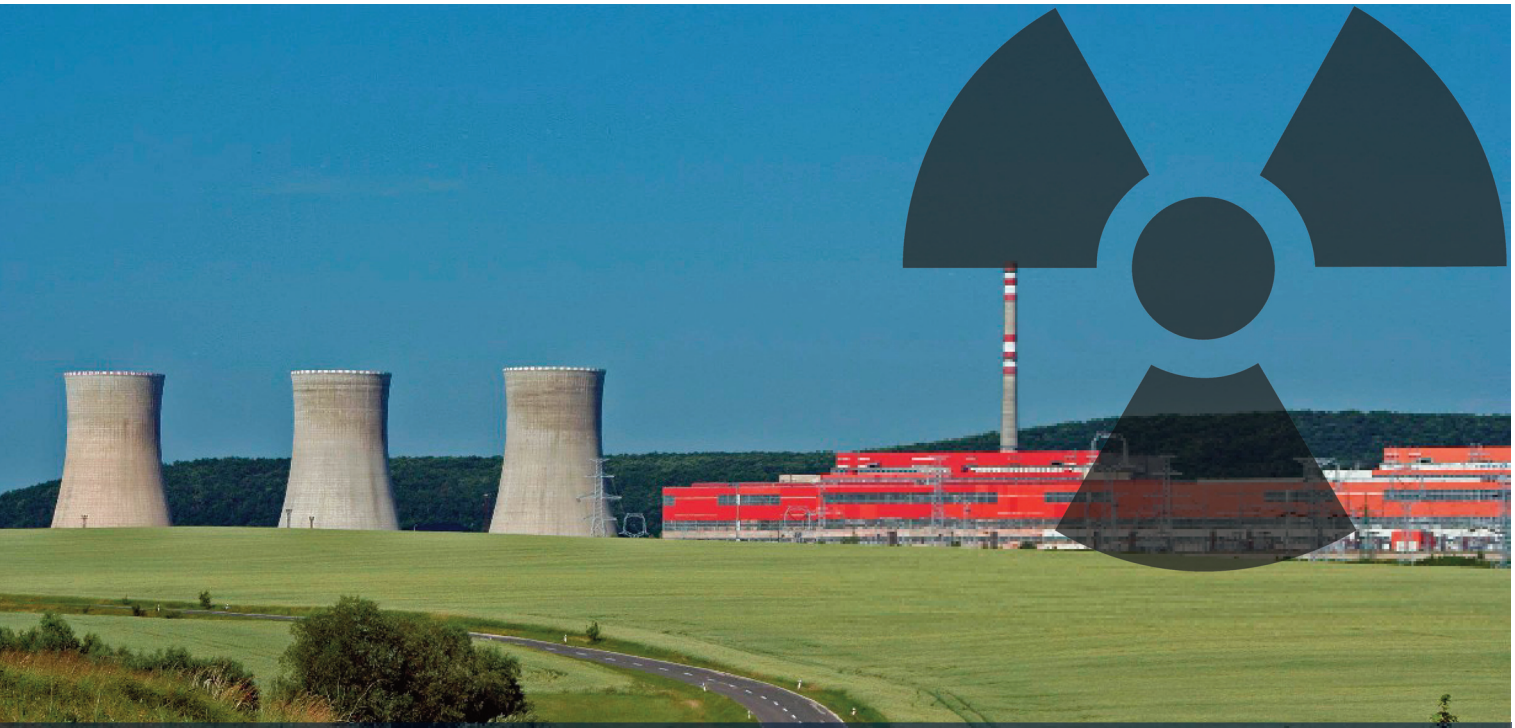


Completing NPP Mochovce 3&4 in Slovakia

Reactors from the 70’s for the 21st Century

The Italian-Slovak utility Enel/SE and the Slovak government are speeding up the completion of Mochovce units 3 and 4. When it comes to nuclear safety of these VVER 440/V213 units, there is conflicting information as to which standard is to be applied!

On November 26, the prime minister of Slovakia, Mr. Fico, informed the public that »three completely new nuclear units will be built«, whereby he probably meant Mochovce 3 and 4 and an additional unit at the Bohunice plant. Mr. Conti, CEO of Enel, stated that Mochovce, which his company intends to build in Slovakia, will be a »Generation III« reactor. However, experts agree that this is technically impossible. Even the Slovak Nuclear Authority UJD stated in 2004: Due to the extent of already existing building structures at Mochovce 3 and 4, it is not possible to reach a nuclear safety level of new nuclear units [UJD 2004].

First we have to examine what constitutes current safety standard: Clearly this is referring to the safety level of nuclear power plants currently under construction or in the planning phase or European Utility Requirements [EUR 2001]; minimum standard has to be best available technology (e.g. Sizewell B).

Nuclear power plant designs are typically divided into four generations of reactors. Generation I is the oldest reactors deployed in the 1960’s, Generation II reactors dominated construction in the 1970’s and 1980’s, and reactors currently under construction are commonly referred to as Generation III, such as the EPR in Finland. Generation IV is in the stage of R&D.

DEFICITS OF VVER 440/V213 COMPARED TO CURRENT SAFETY REQUIREMENTS

Next we look at what a VVER 440/V213 stands for and where the differences lie compared to reactors under construction in 2007. Units 3 and 4 of NPP Mochovce should meet at least the safety standard of a modern Pressurized Water Reactor (Sizewell B or EdF's N4 reactors). Since 2001, terrorism is acknowledged as a serious risk for NPPs, and nuclear power plants have to withstand a crash of a large airplane as well as the impact of missiles.

Mochovce, a VVER 440/V213, is a Soviet Generation II reactor, designed in the period 1970 -1980. »The general basis for the design corresponds to the former Soviet standards« [NEI 1991]. Some improvements compared to the original Russian design had been implemented at Mochovce units 1 and 2, when they started operating 1998/1999 respectively.

The safety level Mochovce will meet depends on: (1) how much safety the operator Enel/SE will pay for, and (2) whether an upgrade is possible.

CRUCIAL SAFETY ISSUES

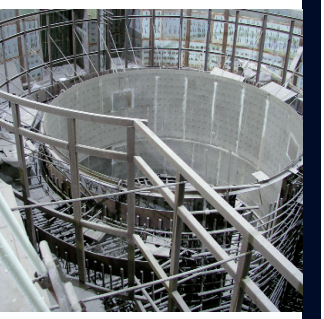
The extent of structural improvements when completing Mochovce 3/4 is limited because in 1993, when construction was stopped, already 70% of civil construction was completed and 30% of the equipment had been supplied: the reactor vessel, steam generators, pressurizer, safety system tanks and major turbine parts (partially installed) have been mothballed and are stored at the plant.

- The structural limitations mainly concern the confinement structures and the possibility of physical separation of safety Systems.
- Neither the reactor building nor the bubble condenser are resistant against external events (air plane crash or missile).
- The lack of segregation of high energy pipe lines: feed water and steam pipes are parallel on the 14,7 m level (connection between reactor and turbine hall). Therefore, the loss of both at the same time cannot be excluded (e.g. caused by an earthquake, pipe whip), which would make the cooling of the reactor almost impossible.
- Mochovce does not have a containment, only a confinement with a bubble condenser to limit the pressure from large pipe ruptures. The tests showed the functioning of the bubble condenser for design basis accidents and some severe accidents, but not all. However, most second generation PWRs have full pressure containments and Generation III reactors will have improved (double wall) containment structures and they will provide options to catch and cool the reactor core in case of reactor pressure vessel failure.
- Seismic design has to be proven in relation to the earthquake risk at the site. Seismic design is a week point of all VVER 440/213 units. Moreover, seismic evaluation and seismic design have evolved fundamentally in recent years. It is unclear whether Mochovce 3 and 4 can meet the latest seismic design standards of the IAEA [IAEA 2002].

CONCLUSIONS

The construction license of 1986, which is the base for the plan to finalize Mochovce 3/4, concerns a design status which includes all the deficiencies listed above. This is likely to result in a safety standard less than Mochovce 1/2. The general basis for the design corresponds to the former Soviet standards but there is a list of improvements that are implemented in Mochovce NPP 1/2 compared to the original Russian design.

Planned lifetime of Mochovce 3/4 is 40 years and start of operation is expected in 2011/12. A NPP that will run until 2050 must fully meet today's latest safety standards. From a precautionary perspective, a new NPP should use best available technology and not equipment and technology from the 1970's, where also improvement is limited due to finished civil structures and old equipment.



Before the start-up of Mochovce 1/2 (1998/99), and also after, further improvements were implemented at the units [VUJE 2001].If all these changes are included in the completion project of Mochovce 3/4, the plant design would be very different from the one licensed in 1986. This requires a new licensing procedure including an EIA (Environmental Impact Assessment) in line with ESPOO procedures. As far as public participation is concerned, the standard applied now is definitely more 1986 than 2007!

REFERENCES

- **EUR 2001:** European Utility Requirements for LWR Nuclear Power Plants Revision C, 2001
- **IAEA 2002:** IAEA (2002): »Evaluation of Seismic Hazards for Nuclear Power Plants« NS-G-3.3, Vienna
- **NEI 1991:** Nuclear Engineering International, July 1991: Modernizing the VVER: a Soviet perspective, Gidropress
- **STRASKY 2007:** Assessing the Options to Increase Nuclear Safety at the Planned Completion of Units 3 and 4 at the Mochovce NPP in Slovakia, Dalibor Strasky, Borovany 2007
- **VUJE 2001:** PSA analysis focused on Mochovce NPP;International conference: Nuclear Energy in CEE, Portoroz.VUJE Trnava;
- **UJD 2004:** Opinion of UJD on the completion of Mochovce,3/ 4, Translation from Slovak: Patricia Lorenz, FOEE