Modernization Program of NPP Kozloduy, Units 5 & 6

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A comprehensive Modernization Program for the Units 5&6 of NPP Kozloduy (Type WWER-1000/320) was established by the Bulgarian Power Utility and by national institutes, supported by the French utility EDF and by Russian design institutes (MOHT) in 1994/95.

The tasks of the program were the safety enhancement of the units in agreement with current Russian and international requirements and practice for operating plants, as well as a set of improvements in order to increase the operational performance.

General and plant specific IAEA reports, proposals of the original plant designer, Bulgarian studies and operational feedback, as well as the assessment of German and French safety consultants (Riskaudit) were incorporated in the program.

Early in 1997 two framework contracts were concluded with two vendors.

The major part of the modernization project, about 120 work items, was awarded to the European Consortium Kozloduy (ECK), consisting of Siemens (leader), Framatome and Atomenergoexport. This consortium had been founded to provide a 100% financing scheme, and to ensure the combination of the original designers' knowledge together with broad experience on western safety upgrading practice.

The ECK is the first east-west consortium of this kind for a big project in the nuclear energy field.

In fall 1998 the first steps of the Modernization Program were started by the European Consortium Kozloduy (ECK):

- Implementation projects are under way for very urgent measures on
  - modernization of non-interruptible power supply (one safety train already in operation in Unit 5),
  - boron meter replacement,
  - replacement of separators.
The basic engineering phase ("BEP Contract") for about 50 measures is close to its finalization.
The goal of this phase was the elaboration of "technical projects" in order to
- justify the offered technical solutions of ECK for measure implementation,
- issue the technical solutions to the Bulgarian Authority for approval,
- define the fixed scope of supplies and services,
- establish the prerequisites for the loan agreements.

The contract for the implementation phase ("Main Contract") was signed in mid 1999.
At the moment the negotiations for the financing of the Main Contract scope are under way. The foreseen financing scheme includes 50% of the overall project to be financed by EURATOM, 30% by Roseximbank, and 20% by German and French export loans.

The overall scope of measures of the European Consortium Kozloduy (ECK) includes the following fields:

- Substantiation of RPV integrity and cold overpressure protection
- Measures for long term core cooling improvement, including provisions against sump clogging, EFW improvement
- Improvement of emergency electrical power supply and other relevant electrical systems (renewal of DC systems, DG improvements, additional DG for unit consumers, replacement of power breakers, etc.)
- Containment integrity preserving measures under beyond-design and severe accident conditions, including hydrogen detection/recombination
- Diagnostic and computerized information systems, including loose parts detection and leakage detection of primary circuit and RPV head
- Mechanical analyses, including primary system fatigue reduction, auxiliary and secondary systems' equipment investigations
- Improvement of SG safety valves, study on implementation of isolation valves in front of main steam blowdown valves to atmosphere
- Seismic improvements, including structural, piping and components analyses and strengthening
- Internal hazard protection measures, including main steam and feedwater line break protection, fire detection and protection improvements, flooding analysis

- Safety analyses, including updating of thermal-hydraulic analyses, equipment classification and qualification analyses, analyses for beyond-design basis accidents, ATWS, bleed and feed

- Improvement of operational documents and maintenance means

- Turbine plant and BOP improvements, including replacement of condenser tubes, water treatment system upgrading, main cooling water filters, heat exchanger improvements, etc.

Further measures of the Modernization Program, not carried out by the European Consortium Kozloduy (ECK), are dedicated to

- Information systems for improvement of the Units' operation

- Modernization of radiation monitoring systems

- Limited scope of analyses