The Jules Horowitz Reactor: Production of Radioisotopes for Medical and Industry Purposes.

Seminar at French Embassy in Japan (April 2019)

Context

The Jules Horowitz Reactor (JHR) is a Material Testing Reactor currently under construction at the CEA Cadarache. The reactor will perform Research and Development programs for the optimization of the present generation of Nuclear Power Plants (NPPs), support the development of the next generation of NPPs and also offer irradiation possibilities for future reactors. JHR will offer irradiation experimental capacities to study material and fuel behaviour under irradiation. The reactor will also be devoted to medical radioisotope production as well as industrial radioisotopes.

Jules Horowitz Reactor Capabilities

In the framework of the isotopes production project on the JHR, we have developed ^{99}Mo irradiation systems and associated tools. The ^{99}Mo will be produced by irradiation of low enriched uranium targets. JHR could be able to contribute for 25% to 50% of the European needs of medical radioisotopes, especially for the ^{99}Mo-^{99m}Tc.

In case of global shortage and with specific provisions taken where appropriate, our maximum capacity could be able to reach up to about 20% of the world's annual demand in ^{99}Mo. In this configuration, ten millions of patients could benefit yearly from radio-isotopes produced on JHR. The flexibility of this production capacity will contribute to limiting future risks of shortages for five decades.

In the same way, the JHR will also able to develop the necessary devices and tools for the production of other radioisotopes in support of nuclear medicine (diagnostic and therapy).

Many irradiation positions are located in the Beryllium reflector. The potential thermal neutron fluxes will allow JHR to produce by neutron activation ^{90}Y, ^{153}Sm, ^{166}Ho, ^{169}Er, ^{177}Lu, ^{186}Re, ^{192}Ir, ^{103}Pd, and ^{125}I (as examples) for medical purpose. Production of radioisotope in fast and epithermal neutron fluxes could be investigated. Finally, JHR could also produce radioisotopes for industrial purpose as ^{192}Ir, ^{60}Co, ^{75}Se and ^{169}Yb.

CEA is experienced in the radioisotope supply chain, since operating, for many years, irradiations in OSIRIS or ORPHEE reactors (CEA Saclay). From the raw material prior to the irradiation to the shipping container departure with the irradiated items, every step of the supply chain inside the facility could be adapted to specific customers.

Conclusion

JHR will be on the radioisotope market for the next decades. CEA is committed to remain a major actor of worldwide network for sustainable long-term production. JHR, with an enhanced target capacity, will contribute to the security of supply of radioisotopes, both medical (diagnostic and therapeutic) and industrial. It is scheduled that JHR will produce

radioisotopes as soon as possible after JHR criticality. Consequently, for medical purposes, ten millions of patients could benefit yearly from radioisotopes produced on JHR.

Objectives of the seminar

The following topics will be addressed during the seminar:

- Detailed presentation of the current status of JHR equipment's for radioisotope productions and associated capabilities
- Direct contacts with medical communities
- Direct contacts with R&D organization working on targeted radionuclide therapies
- Direct contacts with companies.