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A review of argon-41 and tritium emissions following the decommissioning of Australia's HIFAR research reactor and the introduction of OPAL, Australia's new research reactor

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Abstract

The Australian Nuclear Science and Technology Organisation (ANSTO) operated the HIFAR research reactor from 1958 to 2007. During this period HIFAR produced radioactive discharges to the atmosphere which complied with regulatory licence conditions to operate the facility. Noble gases are released during the fission process of uranium fuel. When HIFAR was at power, neutron activation of argon-40 in air, in the voids of some irradiation facilities, produced significant quantities of argon-41. Tritiated water vapour (DTO_2) or tritium was similarly formed by neutron activation of the heavy water moderator. Airborne emissions of argon-41 and tritium were the major contributors to the off-site public dose from HIFAR operations (estimated at the 1.6 km buffer zone boundary).

HIFAR was officially shutdown on 30 January 2007 and ANSTO'S replacement research reactor, OPAL, now provides neutrons for research and the production of radioisotopes. Since the commissioning of the OPAL research reactor releases of argon-41 and tritium to the atmosphere have dramatically decreased.

The facility licence granted by ARPANSA to operate the OPAL reactor specifies permissible airborne discharge limits for argon-41 and tritium that are respectively 75 and 98 percent lower than the original HIFAR discharge limits. Stack discharge data for noble gases and tritium from OPAL confirm the anticipated reduction of these radionuclides entering the environment. Tritium concentrations in discharges of ANSTO low-level liquid effluent to the Sydney Water sewer have also declined significantly. ANSTO regularly monitors stormwater leaving the site, as well as the nearby Woronora River. The results show that concentrations of tritiated water in the local environment have fallen below method quantification limits since HIFAR was permanently shut down and are well below the level considered safe for Australian drinking water.

The data presented will compare pre- and post-OPAL emissions of argon-41 and tritium, demonstrate regulatory compliance with the HIFAR Defuelled Facility licence and show a significant reduction in public dose estimates for reactor operations at the ANSTO boundary. The demonstrated improvement in environmental performance of the OPAL replacement research reactor will be reflected in the next review of ANSTO's Environmental Monitoring program.