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RA10 New Research Reactor for Medical Isotope Production in Argentina

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BACKGROUND

Radioisotopes are widely used in medicine, industry and science, being medical diagnostics the principal purpose. Tc-99m, is used for the detection of disease and for the study of organ structure and function using diagnostic imaging. This radioisotope is especially useful for nuclear medicine procedures due to can be chemically bounded into small molecule and proteins that concentrate in specific organs or tissues when injected into the body. Its half-life is 6 hours and emits 140 keV photons. This photon energy is suited for efficient detection by scintillation instruments such as gamma cameras and the collected data are analyzed to produce detailed structural and functional images.

HISTORY

In Argentina, the National Atomic Energy Commission (CNEA) has been producing Mo-99 since 1985, employing highly enriched uranium (HEU)/aluminum alloy targets. In the year 2000 the RA-3 reactor, located at the Ezeiza Atomic Center (CAE), 40 km from Buenos Aires city, increases power from 5 to 10 MW to increase the production of Mo-99. Bearing in mind commitment of Argentina towards the Treaty on Non-Proliferation of Nuclear Weapons (NPT) and other world initiatives for stricter control of nuclear material, since 2002 CNEA has been developed Mo-99 production methods changing from HEU to Lowly Enriched Uranium (LEU)/Material Testing Reactor (MTR) fuel elements.

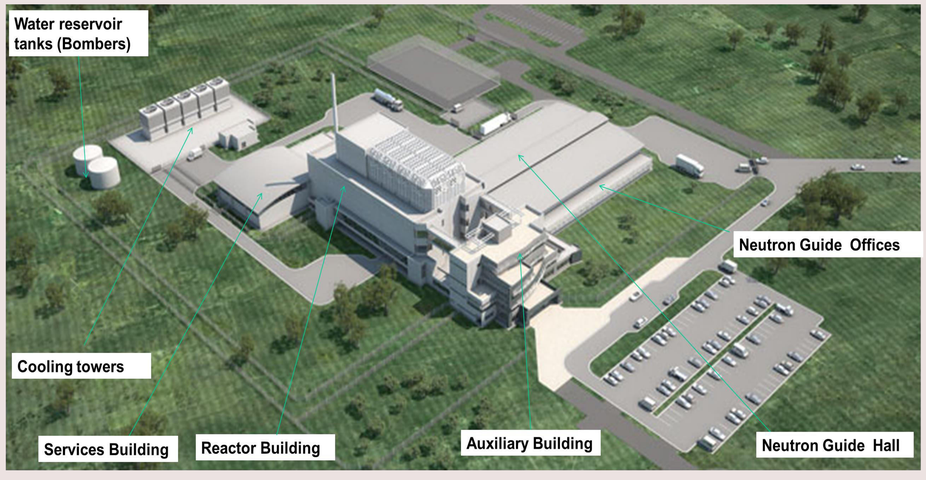
RA10 NEW RESEARCH REACTOR

CURRENT SITUATION

Tc-99m is the decay product of Mo-99. The process for its production includes the fission of U-235 and the purification in a Radioisotope Production Plant. The consume of Tc-99m for radiodiagnosis is raising constantly, in our country about 2 millions of studies are performed every year.

Taking into account the high demand of this radioisotope, the Argentina started the construction of a new 30 MW research reactor (RA-10), located at the CAE in order to increase the production.

The RA-10 is conceived as a multipurpose facility suitable for radioisotopes production, materials and fuel irradiation, neutron techniques applications and silicon doping. The design is based on LEU/MTR fuel element and meet the ARN Safety Regulations and International Atomic Energy Agency (IAEA) Standards. Once in operation, the RA10 will replace the old 10 MW RA3 reactor. This facility will be used for training of personnel with the objective to reach research capacity in basic sciences and technological applications based on advanced neutron techniques.



RA 10 Layout 3D

RA-10 REACTOR

Technical Features:

- 30 MW power-Open pool type
- LEU MTR fuel elements
- Operation cycle 26 continuous days
- Mo-99 weekly production >2000 Ci/W*2
- Heavy water reflector / Different geometries were used according to the radioactivity found.
- Water moderator – coolant / Upward coolant direction
- 2 independent shutdown systems: hafnium plates and heavy water reflector tank emptying

Today the weekly production is app. 900 6 days-Ci, covering at present its own demands and an exportable balance. The weekly production at the new reactor, will allow to increase the production to 2500 6 days-Ci. Such expansion will allow Argentina consolidate the provision of radioisotope for medical applications in the local market and participate of the global market consolidating the position of radioisotope producer.

THE PROJECT:

- By 2020 the National Atomic Energy Commission expects to operate the RA-10 reactor. The project includes the design, the construction and commissioning of the RA-10. The project scheduled includes hold points for regulatory assessment and licensing of safety related stages.

MILESTONES:

- Design Stage. *Finalized*

Safety Preliminary Report was technically evaluated and approved by ARN.

- Construction License. *Finalized*

A construction license for the reactor has been granted by ARN in October 2014.

- Environmental Impact Certificate. *Finalized*

Granted by local authority, OPDS - Organismo para el Desarrollo Sustentable de la Provincia de Buenos Aires, in April 2016.

- Construction Stage. *Started*

30% of the project concluded. January 2017

- Construction of the base of the reactor building. *Finalized*

It was used 3200 ton of concrete type H30 in the concrete slab, in May 2017 (see Fig. 1a and 1b).

- Training of new reactor operators. 2018
- Installation and montage of equipment. 2018

Fig. 2a shows the upper hot cells to manipulate uranium irradiated mini plates. Fig. 2b shows molibdenum device. Fig. 3 shows one the fuel elements of the reactor.

- Testing of equipment and circuits. 2019
- Initial Commissioning License by ARN. Scheduled to 2020.

Fig. 1a and 1b: Base of the reactor: 180 trucks poured 1500 m^3 of concrete over 225 ton of iron to complete the concrete slab, the similar amount to raise a building of 10 floor.

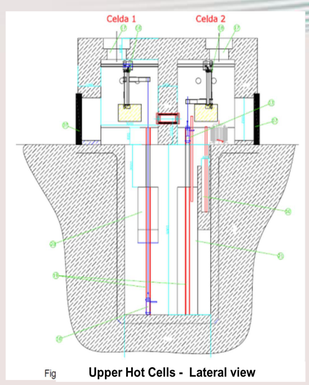


Fig. 2a: Projected upper hot cells 1 and 2 to manipulate radioisotope and irradiated samples

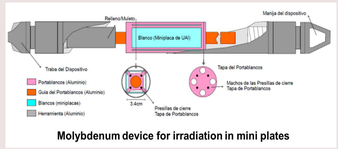


Fig. 2b: Device for irradiation of 8 mini plates of enrichment UAl_2

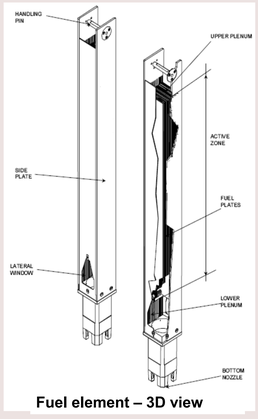


Fig. 3: fuel elements with 21 plates of enrichment uranium of U_3Si_2

NUCLEAR REGULATORY PHILOSOPHY

- ARN use optimized discharges to calculate discharge values following the philosophy of ALARA (As Low As Reasonably Achievable) concept.
- Operation license for RA-3 reactor: using this concept the authorized discharge for Xe-133 is 2.6 x E+14 Bq/y.
- Operation License for RA-10 reactor: In the side of producer is the responsibility for evaluating the improvement in engineering and devices necessary to minimize the noble gas discharges.

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