Source : www.thehindu.com Date : 2024-01-28

MINIMAL RADIOACTIVE DISCHARGES FROM INDIAN NUCLEAR PLANTS: STUDY

Relevant for: Science & Technology | Topic: Science and Technology- developments and their applications and effects in everyday life

January 27, 2024 10:49 pm | Updated January 28, 2024 12:00 am IST

A cooling tower at the Rajasthan Atomic Power Station, RAPS-5 in Rawatbhatta, Rajasthan. File | Photo Credit: The Hindu

Based on an analysis of radiological data of 20 years (2000-2020) from six nuclear power plants based in India, researchers at the Bhabha Atomic Research Centre (BARC), Mumbai have found that the radioactive discharges from the nuclear plants and the resultant potential environmental impact have been “minimal”. “The findings hold potential significance for reinforcing India’s commitment to advancing its nuclear power programme,” the authors write. “The minimal public doses underscore the safe operation of Indian nuclear power plants. The study’s findings have the potential to dispel unfounded beliefs, serving as a catalyst to reinforce India’s commitment to advancing its nuclear power programme, thus encouraging policymakers and the public to reconsider their perspectives.”

The period of study for the Kudankulam Nuclear Power Station is from 2013 to 2020. The other six power plants studied are: Tarapur Atomic Power Station, Madras Atomic Power Station, Kaiga Generating Station, Rajasthan Atomic Power Station, Narora Atomic Power Station, and Kakrapar Atomic Power Station. The results were published recently in the journal Science of the Total Environment.

While samples were collected and measured for a maximum radius of 30 km of each nuclear plant, the study found that the concentrations of fission products beyond 5 km radius was below the minimum detectable activity of the instruments used, implying that the monitored values were “insignificant”. The study has therefore focussed only on the concentrations of fission products and neutron-activated nuclides values within 5 km of each nuclear plant.

The gaseous waste that is released to the atmosphere through stacks consists of fission product noble gases, Argon 41, radioiodine, particulate radionuclides —cobalt-60, strontium-90, caesium-137 — and tritium. The liquid discharge consists of fission product radionuclides — radioiodine, tritium, strontium -90, caesium-137 — and activation products like cobalt-60. The radioactive discharges are carried out through dilution and dispersion and by “adhering to strict radiological and environmental regulatory regimes”.

As per the study, average gross alpha activity in air particulates at all the seven nuclear plants

was less than 0.1 megabecquerel (mBq) per cubic metre. “Though these gross values in air particulates appeared to be nearly the same across all the nuclear power plants, the Narora atomic power station (NAPS) exhibited higher maximum values than the other nuclear plants. This was attributed to the higher atmospheric dust load at NAPS compared to the other sites,” the authors write.

In the case of specific marker, the average radionuclides (iodine-131, caesium-137, and strontium-90) in air particulates across all the seven sites and the average iodine-131 activity concentration was below 1 mBq per cubic metre, while in the case of caesium-137 and strontium-90, the average concentrations were three orders lower and below 10 microbecquerel per cubic metre, they write.

In the case of rivers and lakes, the concentration of caesium-137 and strontium-90 were below 5 mBq per litre, while the concentration was less than 50 megabecquerel per litre in sea water near the nuclear plants.

In the case of sediments, caesium-137 concentration was maximum in the case of the Rajasthan Atomic Power Station, while strontium-90 concentration in the sediments recorded a maximum in the Narora atomic power station sediments. “These values are within the statistical variation of values observed in natural sediments, and do not show any trend of deposition or accumulation of activity in the environment,” they note.

The higher levels of caesium-137 seen at the Rajasthan Atomic Power Station is “likely due to the accumulation of caesium-137 discharged to the water bodies through scavenging and sedimentation process and because of the high distribution coefficient of the sediment at this site,” they write.

The authors stress that tritium was found “detectable above the minimum detectable activity in all the sites except in the Kudankulam Nuclear Power Station”. In the case of the Kudankulam power plant, tritium was “not detected in any single time during the period of study”, while its concentration was “relatively higher” at the Rajasthan Atomic Power Station.

Though the total doses have been lower than the regulatory limits, the total dose at the Rajasthan atomic power station, Madras atomic station and Tarapur atomic power station have been relatively higher. This is because at both the Rajasthan and Madras power stations, the “air-cooled reactor assemblies result in activation of natural argon to radioactive argon-41” before being released into the environment. The nuclear power plants constructed after the Rajasthan and Madras stations use carbon-dioxide instead of air in the annulus space between the calandria tube and pressure tube. This results in reduced production and release of argon-41 by other power plants.

Even though the total doses of Rajasthan, Madras and Tarapur power plants are below the regulatory limits and thus deemed to be safe to the public, efforts are being taken at all three sites to limit the doses further so as to keep the doses as low as reasonably achievable (ALARA), they note.

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