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KEY TECHNICAL AND SAFETY REQUIREMENTS FOR A NEW RESEARCH REACTOR: THE RA-10 REACTOR EXPERIENCE

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A new multipurpose research reactor which will replace RA-3 reactor has been decided to be built in Argentina to satisfy the increasing national and regional demands for radioisotopes. The project, supported by the National Administration, started in 2010 and is planned to be operative in 2019. The expertise acquired in the country, in the design and licensing of nuclear reactors, encourages the National Atomic Energy Commission (CNEA) to face the challenge. INVAP S.E. is involved in the design of the reactor facility and related installations, and will be contracted for the supplying and assembly of SSCs..
Technical and safety requirements have been early established, based on the safety objectives, concepts and principles presented in the NS-R-4. Technical requirements are based on the utilization related requirements and in a consistent reactor availability for the intended use.
Key requirements, considering as a guide, the structure and the contents of the IAEA Nuclear Energy Series No NP-T-5.6, have been met as follow:

1. Licensing
   The Operating Organization (CNEA) developed a Licensing Plan in order to achieve the licensing conditions for the facility.
   Among other features, this plan includes all the regulatory documentation that must be met in the reactor design process.
   In the frame of a Design Procedure that includes a Design Plan for each working structure, the corresponding documentation is included as design requirements that must be explicitly fulfilled. In this way the "Design Evaluation"included in the PSAR could be easily performed and concluded.
   Safety Analysis and the PSAR were elaborated by the Operating Organization.
2. Safety and Radiological Design Requirements
   The general nuclear safety objective for the RA-10 Reactor is to protect individuals, society and environment from harm by establishing and maintaining in nuclear installations effective defenses against radiological hazards.
   In order to achieve the safety objective, the project defines three main principles in the design:

2.1 Defense in depth
The application of the principle of defense in depth in the design of the research reactor provides a series of level of defense (provision of successive physical barriers, conservative design margins, inherent features, equipment and procedures, including on-site and off-site emergency procedures) which are aimed at preventing accidents and ensuring appropriate protection in the event that prevention fails.

2.2 Safety Functions
Safety functions are the essential characteristics functions associated with SSCs that ensure the safety of the reactor.
Beside the three fundamental safety function: shutting down the reactor, cooling the reactor core components continuously and confining radioactive material inside the installation, safety functions related to: fission products barrier and configurations integrity, control and monitoring, reactivity regulation and shutdown, reactor protection, radiative material confinement, core cooling, services supplying, shielding, decayment and purification and physical protection were defined and classified based on their importance to safety. Safety functions were identified to ensure the effectiveness of each level of defense in depth.

2.3 Acceptance criteria and design rules
Acceptance criteria were established for operational states, for DBAs and for selected BDBAs.
For operational states, radiation exposure within the installation or due to any planned release of radioactive material from the installation is kept below prescribed limits and as low as reasonably achievable
For DBAs and BDBAs, all accident sequences were evaluated and demonstrated to comply with the regulatory established acceptance criteria, i.e. their annual occurrence probability combined with the corresponding effective dose must meet a limiting risk level according to the national regulations.
Engineering safety features for DBAs and for BDBAs are implemented to meet this criterion.
For the design of SSCs, acceptance criteria are established in the form of engineering design rules. These rules

include requirements related to the classification of the SSCs that are important to safety.
The operative experience of the CNEA and the design experience of INVAP were the main tools for meeting the acceptance criteria.

1. Utilization related design requirements
   Utilization related requirements provided by the user were consolidated and restricted, resulting in the following utilization related design features: neutron activation analysis, radioisotopes production, neutron transmutation doping, neutron beam applications for material structure studies and neutron radiography.
2. Others key technical requirements
   The availability of the reactor is required to be consistent with its intended use. In order to assure an availability of 80% for the reactor and of 90% for the facilities, availability factors were assigned to SSCs considering its need for the reactor or facilities operation. These availability factors resulted in a quality classification for all ESCs.
   The spent fuel storage facility is required to provide space for the volume of ten years operation (20 cores). The facility will be placed in the Reactor Service Pool and will be compatible with a transportation cask for carrying the spent fuel to a general storage facility.

Organization

National Atomic Energy Commission

Country

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