GOVERNMENT OF INDIA
ATOMIC ENERGY
LOK SABHA

UNSTARRED QUESTION NO:634
ANSWERED ON:27.02.2013
THORIUM BASED REACTORS
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Will the Minister of ATOMIC ENERGY be pleased to state:

(a) whether India is actively pursuing a research programme for developing thorium-based reactors for generation of power and if so, the details thereof;

(b) whether the said research programme is being carried on in collaboration with other nations and public/private institutions, and if so, the details thereof;

(c) whether the vast reserves of thorium in Kerala is being considered as a national resource and adequately protected; and

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

Answer

THE MINISTER OF STATE FOR PERSONNEL, PUBLIC GRIEVANCES & PENSIONS AND PRIME MINISTER'S OFFICE (SHRI V. NARAYANASAMY) :

(a) Yes, Sir. Thorium plays a pivotal role in Indian Nuclear power programme. Right from the inception of Indian nuclear power programme, work has been carried out on various aspects of thorium utilisation-mining and extraction of thorium, fuel fabrication, irradiation in reactors, reprocessing and refabrication. In addition, studies have been carried out regarding use of thorium in different types of reactors. Details of Research Programme:

(i) Thorium fuel fabrication through powder pellet route has been well established. Few tons of fuel have been made for CIRUS and Dhruva, Pressurised Heavy Water Reactor (PHWR) and for blanket assemblies for Fast Breeder Test Reactor (FBTR). Few pins have been fabricated using mixed oxides of (Th-Pu) for irradiation in research reactors.

(ii) Thoria bundles are used in the initial cores of PHWR. The irradiation experience of thoria fuel in the research reactors CIRUS and Dhruva, PHWR and test irradiations are satisfactory.

(iii) The thoria pins of CIRUS have been reprocessed to obtain U233. The recovered U233 has been fabricated as fuel for KAMINI reactor at Kalpakkam. The Post Irradiation Examination of one of the thoria bundle irradiated in PHWR has also been carried out for validation of theoretical analyses.

(iv) Studies have been carried out regarding use of thorium in different types of reactors with respect to fuel management, reactor control and fuel utilisation.

(v) A Critical Facility for Advanced Heavy Water Reactor has been commissioned in 2008 and is used for carrying out experiments to further validate the physics design features of Advanced Heavy Water Reactor.

(vi) A small research reactor KAMINI with 30 kWth capacity which utilises nuclear fuel based on Uranium-233 derived from irradiation of thorium, has been in operation at Indira Gandhi Centre for Atomic Research (IGCAR), Kalpakkam.

Generation of power from Thorium:

(i) While it is true that Thorium can be used to produce nuclear energy, it should be noted that Thorium cannot be used directly. Thorium does not contain any fissile isotope, hence it cannot be used in a reactor alone. It can be used with added fissile material that can be either enriched Uranium, Plutonium or Uranium-233 (obtained after irradiation of Thorium).

(ii) Thorium absorbs the neutrons, which can more efficiently produce more Plutonium in Fast Breeder Reactor for a faster growth. Therefore, using Thorium in the first, or an early part of second stage of nuclear power programme will adversely affect the rate of growth of nuclear power generation capacity in the initial periods.

(iii) Due to these reasons, large scale deployment of Thorium is to be postponed till the later part of the second stage. Thorium is to be introduced only at an optimal point during operation of Fast Breeder Reactors in the second stage. Thorium, for power generation is to be used mainly in the third stage. The time taken for large scale thorium deployment is around 3 - 4 decades after the

commercial operation of Fast Breeder Reactors with short doubling time. All efforts towards technology development and demonstration are made, so that a mature technology is available in time. The third stage of Indian nuclear power programme contemplates making use of Uranium-233 to fuel Uranium-233 − Thorium based reactors, which can provide energy independence to the country for several centuries.

(iv) To accelerate thorium utilisation, BARC has designed an Advanced Heavy Water Reactor (AHWR) to serve as a technology demonstrator. The 300 MWe reactor is specially meant for demonstration of large scale commercial utilisation of thorium, generating nearly 70% of its power from in-situ burn up of thorium. The design of all nuclear systems of the reactor has been completed and associated confirmatory R&D is in a very advanced stage. Detailed engineering is being carried out in consultancy mode.

(b) No, Sir.

(c)&(d) Thorium is a naturally occurring radioactive chemical element and it plays a pivotal role in Indian Nuclear power programme. The Government has notified Thorium as Prescribed Substance under the Atomic Energy Act 1962. The Government has also notified Atomic Energy (Working of the Mines, Minerals and Handling of Prescribed Substances) Rules 1984 under which no person shall mine, mill, process and/or handle any ore mineral or other material from which any one or more of the Prescribed Substances can be extracted, without obtaining a license and except in accordance with the terms and conditions of such license.