

Current Status of the Refurbishment of Five Semi-hot Cells at NRI Rez

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Abstract. The paper presents the procedure and current status of refurbishment of five semi-hot cells at Nuclear Research Institute Rez (NRI Rez). Reconstruction is carried out at the Mechanical Testing Department of Integrity and Technical Engineering Division. The whole procedure from the start of the project (feasibility study, work schedule) to the current status of refurbishment is depicted in this paper.

1. INTRODUCTION

Semi-hot cells are used at NRI Rez for mechanical testing of irradiated structural materials, usually from reactor pressure vessels within the frame of surveillance programs of Czech and Slovak commercial nuclear power stations. The system of semi-hot and hot cells at NRI Rez consists of 51 cells situated in 3 floors, from which 5 cells are at the present time in reconstruction.

The design of semi-hot cells differs significantly from hot cell facility. Hot cells, where the preparatory activities as unloading of irradiation containers and testing specimen machining are performed, are shielded by 1.25 m thick layer of heavy concrete, while standard NRI Rez semi-hot cells are shielded by 100–150 mm of lead.

The hot cells facility was constructed in NRI Rez at the end of 1970. In the first period of service until 1978, considerable attention was paid in hot cells to verifying the operational ability of fuel elements. In connection with introducing the manufacture of WWER-440 type light water reactor pressure vessels in former Czechoslovakia, hot cells were used since 1978 for an extensive program of verification tests of the technology of 15KCh2MFA steel production. In 1984 program was extended to 15KCh2NMFA steel for the WWER-1000 type reactors.

In 1980–1985, extensive reconstruction of semi-hot laboratory was carried out to enable to study experimentally the change of mechanical properties of surveillance specimens of VVER reactors. Besides the surveillance program, the main task solved in hot cells in NRI Rez is the problem of the effects of recovery heating on mechanical properties of material after the irradiation.

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FIG. 1.1. The Mechanical Testing Department's semi-hot facility.

2. REFURBISHMENT PROJECT

Starting point for the refurbishment was the strong need for enlargement of the testing capacity of Mechanical Testing Department in the scope of testing for the surveillance programs of Czech and Slovak commercial nuclear reactors. In the year 2009 was decided to refurbish five semi-hot cells from former radiochemistry facility. Preparatory activities included feasibility study of reconstruction, project work plan and obligatory approval of State Office for Nuclear Safety of Czech Republic.

Considerable attention was paid within the project to planning and continuous photo documentation. For each work was prepared detailed assignment procedure. Former radiochemistry facility consisted of five glove boxes with several rod manipulators, connected with belt conveyer transport system. Significant advantage that has been taken to account in the preparatory phase was the absence of α contamination in the former facility. This fact contributed to simplification of work procedures prepared for the dismantling phase of the refurbishment.

In the year 2010 reconstruction works started with the dismantling phase. Facility is accessible from two sides – from operator area and from active maintenance corridor. From both sides was constructed sealed area from modular plastic panels to prevent the possible contamination outside the work place. After that, glove boxes and its support construction were dismantled. Also, according to the new design of planned semi-hot cells, the shielding concrete wall of the transport system was dismantled.

Construction phase of the project started in the beginning of year 2011 with the assembly of the support system for modular steel shielding. Shielding consists of several layers of 50 mm thick steel plates connected with bolts. After assembly of the steel shielding, cells were equipped with the welded inner layer of stainless steel, which was sanded after the installation. Subsequently, construction works continued with the installation of inner lighting system, painting of the front wall in the operator area and assembly of the shielding windows.



FIG. 2.1. Welding of inner stainless steel layer.



FIG. 2.2. Inner surface of the cell after sanding.

3. CONCLUSION

Next steps in the refurbishment project are the installation of supply systems for water, air, liquid nitrogen etc., installation of manipulators and testing equipment. Start of the operation of the facility is scheduled on October 2011 – refurbishment works are carried out according to the project schedule.

Reconstruction of the former radiochemistry facility was projected on the basis of successful previous construction projects and the whole project was unique opportunity for the transfer of knowledge from experienced personnel to young colleagues.

Successful previous projects:

- a. Construction of the hot cell for unloading of surveillance irradiation containers from Temélin NPP .
- b. Construction of the hot cell for repacking of spent nuclear fuel from NRI Rez LVR-15 research reactor.

A significant advantage of the project is the new modular system (steel shielding plates and inner stainless steel layer) of the semi-hot cells, designed taking into account the future decommissioning of the facility.