

# The Surveillance Program for the Life Extension of the Reactor LVR-15

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## 1. Abstract / Introduction

This work is focused on the surveillance program for the life extension of the LVR-15 reactor. The flange for connection between the reactor vessel and horizontal canal, which ensures a connection between two different materials, and thus was chosen for investigation. The reactor vessel is made of stainless steel and the horizontal canal is made of aluminum. The identical flange was manufactured with the use of the same materials as the original one and has been irradiated in LVR-15 for 10 years till 2018. After that, the flange was transported to the hot cell facility, in January, 2019. The irradiation process simulates a life span of the original part. The dose equivalent rate of 40 mSv/h was measured on the surface after irradiation.

Due to the mass of the flange of about 30 kg, it was necessary to prepare a detailed schedule of the manipulation. Since the manipulators maximum loading is only 5 kg, the handling with the flange was tricky and risky. This work describes handling, cutting, sample preparation and microstructure analysis of the highly irradiated flange in the hot cell facility.

## 2. The process of the preparation

### Operations with the flange

After the transportation of the flange to the hot cells facility, the shielded drum was opened, the flange was taken out and transported to the adjacent cell for visual inspection (Fig. 1,2). This procedure was done by an overhead crane with special safety precautions.

The second operation is the leaking test with non-corrosive fluid in a controlled environment. This procedure contains drilling of a hole with defined parameters in the flange, filling it with non-corrosive fluid and monitor leaking.



Figure 1 . The flange transported to the hot cell



Figure 2. The defect on the surface of the flange

The following operation with the flange is the preparation of the fine samples for mechanical testing and scanning electron microscopy (SEM) analysis. Due to the dimensions of the flange, it cannot be cut directly using electric discharge machine. New big-band saw is installed to the hot cell for this purpose. Furthermore, another flange was manufactured to verify cutting operations using non-active material. So that the cutting plan can be created according to the results of manipulation with non-active material.

The first active flange cut is to be done in May 2019, so the semi-products for further processing will be produced. These semi-products will be then prepared either using the electric discharge machine or using metallographic techniques for surface analysis on SEM. Others samples will be machined for tensile testing in order to acquire the mechanical properties of the flange material.

The final report will be used as a foundation for the application for the life extension of the LVR 15 reactor to the Czech State Office for Nuclear Safety.

The above-described work is planned during the summer of 2019. The results will be presented on HOTLAB 2019.

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### **References**

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