CONTAINMENT LEAK-TIGHTNESS ENHANCEMENT AT VVER 440 NPPS

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Abstract

The hermetic compartments of VVER 440 NPPs fulfil the function of the containment used at NPPs all over the world. The purpose of the containment is to protect the NPP personnel against radioactive impact as well as to prevent radioactive leakage to the environment during a lost of coolant accident.

Leak-tightness enhancement in NPPs with WWER 440/213 and WWER 440/230 reactors is an important safety issue. New procedures, measures and methods were adopted at NPPs in Mochovce, J. Bohunice, Dukovany and Paks for leak identification and sealing works performed by VUEZ Levice.

Methods

Mochovce units 1 and 2:

During the years 1997 to 1999 (before startup operation) a lot of leak tests were performed according to improved programs prepared in compliance with standards and requirements contained in internationally recognized regulations e.g. KTA 3405 or ANSI/ANS 56.8. More than 1000 local leak tests (super-checking) have been performed per unit. After leak resealing the individual test of hermetic compartments and the integral leak rate test of containment have been performed.

J. Bohunice units 1-4 and Dukovany units 1 and 3:

Enhancement leak rate measures were started for the period beginning with 1990 at the V-1NPP and with 1995 at the V-2 NPPs and Dukovany NPPs (during operation of the units). To increase the containment leak-tightness, new procedures of leak identification and sealing works have been adopted:

- application of sealing compounds,
- application of adhesives,
- application of coating,
- application of foams and injection.

The process of leak rate reduction has been performed in stages:

- leak detection (follow-up integrated leak rate test),
- repair of leaks detected on the hermetic boundary and hidden leaks (by removal of a part of cover concrete or using injection)
- local, individual and periodical integrated leak rate tests to prove the efficiency of sealing works.

With regard to the design of the individual technological nodes, different methods of leak testing are applied to hermetic boundary components.

With regard to this improved leak tightness of containment, new methods for leak rate evaluation and for verification of leakage-test accuracy have been adopted.

Results

The integrated leakage rate tests performed at the end of refueling outages have proven the efficiency of sealing works conducted during refueling outages. Containment leakage rate is still lower than that obtained during the last refueling outages.

(Charts of leakage rate will be presented)

To obtain better results of integrated leak rate tests, periodical resealing as well as local and individual leak testing should be repeated. Resealing of structural nodes (hermetic doors, hatches, ...) should be periodically repeated. The procedure adopted for the performance of sealing works proved itself.

Leakage rate reached at Mochovce NPP is comparable with those in western Europe NPPs containments. Components on the external hermetic boundary preserve proper integrity during lost of coolant accidents.

Conclusions

Containment properties would deteriorate without periodical tests of individual hermetic nodes on the hermetic boundary and sealing works.

The excellent leak-tightness of the Mochovce NPP containment comparable with that of western Europe containments and the step-wise enhancement of leak-tightness in the Bohunice and Dukovany NPPs enable to rank the WWER 440 NPPs among those meeting international nuclear safety standards.