GOVERNMENT OF INDIA
DEPARTMENT OF ATOMIC ENERGY

RAJYASABHA
STARRED QUESTION NO. 299
ANSWERED ON 27.03.2025

DEVELOPMENT AND DEPLOYMENT OF SMR IN THE COUNTRY

*299. SHRI SANJEEV ARORA:

Will the PRIME MINISTER be pleased to state?

(a) the current status of India's Small Modular Reactor (SMR) development and its potential role in the energy transition;
(b) whether the Government has collaborated with international agencies on SMR technology;
(c) the measures taken to strengthen nuclear safety in the wake of global discussions on nuclear security risks; and
(d) the details of the nuclear waste management strategies being implemented?

ANSWER

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

(a) to (d) : A statement is placed on the Table of the House.

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STATEMENT REFERRED TO IN REPLY TO PARTS (A) TO (D) IN RESPECT OF RAJYA SABHA STARRED QUESTION NO. *299 FOR REPLY ON 27.03.2025 REGARDING DEVELOPMENT AND DEPLOYMENT OF SMR IN THE COUNTRY ASKED BY SHRI SANJEEV ARORA.

(a) Three types of small modular reactors (SMRs) are planned to be developed and deployed. Current status of these new reactors being pursued is mentioned below:

i. Bharat Small Modular Reactor (BSMR-200), is Completely indigenous 200 MWe Pressurised Water Reactor (PWR). DAE has requisite scientific & technological know-how for its design and development. Majority of equipment are within manufacturing capability of Indian industries. It can be deployed as captive plant for bigger industries, and exclusion zone required will be significantly lower. Proposal for construction of lead unit of BSMR 200 MWe at DAE site is to be placed for in-principle approval.

ii. Small Modular Reactor (SMR) is 55 MWe Pressurised Water Reactor, the design is block type and highly modular. Exclusion zone for this reactor is not beyond plant boundary. Two lead units are planned to be installed at DAE site. Currently, the conceptual design of this reactor is in advanced stage. Necessary technology for deployment of these reactors is available in the country and majority of equipment are within manufacturing capability of Indian Industries.

iii. Conceptual design of Indian Gas Cooled Reactor (IGCR) (5 MWth) is being carried out. The high temperature reactor will be coupled with plant utilising thermo-chemical process for demonstration of hydrogen production. Nuclear power is considered as one of the most promising clean energy options for power generation. There is a thrust world over to use nuclear power that could reduce reliance on fossil fuels over the coming years. SMRs will play important role as captive power plants in energy intensive industry and for providing reliable energy source in remote areas.

(b) In view of availability of requisite in-house expertise for advanced nuclear technology development required for nuclear reactors described in answer (a), international collaborations are not pursued. However, India being a Member State of International Atomic Energy Agency (IAEA) participates regularly in technical events organised by IAEA for knowledge sharing.

(c) The important threats to nuclear safety and security for the Indian nuclear power plants are theft of nuclear material and sabotage of nuclear facilities. For the mitigation of these threats, mutli-layers / defence in depth, physical protection measures in terms of detection, delay and response are implemented in every Indian nuclear power plant.

Rigorous procedure is in place for design, development and operation of the systems used in Indian NPPs.

For safety and security of the critical systems, they are designed and developed in-house using custom built hardware and software. These systems are subjected to independent regulatory verification and validation by Atomic Energy Regulatory Board (AERB). AERB's regulations and guidelines are in-line with international standards laid down by International Atomic Energy Agency (IAEA).

Radiation monitors have been deployed nationwide under the Indian Environmental Radiation Monitoring Network (IERMON) for continuous surveillance.

Radiation Emergency Response Centres (RERCs) have been established in the country for technical support in responding to nuclear or radiological emergencies.

Highest priority is accorded to safety in all aspects of nuclear power viz, siting, design, construction, commissioning and operation. Nuclear power plants are designed adopting safety principles of redundancy, diversity and provide fail-safe design features following a defence-in depth approach. This ensures that there are multiple barriers between the source of radioactivity and the environment. These safety principles are independent of operator.

The Government of India is a signatory to the Convention on Nuclear Safety which aims to achieve and maintain a high level of nuclear safety worldwide. The adherence to the obligations of the Convention are periodically peer reviewed by the Contracting Parties.

AERB, through its regulations, ensures that effective defenses in nuclear installations against potential radiological hazards are established and maintained, in order to protect individuals, society and the environment from harmful effects of ionizing radiation from such installations; prevent accidents with radiological consequences and to mitigate such consequences, should they occur.

With respect to nuclear security, AERB also regulates those aspects of nuclear security which have a bearing on safety, within the main plant boundary of Nuclear Power Plant (NPP), as per requirements specified in the AERB document titled "Nuclear Security Requirements for Nuclear Power Plants".

State-of-the-art security measures are in place to ensure threat detection and response in nuclear power stations. These are implemented as an integral part of the Nuclear Power Plants and subjected to periodic audits, reviews and necessary upgrades.

(d) The nuclear waste generated from the operation of nuclear power plants is managed safely in accordance with established safety regulations. It undergoes pre-disposal processes, followed by conditioning and disposal within engineered barriers at near-surface disposal facilities. Adherence to regulatory requirements, along with continuous monitoring and surveillance, ensures the safe disposal of nuclear waste in line with international standards. Advancements in technology and innovation strategies focus on waste minimization, as well as the recovery and recycling of valuable radioisotopes for societal and industrial applications.

All the nuclear power plants have authorization from Atomic Energy Regulatory Board (AERB) under the Atomic Energy (Safe Disposal of Radioactive Wastes) Rules, 1987 (G.S.R.125), to discharge radioactive effluents within the specified limits through designated routes. The limits for radioactive effluent discharges specified by AERB are

based on the internationally followed norms and safe practices. The nuclear waste handling, treatment, storage and disposal are carried out as per the well laid down procedures and guidelines stipulated by the AERB in accordance with the Atomic Energy (Safe Disposal of Radioactive Wastes) Rules, 1987 and the requirements of AERB Safety Code on 'Management of Radioactive Waste (AERB/NRF/SC/RW)'.

The wastes generated at the nuclear power stations during their operation are of low and intermediate radioactivity level. These wastes are appropriately treated, concentrated and subjected to volume reduction. The concentrates are immobilized in inert materials like cement, bitumen, polymers etc. and stored in specially constructed structures (near surface disposal facilities) located at the site under monitoring. The treated liquids and gases are diluted and discharged under continuous monitoring, ensuring that the discharges are well within the limits set by Atomic Energy Regulatory Board (AERB). The radioactivity level of the stored wastes reduces with time and by the end of the plant life, falls to very low levels.

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