GOVERNMENT OF INDIA
ATOMIC ENERGY
LOK SABHA

UNSTARRED QUESTION NO:1181
ANSWERED ON:21.03.2012
THORIUM BASED NPP
Kanubhai Patel Jayshreeben

Will the Minister of ATOMIC ENERGY be pleased to state:

(a) whether scientists have now started to experiment the power of other radioactive element, thorium for safe and clear energy source;

(b) if so, whether according to them, the thorium based small nuclear reactors can make the world free from its dependency on coal and natural gas;

(c) if so, the reaction of the Government thereto and whether the Government is contemplating to use it; and

(d) if so, the time as well as the manner by which it is likely to be done?

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. In fact, right at the beginning of our nuclear power programme, use of thorium as an energy source has been contemplated during the third phase. 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, and irradiation in reactors, reprocessing and refabrication. In addition studies are underway for utilisation of thorium in different types of reactors.

(b) India has vast reserves of Thorium. Total estimated reserves of monazite in India are about 10.7 million tonnes (containing about 0.84 million tonnes of thorium metal) occurring in beach and river sands in association with other heavy minerals. Out of nearly 100 deposits of the heavy minerals, at present only 17 deposits containing about ~4 million tonnes of monazite have been identified as exploitable. Mineable reserves are ~70% of identified exploitable resources. Therefore, about 2,25,000tonnes of thorium metal is available for nuclear power programme.

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. This will avoid the dependency on coal and natural gas.

(c) Use of Thorium as an energy source has been contemplated during the third phase of our nuclear power programme. Right from the inception of Indian nuclear power programme, work has been carried on various aspects of thorium utilisation-mining and extraction of thorium, fuel fabrication, irradiation in reactors, reprocessing and refabrication. In addition, studies are underway for utilisation of thorium in different types of reactors.

(d) Thorium can be used to produce nuclear energy, but not directly. On account of physics characteristics of Thorium, it is not possible to build a nuclear reactor using Thorium alone. Thorium has to be converted to U-233 in a reactor before it can be used as fuel.

However, for efficient conversion of Thorium to Uranium-233, Fast Breeder Reactors are required. 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.

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, will be used mainly in the third stage. The time of large scale thorium deployment is expected to be 3 - 4 decades after the commercial operation of Fast Breeder Reactors with short doubling time. All efforts towards technology development and demonstration are being made now so that a mature technology is available in time. Various steps taken in that direction are as follows:

i) Thorium fuel fabrication through powder pellet route has been well established. Few tons of fuel have been made for CIRUS and Dhruva, PHWR and for blanket assemblies for 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) Thoria pins of CIRUS have been reprocessed to obtain U233. The recovered U233 has been fabricated as fuel for KAMINI reactor, which is a small research reactor with 30 kWth capacity based on Uranium-233. It is in operation at Indira Gandhi Centre for Atomic Research (IGCAR), Kalpakkam.

iv) The Post Irradiation Examination of one of the thoria bundle irradiated in PHWR has also been carried out for validation of theoretical analyses.

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

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

vii) To accelerate thorium utilisation, BARC has designed an Advanced Heavy Water Reactor (AHWR). The 300 MWe Advanced Heavy Water Reactor is specially meant for large scale commercial utilization 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.