Nuclear Waste Management

Prelims – *Current events of National and International Importance| Science & Technology.*

Why in News?

Recently, the government highlighted ongoing research and regulatory reforms aimed at safely managing nuclear waste from its 100 GW nuclear power expansion target-2047.

- **Need -** To protect the environment from harmful radiation and ensure public health and safety.
- To support long-term use of nuclear energy in a sustainable way.
- To manage the expected rise in nuclear waste from the planned expansion to ***100 GW by 2047,*** using India's existing, well-established waste management practices.
- **Regulations –** The Atomic Energy Act,1962 and the Atomic Energy (Safe Disposal of Radioactive Wastes) Rules 1987.
- **Waste management philosophy –** No waste in any physical form is released/disposed of to the environment unless the same is cleared, exempted or excluded from regulations.
- **Closed fuel cycle –** It recovers fissile material and reduces the burden of nuclear waste management, where domestic spent fuel is reprocessed.
- Most of its components are recycled back as fuel for future reactors.
- **Radioactive waste management –** It is generated at nuclear power plants, during their operation, and is of low & intermediate activity levels and is managed at the site.
- It is generated during the operational life, and decommissioning is within ***0.15 cubic meters per year per MW.***
- **Treatment and storage –** It is treated, concentrated, compacted, and immobilized in solid materials like cement.
- Disposed in specially designed engineered structures such as reinforced concrete trenches and tile holes, constructed within the plant site.
- High-level radioactive waste generated during reprocessing is

immobilized in an ***inert glass matrix by vitrification*** and stored in Solid Storage Surveillance Facilities.

- **Monitoring disposed waste –** Disposal sites are constantly monitored using bore-wells placed strategically around them.
- Regular checks of underground water and soil ensure that radioactive waste is safely contained.
- **Maintaining global Standards –** Nuclear waste management follows international practices and guidelines set by the ***International Atomic Energy Agency (IAEA).***

The International Atomic Energy Agency is the world's central intergovernmental forum for scientific and technical cooperation in the nuclear field. It works for the safe, secure and peaceful uses of nuclear science and technology, contributing to international peace and security.

- **Record maintenance –** It is regularly filed with the regulatory authority regarding the quantity and location of such waste disposed.
- **Future responsibilities –** Ground-preparatory activities are to be completed within a tight time frame of 5 to 7 years.
- It focuses on policy, legal, and regulatory reforms in all related areas of nuclear power generation, including spent fuel reprocessing and waste management.
- R&D on partitioning technologies to recover long-lived radioactive elements and extract useful radioisotopes for societal application, waste volume reduction.
- Long-lived radioactive actinides can be converted into short-lived or inactive forms through incineration.
- This process may remove the need for long-term disposal of nuclear waste in the future.

Reference

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