Mt). State-wise details of in situ monazite resource established by AMD (as on June, 2018) are given below.

State	No. of deposits	Resource (Million tonne)
Odisha	10	3.06
Andhra Pradesh	26	3.69
Tamil Nadu	51	2.46
Kerala	35	1.84
West Bengal	1	1.20
Jharkhand	1	0.21
Maharashtra	3	0.004
Gujarat	1	0.003
Total	128	12.467

Monazite in these placer sands contains about 9-10% thorium oxide (ThO_2). The monazite resource (12.47 million tonne) contains approximately 0.98 million tonne thorium metal (Th) or approximately 1.12 million tonne thorium oxide (ThO_2).

In India, Monazite available in beach sand is the main source of Thorium. Indian Rare Earths Limited (IREL), Orissa Sands Complex (OSCOM), Odisha has installed a 10,000 tons/ year Monazite Processing plant for production of Nuclear Grade Ammonium Di-urante (NGADU), Trisodium Phosphate (TSP), Rare Earth Chloride ($RECL_3$) along with 2,000 tons/year capacity of Thorium Oxalate.

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