Safe Management and Effective Utilization of the PALLAS Research Reactor

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The High Flux Reactor (HFR) in Petten, The Netherlands, is one of the world's main isotope production and research reactors. Given the advanced age of this reactor (50 years of operation in 2011), the Nuclear Research and Consultancy Group (NRG) has taken the initiative to build PALLAS, a flexible and high capacity research reactor. PALLAS will become part of the dense network of adjacent facilities on the Petten research site — for instance the hot-cell laboratories used for post irradiation examination and a Mo-production facility.

The paper will address the safe management and foreseen effective utilization of the PALLAS research reactor which realisation is based on 50 years of experience in operating, maintaining and using the HFR as well as an integrated project organisation for the design and build phases of PALLAS. The design and safety demonstration comply with the IAEA safety requirements and guidelines and take into account the lessons learned and stress test approach following the Fukushima accident.

Bases for the design and safety analyses are:

— Tank-in-pool reactor type, power range 30 to 80 MW;
— Flexible core design in view of market development and fuel utilization efficiency;
— Radio-isotope production and fuel and materials' research in core and reflector zone;
— Uranium silicide fuel in proven plate configuration with the option to convert to uranium molybdenum fuel;
— Long autarchy period in view of loss of power and/or ultimate heat sink and logistic obstacles;
— Wide variety of DBA (postulated internal and external) and BDBA based on requirements for NPP using a graded approach;
— Level 1 to 3 PSA.

The project is executed fully transparent with the national press, the local community and the different governmental institutions involved; regular meetings with the competent authorities and the local communities are in place to increase both awareness and support. The project is also supported by the latest NEA and OECD reports on the supply of medical isotopes.

The future utilization is based on a thorough business case in which the present situation, the foreseen market development and, of course, the long-term experience with the HFR are taken into account. To ensure maximum flexibility in view of possible changes in market demands, the design of the core and its irradiation positions will allow for modular use and inter-changeability. Cycle to cycle power variation will be possible with subsequent changes in the OLCs concerned. To ensure a high level of availability, diverse and independent removal of the generated heat is included in the design by means of a water cooled secondary system and the possibility to use air coolers. At the commissioning phase several reference isotope production devices and reference experimental devices will be used to verify the safety aspects, functional behaviour and performance of the PALLAS reactor and its irradiation devices in an integrated manner. During the development of these devices the HFR will be used for the testing of the mock-ups and dedicated handling equipment.

With the realisation of PALLAS a vital tool for the production of radioisotopes and the irradiation of nuclear fuels and structural materials will become available for the international community.

References

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