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CHERNOBYL AND STATUS OF NUCLEAR POWER
DEVELOPMENT IN THE USSR

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The Chernobyl accident has seriously affected development of the USSR nuclear power.

But it has not eliminated the basic prerequisites for nuclear power development in the USSR, which are:

- resources and consumption territorial disproportions;
- large share of oil and gas in electricity generation;
- negative ecological aspects of coal plants;
- high power industry development rate.

At the same time it has aggravated the old problems and has given rise to some new ones of which the most important are:

- increased safety requirements;
- rise in costs;
- longer construction schedules;
- public opinion.

The main requirements of safe development of nuclear power imposed by these problems may be briefly formulated as follows:

- enhancement of safety and reliability of current generation nuclear power plants and parallel development of new generation NPPs with a higher level of safety;
- scale of development of nuclear power, its economic efficiency comparing with other energy sources and extension of areas of its utilization in the national economy, which are needed from the viewpoint of the fuel and energy balance;
- social acceptability of nuclear power.

These requirements have determined the main directions of works.

It required efforts to be made primarily to take some urgent measures and then to develop a long-term program on elimination of the Chernobyl accident consequences. The results of these activities were:

- construction of the protection facility "Entombment" assuring a reliable protection of the environment against radioactive materials from the destroyed reactor unit and against radiation emission;
- decontamination of the Chernobyl NPP site, NPP-1,2 and 3, buildings inside and outside and residential areas within the territory subjected to radioactive contamination;
- putting the Chernobyl 1,2 and 3 into operation;
- completion of the measures on assuring the living conditions of the evacuated population and regarding their employment;
- realization of necessary medical and sanitary measures on assurance of safety and health protection of the population.

It should also be noted that studies performed in 1988 made it possible to advance in the analysis of the state of the fuel mass and geometry of its location inside "Entombment" and make conclusions on its nuclear safety.

It seems reasonable that within 2-3 years, but before the beginning of the Chernobyl NPP decommissioning, all necessary data would be available for making decision about dismantling or modernizing of the "Entombment".

On the whole for further safe development of nuclear power a detailed analysis of the Chernobyl accident is required, including studies of long-term accident consequences and measures of their mitigation and elimination.

A necessary condition for NPP operation to be continued would also be development and rapid implementation of technical approaches

which would permit to eliminate the design shortcomings in the RBMK - NPPs both operating and those under construction. We have to exclude factors contributing to development of an accident and responsible for increase of its scale.

Some changes in the core composition and in the control system design have been implemented that eliminate rapid uncontrolled surge of the reactor. Additional organizational and technical measures on prevention of accident situations were adopted, including improvement of the control room and operation schedule. The next important step to increase the safety of the RBMK-NPP is connected with the developed concept of backfitting of the RBMK-1000 power units. A number of safety enhancement measures are being implemented for NPPs with other reactor types (VVER, BN etc) primarily by improving the diagnostics and containment systems and using additional safety systems.

Measures for safety enhancement and concrete improvements of the RBMK and VVER reactors are summarized in the following figure. Next the main propositions of the reconstruction concept (backfitting concept) for operating reactors are presented.

Further prospects for safe development of nuclear power are associated with designing the nuclear power units with enhanced and ultimate safety. The nuclear power installations of next generation must be developed using totally new principles for safety system. At the same time we have to ensure their competitiveness with other energy sources and possibility of expansion of their applications. It is assumed that nuclear power development to about 2010 would be mostly accomplished using light-water reactors. The nearest step in this direction is the development of the new VVER-88 reactor design. This design is different from the V-320 design of VVER-1000, which is being implemented now in some systems ensuring the reactor

plant stability against severe accident. The main features of this design are shown in the figure.

The important problem of further nuclear power development is creation of the new VVER-type (VVER-92) reactor design. The design of this reactor will use the best that the domestic and international science and technology can offer and the experience gained in development and operation of the nuclear units, which will assure the safety and required economic characteristics. This will be done by radical simplification of the design, improvement of the diagnostics and of the passive safety systems. Commercialization of the NPPs with VVER-92 is expected to begin in the late 90s.

In the nearest future we intend to develop technical proposals on advanced power plants with enhanced safety. In doing this we will use the inherent safety properties and passive protection means and modernized water reactors for nuclear district heating plants with the aim of creating the new generation reactor prototypes on the basis of this technology. This will be done in 1995-2000. Other advanced reactor concepts are also being considered.

I should like to emphasize specially the problem of public opinion of nuclear power. After the Chernobyl accident we have faced a social phenomenon which is quite new in our country: I mean wide public opposition to nuclear energy. It is manifested in the same forms as in other countries (meetings, demonstrations, publications etc.). There is almost no site where the population was not opposed to NPP construction. Building of the Minsk nuclear co-generation plant, the Krasnodar and Ignolinsk NPPs has been stopped. At present the total output of power units that are not permitted to be erected at the sites planned earlier approaches 30 GW. Hot discussions has flared up about construction of the Crimea NPP and the Gorky and Voronezh district heating plants.

For us these problems are especially difficult as we have had no experience of this kind of interactions with the public. We are planning and begin to realize a program basing on the current world experience. This program includes primarily a wide series of publications on the problems of nuclear energy, its ecologic and economic advantages as compared with conventional and alternative energy sources, using all current media. Centers of public information, discussion clubs, exhibitions etc are being organized. In particular, our Institute has recently concluded agreement on cooperation with the American Nuclear Society, and these problems are also reflected in this agreement. We believe that the IAEA inspections, both being carried out, as, for instance, the recent OSART mission at the Rovno NPP, and those planned, of the Soviet nuclear projects and of the operating NPPs will enable us to make the public confidence in nuclear power come back. At present the IAEA expert inspection of the Gorky NPP is being prepared, which will include both the concept and the NPP design analysis and their practical realization at the plant under construction. But first of all we rely on our own efforts. I believe that soon a new social organization will appear in the USSR - the Soviet Nuclear Society.

In any case, however, the most effective realization of the whole program of works on nuclear power needs a wide international cooperation.