Improving of the working conditions and cleaning of gas discharges during the outage at Bohunice V1 NPP

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1. Introduction

Bohunice Nuclear Power Plant is situated in south - western part of Slovakia about 50 km away from Bratislava. There are four PWR reactors 440 MWe each - two units with reactors VVER - 230 (V1 NPP) and two units with VVER - 213 (V2 NPP).

V1 NPP finished its upgrading and thus reached the acceptable level of nuclear safety in the year 2000. Nevertheless due to the political pressure the plant should be shut down. Unit 1 in December this year and Unit 2 in 2007. V2 NPP has started the modernisation process several years ago.

The presentation will provide the information about the measures and modifications performed in V1 NPP in order to improve radiation conditions of the air in the reactor hall during the outage works.

2. Description of the problem

According to the design of the NPP - VVER 230 there is a large room, which is common for both reactors (Fig.1).

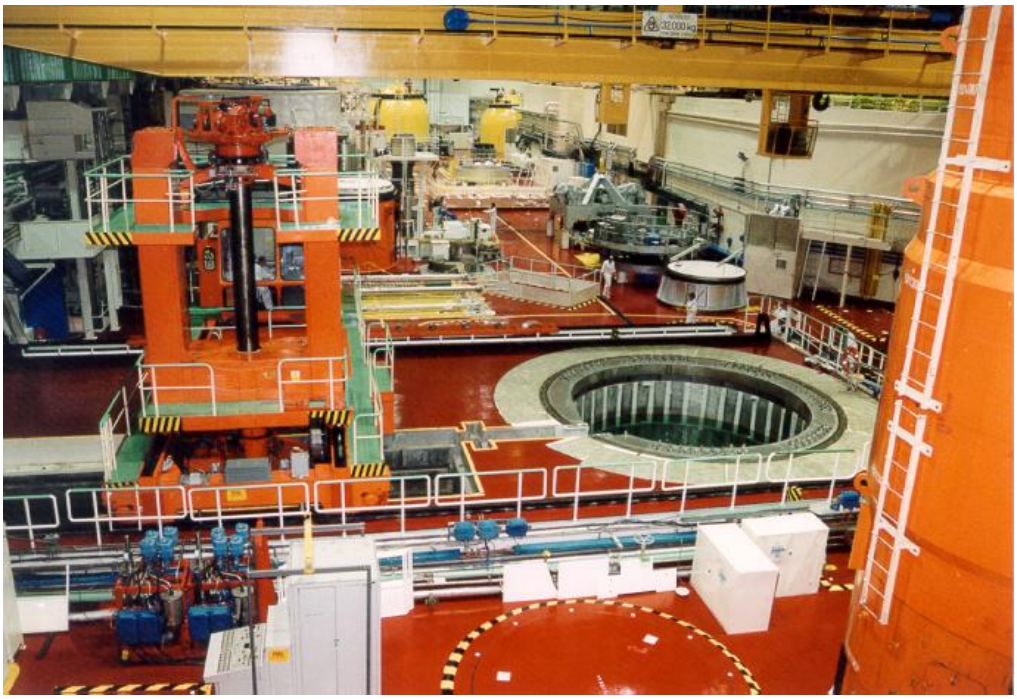


Fig.1: The „reactor hall“ of V1 Bohunice NPP. The reactor hall is common for both units.

As there is not enough room in the V1 NPP to perform outage maintenance activities, much radiation hazard work is performed in the mentioned so called „reactor hall“. During the normal operation the atmosphere in the reactor hall is clean. But a contamination can penetrate to the air when

the components of primary circuit are opened. The air flow through different openings, doors, etc. between containment and adjacent rooms had been investigated by the power plant and it had been demonstrated that due to insufficient underpressure of some ventilations systems, the potentially contaminated air from the containment (especially from the reactor cavity) can freely get to the reactor hall . In such a way workers in that hall could be exposed to the air contamination if this occurred. Further it must be said that the original design of the reactor hall air exhausting system is directly connected to the ventilation stack without the air purification.

3. Measures and modifications

In order to protect the workers against the internal contamination by decreasing the air contamination in the reactor hall and to minimise the discharged activity to the environment several measures and modifications were performed in the last five years.

3.1. Generation of the underpressure in the reactor after its first opening

An exhausting plastic tube is positioned to the upper part of the reactor control rod drive immediately after the first opening of the reactor. The plastic hose is connected to the ventilation system equipped with the aerosol and iodine filters. The exhausting lasts minimum 8 hours and during that the specific radioactivity of the exhausted air is continuously measured. The example of plastic house just after its disconnection from the upper part of the control rod drive is in the figure 2.

Fig. 2: The example of plastic hose just after its disconnection from the upper part of the control rod drive

3.2. Improving of the air exhausting above the water level during the reactor vessel filling

The reactor cavity when it is filled with the water is covered with the aluminium plastic lid to improve the efficiency of he exhausting ventilation system. That measure has been used in Bohunice for many years and is also known in other plants. The ventilation system has aerosol and iodine filters. Without the lid the existing ventilation system would not be able to create an effective underpressure above the water level and contamination could spread to the reactor hall. Blue plastic of the lid can be

seen in the figure 3 as well as the part of the red refuelling machine and yellow cover of the reactor in the back

Fig. 3: Blue plastic of the lid, the part of the red refuelling machine and yellow cover of the reactor in the back

3.3. Modification of the exhausting ventilation systems from the reactor hall – purification of the air before the discharge to the environment

The modification of air exhaust systems from reactor hall to the ventilation stack had been performed in order to utilise the air purification stations of those systems that had been closed (and no more used) after the reconstruction of V1. The modification was finished in 2004. Modification can be seen in the figures 4 and 5.

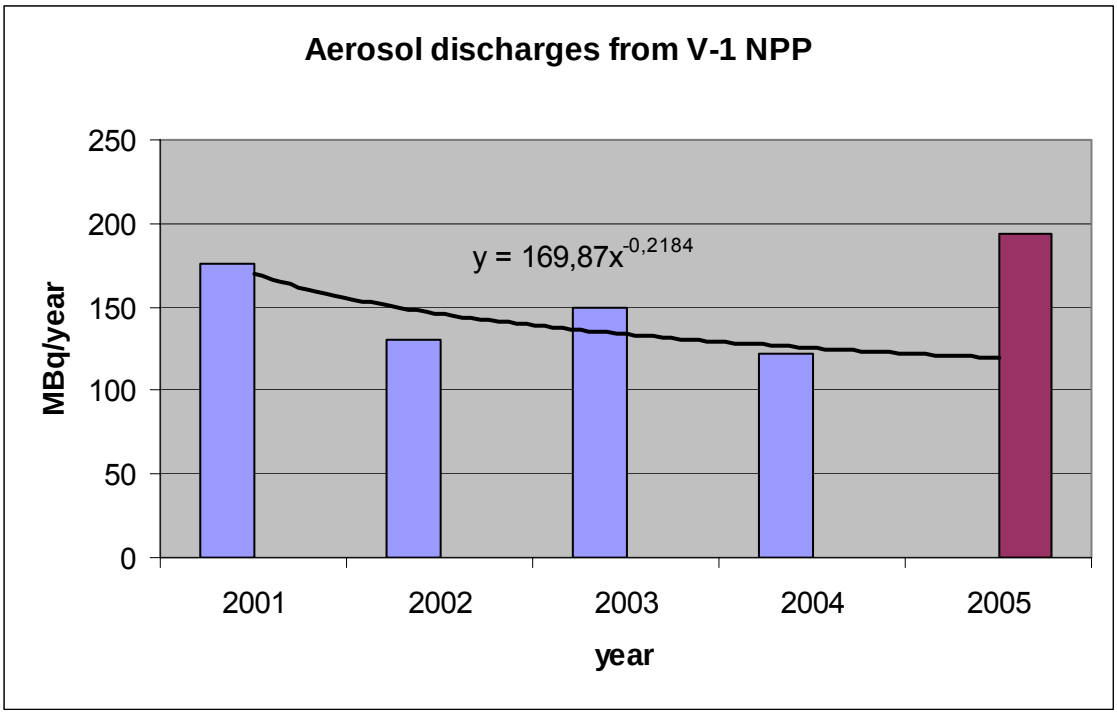
Fig. 4: The modification of air exhaust systems from reactor hall

Fig. 7: One part of the modification of air exhaust systems from reactor hall

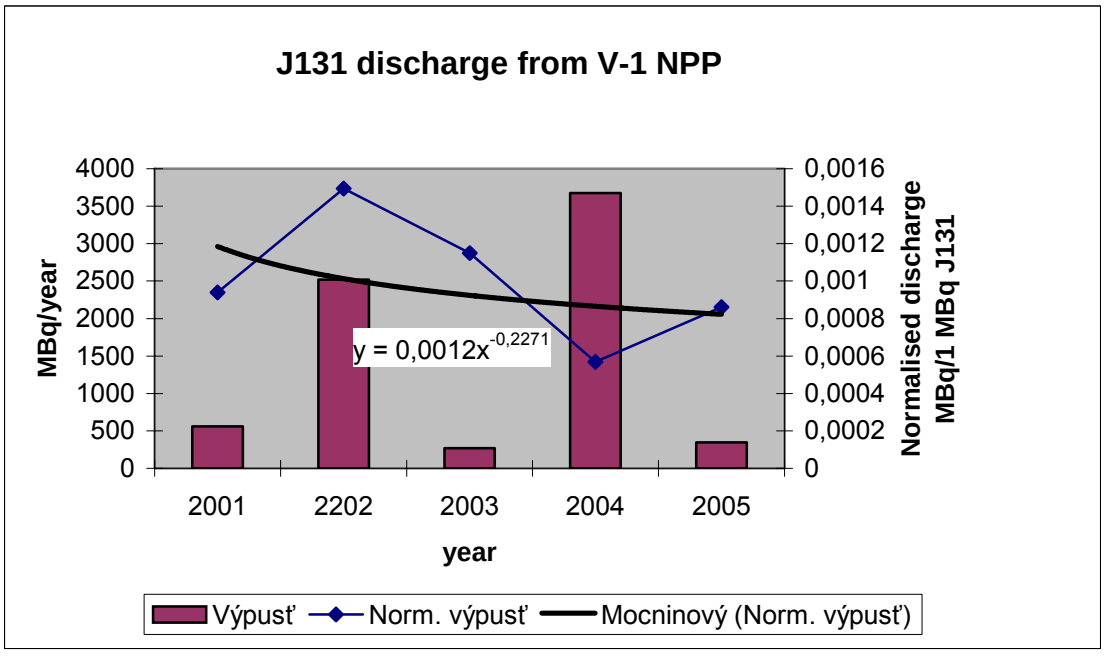
4. Conclusion

Implemented measures and modification have contributed to the improvement of the radiation protection in V1 NPP as well in its surroundings:

- Improvement of working conditions in the reactor hall during the outages as the contamination of the air dropped below the MDA of the continual measurement. The necessity of using of respiratory equipment was restricted and workers can work in more convenient condition
- Decrease of the radioactive aerosols and iodine discharge to the surroundings. The fact is described in following graphs. Graph 1 demonstrates the influence of the accepted measures for annual aerosol discharges and graph 2 for iodine discharges



Graph 1: The influence of the accepted measures for annual aerosol discharges. The decrease of the aerosol discharge is evident till 2004. Higher aerosol discharge in 2005 was caused by the works combined with the removing of the resins that penetrated to the primary circuit during the outage of Unit 2. All 6 primary loops had to be opened, internal part of the reactor had to be removed and all items including the reactor vessel and many tanks had to be cleaned. The event prolonged the outage for 30 days more.



Graph 2: The influence of the accepted measures for annual iodine discharges. The iodine discharge depends on the iodine activity in the primary coolant (fuel leakage). There were different fuel leakages in the years (see red columns in the graph). In order to have better assessment of the implemented measures, the discharge had been calculated relatively to 1 MBq of iodine 131 in the coolant after the shut down and pressure drop (see blue line)