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SU NPP unit 1 reactor control system's drives reconstruction.
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Groupe and individual control system (SGIU) and ShEM drives of reactor control system (SUZ) have been operating at power unit No. 1 since 1982.

The lifetime of this equipment established by the manufacturing plant is 10 years. Taking into consideration determinative significance of this equipment for reactor installation reliability and safety, NPP's specialists since 1991 started to prepare control rods' drives and SGIU system reconstruction. For this purpose the commitment was gained with Škoda Nuclear Machinery, Ltd. in 1992 for supply one ShEM drive designed jointly by OKB "Gidropress" and Škoda to SU NPP serial power unit No. 3 for experimental-industrial operation within reactor installation. Simultaneously, power control panel and drive position control panel manufactured by Škoda Controls were supplied. At that, it was taken into consideration that Škoda had been successfully working in the area of equipment development and production for VVER type NPPs.

In 1980, Škoda contracted OKB "Gidropress" to perform works on control rods' drives modernization at Novovoronezh NPP unit 5, experimental specimens of which were made in 1983. These drives passed a cycle of tests and modifications which ensured technical characteristic improvement: the drives' lifetime has been 30 years of continuous operation at the increased temperature of 300°C. Driving force allows to move cluster with weight of up to 27 kg. Simultaneously with this there were SGIU system modification conducted on the basis of digital control system; computer diagnostic system implementation; service software modification providing data processing, storing and information availability to the operator-technologist of main control room (MCR) about control rods' drives operation.

Therefore, during the contract conclusion on the set of ShEM drives and SGIU programming-technical complex (PTK) supply there was taken a decision to use during the reconstruction just this modernized ShEM drive with electronic SGIU equipment set of Škoda production. To confirm characteristics attained as well as to meet new requirements on nuclear safety by control rod equipment it was decided to repeat interdepartmental tests on ShEM-M drive and SGIU electrical equipment at the joint meeting in 1994 on control rods reconstruction of serial Ukrainian VVER units (May 24-26, 1994, Yuzhnoukrainsk).

Reosurce tests of control rods’ drives and PTK SGIU tests finished in June 1995 and in February 1996 respectively. Drive and control system confirmed reliability and faultless of their operation at the performance of 6000 double strokes and cluster weight of 27 kg. Interdepartmental commission created by the order of Goskomatom Chairman recommended in its final protocol to apply ShEM-M control rods' drive of Škoda production at all the Ukrainian NPPs with VVER reactors.

Control rods drives and control system reconstruction at power unit No. 1 was conducted during Scheduled Preventative Maintenance '96 within 105 days. The list of works included:
1. Documentation preparation on control rods drives replacement technology
2. Installation, adjustment and commissioning of the stand on control rods drives test in the containment of reactor building
3. Adjustment and commissioning of building slip on control rods drives test in the containment of reactor building
4. Arrangement of casings and control rods drives acceptance test in M-114 compartment as well as electronic equipment in the control rods panels compartment
5. Adjustment and commissioning of the installation for control rods casings' hydraulic tests on the containment level of 38.0 of reactor building
6. Disassembling of old control rods drives and casings
7. Disassembling of old control rods panels and control rods control equipment in the MCR
8. Installation and tests of casings and control rods drives at the upper unit of the reactor
9. Installation and tests of new SGIU panels, control rods control and indication instrumentation at MCR and Emergency Control Room
10. Full-scale tests of control rods within reactor installation.

For all the works there was generated a network schedules and organized a control of their performance. Works were performed by I&C Shop, organization on adjustment “Novovoronezhatomenergo” under the author's oversight, and direct participation of Škoda's specialists.

The quality of the separate works performance was controlled by NPP's Technical Control Department specialists, departmental inspection at SU NPP and GANU inspection. Technical issues appeared during reconstruction were solved at the daily meetings and reflected in the assembling log undersigned by works managers from Škoda and SU NPP.

In parallels, the work on documentation preparation to obtain GANU permission for this system commissioning was carried out. The biggest difficulties were encountered at this stage. Limited time, complication of system being reconstructed, large amount of Nuclear Regulation Administration and GANU inspection requirements required to develop about forty new documents within three months. Amongst the basic were the following:

1. Technical specifications for ShEM-M drive
2. Technical specifications for SGIU electrical equipment
3. Plan and report on SGIU software validation and verification
4. Control rods system reliability report
5. Quality assurance programs on the manufacturing, assembling, adjustment and test stages of control rods drives and SGIU equipment
6. Acceptance test programs
7. Works conduction programs
8. Statements and protocols of interim and full-scale tests results
9. Descriptions and operating manuals for constituent parts and entire system.
10. Explanatory note and control rods reconstruction project.
Most of these documents were subject of expertise according to requirement of Nuclear Regulation Administration. Results of the expertise were also submitted to Central GANU Inspection.

During the process of consideration of documents set on control rods reconstruction Central GANU Inspection required to provide additional information on equipment tests at Škoda plant and at NPP results, that was done. According to the results of submitted documents consideration GANU Inspection issued the license for modernized control rods system commissioning within reactor installation.

Conclusions:
1. It is possible to carry out large reconstruction works at NPP during scheduled preventative maintenance.
2. Terms and quality of such works performance are dependent on preparatory activities scope which are necessary to be performed before the beginning of the reconstructive works at the power unit.
3. Requirements for every document included into the list of documents submitted to GANU to obtain license for commissioning the system under reconstruction have to be generated.
4. The work on standards (GOST, OST) and codes being in force in Ukraine concordance to normative and technical documents in force in countries supplying their equipment to Ukrainian NPPs have to be continued.