Design of Target Handling System in Pool of Research Reactor

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1. Introduction

Radioisotopes are one of the main products of research reactor. The radioisotopes can be produced from uranium targets. A new target is assembled with a target holder in the pool water. The target assembly is irradiated in the reactor core located in the pool. Cooling prevents the irradiated target melting. The targets are transferred in the pool before working in the hot cell. Workers handle the target remotely from outside the pool. Many devices and system are required for handling new and irradiated targets in the pool.

In this work, we introduce the target handling system and target handling process in the pool of research reactor.

2. System Design

The target handling system is installed and used throughout the pool and the pool top area. The main function of the target handling system are loading/unloading the target assembly into/from the reactor core and the transfer of target assembly and target in the pool. The target handling system consists of many devices as shown in Figs 1 and 2.

The target holder handling tool is used for transfer of target assembly or target holder in the pool. The target holder handling tool is also used for loading of the target assembly into the reactor core. Locking device is designed to assure the engagement of the target holder handling tool and the target holder. The target holder handling tool is designed to secure sufficient area of coolant flow when the target assembly is loaded into the reactor core. The target handling tool is used for transfer of the target in the pool and loading the target into the target holder. Both handling tools enables remote manipulation by workers on the pool top. Levers are equipped for working at different levels. Appropriate depth of water shielding for the irradiated target is kept during the transfer of the target by using the handling tools.

The fresh target basket is used for transfer of the fresh target from pool top into the pool. The fresh target basket provides a storage for a target with guides for the target and the target handling tool. The target transfer basket is used for transfer of the irradiated target to the hot cell through the transfer elevator. Both baskets have holes for draining of pool water in case of lifting out of the pools.

The target handling rack provides storage for a target holder and a fresh target basket. The target holder is held in the target handling rack for loading and unloading of the target. The target holder rack provides storage for target holders. Both racks are installed in the pool water and are removable.

The target cooling station is a device for cooling the irradiated target assembly. The cooling holder provides storage for a target assembly. The target cooling station is locked during cooling of the irradiated target. The locking function is released after predetermined cooling time.

KEPIC MNF[1] is used as a guide in the design of racks and baskets.

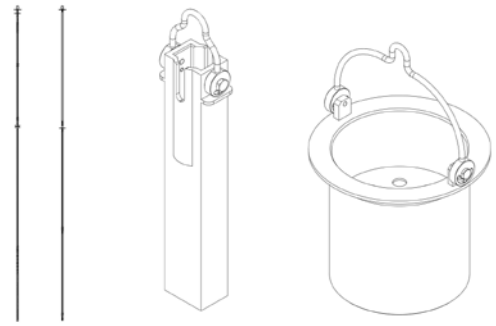

Fig. 1. Target holder handling tool, target handling tool, fresh target basket, and target transfer basket (from left to right)

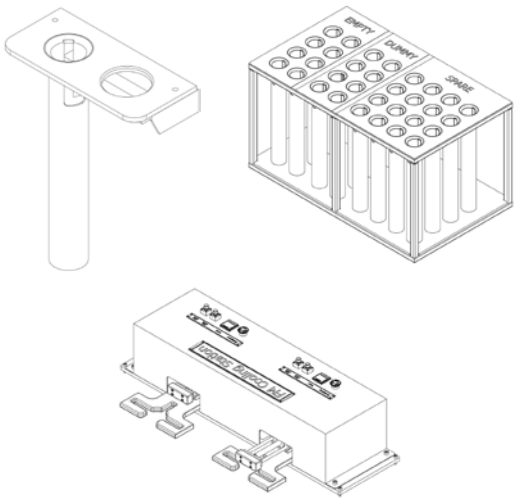

Fig. 2. Target handling rack, target holder rack, and target cooling station

3. Target Handling Process

The target handling process consists of loading of the fresh target into the reactor core, cooling after irradiation, and transfer of the irradiated target.

2.1 Loading Process

The fresh target is prepared in the fresh fuel storage room. The fresh target is loaded into the the fresh target basket. The fresh target basket with the fresh target is transferred onto the target handling rack in the pool by using hoist crane. The fresh target is taken out of the fresh target basket and is loaded into the target holder which is placed on the target handling rack by using the target handling tool. The dummy target assembly is taken out of the reactor core and is stored in the target holder rack by using the target holder handling tool. The fresh target assembly is transferred from the target handling rack to the irradiation position of the reactor core by using the target holder handling tool.

2.2 Cooling Process

After the irradiation finishes, the irradiated target should be cooled in the pool to prevent melting accident. The irradiated target assembly is taken out of the reactor core and transferred into the cooling holder of the target cooling station by using the target holder handling tool. The irradiated target can be cooled in the cooling holder for a predetermined time.

2.3 Transfer Process

After the cooling process, the irradiated target assembly is taken out of the target cooling holder and is transferred to the target handling rack by using the target holder handling tool. The target is taken out of the target holder and is transferred into the target transfer basket which is placed on the transfer elevator holder by using the target handling tool. The target is transferred to the hot cell through the transfer elevator.

4. Summary

In this work, the target handling system in the pool of research reactor is introduced. The system is designed for utilization and installation in the pool water. Function of each device in the target handling system is described. The target handling process in the pool is also described. The process includes loading the target in the reactor core, cooling the irradiated target, and transfer the target in the pool.

Acknowledgment

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REFERENCES

[1] Korea Electric Power Industry Code MNF, Korea Electric Association, 2005.