CAPACITY EXTENSION OF ISFSF JASLOVSKE BOHUNICE

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Abstract

The Interim Spent Fuel Storage Facility (ISFSF) Jaslovské Bohunice purpose was to cool down the spent fuel under water before its transport to the Soviet Union. After the political change this transport became impossible. Therefore, the capacity of ISFSF had to be increased. However, the storage capacity will be fully exhausted in 2022. As there is not any other option yet, the solution is to expand the current storage capacity.

The operator of ISFSF, the Nuclear and Decommissioning Company (JAVYS), decided to build a new dry storage. In 2016 the EIA process was successfully completed and after selection of contractor in 2018 the preparatory work started.

An important role in this process has been performed by the Nuclear Regulatory Authority of the Slovak Republic (UJD). After extensive discussions the basic requirements have been set up. New storage capacity will be dry, vault type storage with passive residual heat removal.

At present the basic documents are completed. The Technical Report "Assignment to Safety Analyzes" was approved, and the technical report will, in addition to the assessment of normal operation and its impact on the radiation protection of the population, also assess the radiation risk to the population in the following postulated internal initiation events: loss of power supply, transport and handling accidents, accidents associated with loss of heat removal, criticality accidents, loss of the monitoring functions, the leakage of primary and of the secondary lid of the canister. External initiation events: explosion, fire, flooding, earthquake, extremely hot and cold and plane crash.

The UJD will pay particular attention to requirements for seismic resistance and protection against accidental fall, or deliberate attack with airliner. UJD will also demand all spent fuel suitable for dry storage to be transported form wet to dry store. This will increase nuclear safety and nuclear security as well.

1. INTRODUCTION

First NPP in former Czechoslovakia started the operation in 1972 at Jaslovské Bohunice site. All spent fuel from this NPP was transported to former Soviet Union in seventies to nineties.

In Slovakia we have eight VVER nuclear power units, four of them in operation, two in decommissioning phase and two under construction. Units in operation produce about 300 spent fuel assemblies (approximately 36 ton of heavy metal) a year. For temporary storage of the spent fuel after its terminate reloading from the reactor core the at-reactor spent fuel storage pools are used. The spent fuel is stored inside a base grid in the bottom area of the spent fuel pool. The base grid of all units at V2 NPP Jaslovské Bohunice was designed to store 319 spent fuel assemblies and 60 hermetic casings for defective fuel assemblies. At EMO 1, 2 NPP Mochovce a new compact grid was designed with capacity of 603 fuel assemblies and 54 hermetic casings. After at least 2.5 years of storage in the at-reactor pools, the spent fuel is transported to the ISFSF.

The original design of VVER-440 units presumed, that after three years cooling time in the spent fuel storage at-reactor pools, the spent fuel will be transported into the former Soviet Union. Later, the Soviet side required the storage of spent fuel for at least 10 years before the transport. Due to this, an ISFSF was built in Jaslovské Bohunice for the needs of VVER-440 units.

ISFSF is a nuclear installation, which serves for temporary and safe storage of spent nuclear fuel from the VVER reactors before its further processing in a reprocessing plant or before its definite disposal. It is designed as a wet storage, and it was commissioned in 1986. Active operation began in 1987.

Since 1989 also spent fuel from NPP Dukovany in the Czech Republic was stored in ISFSF. After the construction of storage in the Czech Republic, this fuel was during 1995-1997 gradually transported back to NPP Dukovany.

2. FIRST ISFSF CAPACITY EXTENSION

Due to political change in 1989 it became clear, that we could not transport spent fuel to Soviet Union, Russian Federation respectively. Therefore, ISFSF was during 1997 – 1999 reconstructed in order to increase the storage capacity and seismic resistance. Total storage capacity of ISFSF after reconstruction and seismic improvement is almost three times as big as the designed one - increase from the original 5.040 to the current 14.112 spent fuel assemblies -1.694 t HM.

The capacity has been continuously increased through replacement of the original T-12 containers with KZ-48 new containers (completed in 2007) and would be sufficient to store all spent nuclear fuel produced during operation of units Jaslovské Bohunice NPP 1- 4. However, since 2006 the spent fuel from Mochovce NPP is being transported to the ISFSF after cooling in at-reactor pools. At the end of 2018, the storage capacity was used on 87.7 % (see Fig. 1).

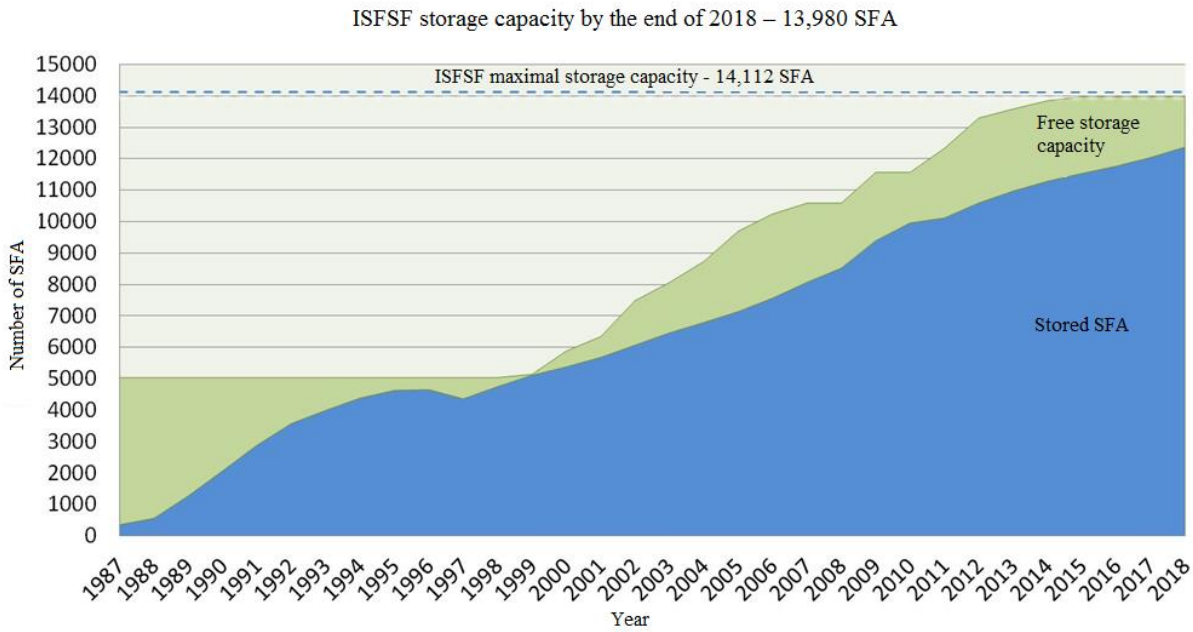

FIG. 1. ISFSF storage capacity use.

3. PLANED ISFSF CAPACITY EXTENSION

Depending on the progress of the construction of units three and four at Mochovce site, the storage capacity of the ISFSF will be exhausted approximately in 2022 – 2023. As there is not any other option yet, it was decided to expand the current storage capacity. The operator of ISFSF, the JAVYS company, decided to build a new dry storage. In 2016 the EIA process was successfully completed and after selection of contractor in 2018 the preparatory work started.

An important role in this process has been performed by the UJD. After extensive discussions the basic requirements have been set up. New storage capacity will be a dry vault type storage with passive residual heat removal. Spent fuel will be stored in steel canisters 84 or 85 SF assemblies each, placed in the reinforced concrete storage modules of the new ISFSF. Spent fuel will be transported from wet storage in shielding transport container. The extension of the current storage capacity of the ISFSF in the Jaslovske Bohunice site represents a total expansion of 18,600 spent fuel assemblies in two phases, the first phase representing an expansion of about 10,100 spent fuel assemblies, the second phase of the expansion of about 8,500 spent fuel assemblies. The construction of first module with capacity of 130 canisters will be finished by the end of 2021. The second module will be completed later. Fig. 2. shows ground plan of existing and new ISFSF buildings.

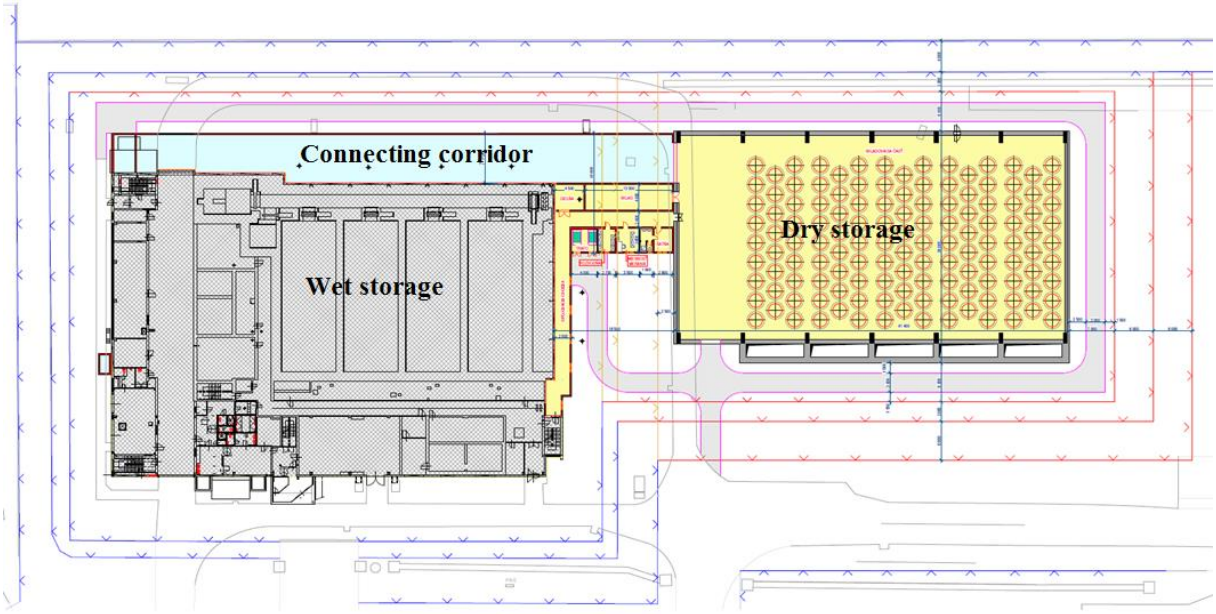

FIG. 2. New dry ISFSF storage capacity.

At present the following documents are completed: Preliminary Report, Quality Assurance Plan, Occupational Health and Safety Plan, Waste Management Plan, Decommissioning Plan, Interface Management Manual, Report from the Engineering-Geological Survey and The project for the building permit. Further, calculations for the design of the building component and the package assessment, 2D thermo-kinetic analysis, Analysis of shielding from neutron radiation and Safety analyzes were finished. The Technical Report "Assignment to Safety Analyzes" was approved, and the technical report will, in addition to the assessment of normal operation and its impact on the radiation protection of the population, also assess the radiation risk to the population in the following postulated initiation events:

— Internal initiation events.
  - Loss of power supply;
  - Transport and handling accidents;
  - Accidents associated with loss of heat removal;
  - Criticality accidents;
  - Loss of the monitoring functions;
  - The leakage of primary and of the secondary lid of the canister.

— External initiation events.
  - Explosion;
  - Fire;
  - Flooding;
  - Earthquake;
  - Extremely hot and cold;
  - Plane crash.

The methodology for the preparation of the project for the building permit was submitted to the UJD last year. It will be completed in the near future with the latest requirements and recommendations from the relevant IAEA and WENRA documents. In view of the expected long-term operation of new storage, the UJD required that following principal requirements will be incorporated into the project for the building permit.

3.1. Refurbishment of the concrete substructure of existing ISFSF

The UJD assessed existing measurements results on storage pools subsidence. The results of this assessment as well as the results of the geological survey of the subsoil under the existing and planned storage, showed the need to adopt measures aimed at stabilizing the uneven subsidence of the substructure of the concrete part of the ISFSF before commencing the construction of the new storage building.

3.2. Seismicity

In a seismic analysis "Determination of RLE for NPP Bohunice", prepared by the Geophysical Institute of Slovak Academy of Science in 1998, the maximum horizontal acceleration PGA_H = 0,344 g was set at the free terrain level (± 0.0 m) and maximum vertical acceleration PGA_V = 0.214 g at free terrain (± 0.0 m), 10 seconds of decisive movements, probability of occurrence once every 10,000 years. With respect to the international recommendation the UJD defined the requirement for the PGA values to be increased by 50%. The UJD therefore requires the following minimum RLEs to be incorporated into the project for the building permit: maximum horizontal acceleration PGA_H = 0.516 g at free terrain (± 0.0 m) and maximum vertical acceleration PGA_V = 0.321 g at free terrain (± 0.0 m).

3.3. Protection against the fall of a transport aircraft

The UJD requires that the planning and design of the project for the building permit to be considered with the future protection of the objects of ISFSF against accidental crash of an airliner, or deliberate attack with an airliner, after the completion of the new storage capacity.

4. CONCLUSION

After the completion of the first dry storage module the new dry storage will provide high level of nuclear safety, as well as nuclear security for spent fuel. The increased requirements for seismic resistance and protection against accidental fall, or deliberate attack with an airliner, passive residual heat removal will ensure better conditions for spent fuel storage as in wet part of ISFSF. UJD will therefore demand all spent suitable for dry storage to be transported form wet to dry store. This will also reduce the load on the substructure of wet ISFSF.