Concept re-extension of service life power units No. 1 and 2 of the Kola NPP

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NPP with reactor plant of WWER-440

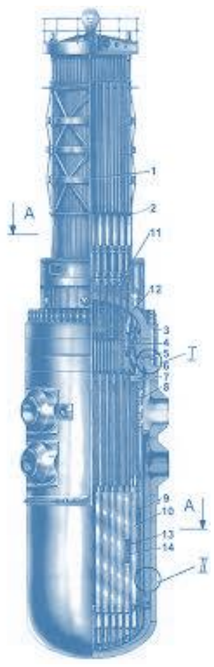
The vver reactor technology has been developing rather quickly since its emergence in the ussr, resulting in a significant variety of designs of WWER-440 NPPS

MEDZAMOR 2 V270 | KOZLODUY V230 | DUKOVANY V213 | LOVIISA V213 | PAKS V213 | KOLA / NVNPP V230,V213/ V179 | BOHUNICE V230/213 | ROVNO V213

WWER-440 NPPS, in spite of their common physical and technological basis, call for an individual approach to decommissioning of each npp unit.

Differences allow accumulating necessary practical experience in implementation of various technical and technology solutions, including those relating to safety and cost efficiency of decommissioning operations.

Experience of preparing for and performing the decommissioning of vver-440 npps constructed in the east european countries is sufficient for analysis, systematization, generalization and wide practical application of the technical and technology solutions used.

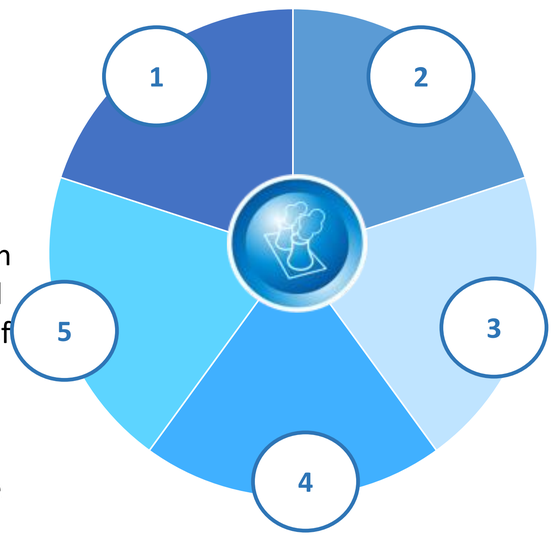


Kola NPP The northernmost nuclear power plant in Europe

When preparing a decision to re-extend the operating life of power units 1 and 2 of the Kola NPP, the following important aspects must be taken into account:

- a 30-year service life was established during the design to ensure a conservative approach based on limited knowledge in the field of nuclear energy use, the then existing calculation methods and the absence of actual operational data on the reliability of nuclear power plant equipment;
- the accumulated experience in operating power units 1 and 2 of the Kola NPP during the extended service life in 2003-2013 allows us to conclude that there is no negative trend towards deterioration in the operational performance of power units, which is confirmed by the materials of annual reports on the assessment of the state of operational safety (OSSE);
- implementation of the principle of continuous improvement of safety through modernization led to the fact that the numerical indicators of the safety level of power units 1 and 2 in terms of the frequency of core damage, determined from the results of the probabilistic safety analysis (PSA), were improved by more than two orders of magnitude.
- performed analyzes of inconsistencies of units 1 and 2 with the requirements of current regulatory documents indicate the absence of safety problems of high and medium importance. Safety issues of lesser importance are adequately compensated for by the measures developed;
- safety analyzes performed show that power units 1 and 2 have reserves for increasing safety. The use of these reserves in conjunction with measures to manage the resource characteristics of equipment makes it possible to count on the possibility of repeatedly extending the service life while simultaneously increasing the level of safety.
- an analysis of the experience of operating units beyond the design life was carried out and predictive technical and economic assessments of the efficiency ;
- an assessment of the economic efficiency of repeated extension of the operating life of power units 1 and 2 of the Kola NPP was carried out;
-an assessment of the condition of the units’ equipment and its residual life was carried out;
- elements of power units that require replacement and modernization when extending service life beyond 45 years have been identified;
- elements of power units that require additional work to examine and justify the residual resource have been identified.

The results of the work performed showed the fundamental technical possibility of further extending the service life of units No. 1, 2 beyond 45 years.



BASIC PRIORITIES

- PROTECTION OF PERSONNEL AND THE POPULATION
- ENVIRONMENT PROTECTION
- OPTIMIZATION OF TECHNICAL SOLUTIONS
- MANAGEMENT OF RADIOACTIVE WASTE

The main provisions of the concept of increasing safety during repeated extension of the operating life of units 1 and 2 of the Kola NPP

1. Increasing safety to a level at which the radiation impact of power units 1 and 2 on personnel, the population and the environment during normal operation, disruptions of normal operation, including design basis accidents, does not lead to exceeding the established radiation doses for personnel and the population, standards for emissions and discharges , the content of radioactive substances in the environment, and is also limited in case of beyond design basis accidents.
2. Increasing the resistance of blocks to extreme external influences of a natural and man-made nature.
3. Justification for the possibility of repeatedly extending the service life of irreplaceable reactor equipment.
4. Ensuring the technical and economic efficiency of extending the service life, taking into account the socio-economic factors characteristic of the region where the Kola NPP is located
5. Optimization of all processes necessary for NPP re-extension

- Introduction of a passive core cooling system - 2 channels of 2;
- Replacement of 3 emergency feed pumps with high pressure pumps;
- Implementation of an active low-pressure core cooling system by replacing 3 emergency feed pumps with low-pressure pumps;
- Modernization of the jet-vortex condenser in order to ensure its operability when expanding the range of design basis accidents;
- Increasing the density of the hermetic volume;
- special examination of the actual condition of the equipment and pipelines of the reactor plant for compliance with the criteria and requirements of current regulatory documents in the field of the use of atomic energy;
- development of new methods for extending the service life of reactor plant equipment;
- predicting the service properties of the base metal, metal of welded joints and surfacing of irreplaceable equipment of the reactor plant, including supporting structures;
- calculation justification for the strength of non-replaceable equipment and pipelines;
- calculation justification of the strength in the event of static and dynamic loads for the equipment of a modernized reactor plant in the event of a rupture of a pipeline with a diameter of 500