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Visions for the Global Nuclear Industry in the 21st Century

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It is a great honour for me to be one of the first speakers at this Symposium. I would like to give you some information about Russian ideas on the development of the nuclear industry in the coming century. Naturally, I hope that everybody will understand that it is very difficult to develop plans for a period as long as a century, and even more difficult to explain them here in ten minutes.

Plans for the development of nuclear power in Russia in first half of the 21st century were endorsed by the Russian government last year, and I will try to describe them here. A recent analysis of the problems that are making it difficult to develop nuclear power showed that, in order to gain public acceptance of this kind of energy, it is necessary at least to guarantee the provision of fuel for a very long period; to ensure that nuclear generation is cheaper than other forms of generation; to guarantee acceptable levels of safety; to ensure as low as possible a risk of proliferation; and to solve the problems of spent fuel and radioactive waste disposal in a way that it is acceptable to the general public.

The solution to these problems will, in our opinion, be the cornerstone of the future of the nuclear industry. Some drawings and tables are available *(see Appendix below)*, but I have no time to comment on them in detail here. In particular, they demonstrate the need for fissile materials in Russia and that, in order to meet our plans for the future development of nuclear energy, there can be no viable decision other than to include fast breeder reactors as part of our nuclear energy programme. This is because we need to accumulate new fissile materials such as plutonium or, maybe in the distant future, uranium 233. In our analysis we took into account all kinds of fissile materials and our conclusions are based on this. In short, it will be possible to fulfil our plans for a substantial increase of nuclear power in Russia' s energy output only if reactors with plutonium reproduction are used or, in the distant future – as I mentioned before, - if uranium 233 is used in the thorium cycle.

Therefore, starting in 2020-2025, a cornerstone in the development of nuclear power in Russia will be fast neutron reactors with closed fuel cycle and uranium/plutonium fuel. It is intended that, subsequently, this form of generation will account for an increasing share of nuclear power.

I must emphasise that our plans are to construct a new generation of fast reactors. You will know that the BN-600 and the pilot BOR-60 NPP have long been operational in Russia, and we started this year to move towards the construction of the BN-800 reactor. As I mentioned, these NPPs are the first generation of fast reactors and we hope to build on our successful experience to date over the next decade.

We will also be developing a new generation of fast reactors, but it is absolutely clear that nuclear power has to remain competitive within specific financial limits. These limits have been developed as a reference point. However, I do not want to comment on these figures in detail because they are still under discussion and may change. The figures also take into account some specific features of Russia, for example, its huge territories and the long distances between towns. The studies also showed that nuclear energy will be attractive for all of our industry, including that in the northern regions of the country. They also indicated that, in the near future, the competitiveness of new nuclear plant will increase and become even more attractive.

Of course, as speakers before me have mentioned, the main requirements for the future of nuclear power are nuclear and radiation safety. It is clear that accidents of any nature at the new generation of NPPs, releases of radioactivity, radiation accidents and accidents involving fuels must all be avoided. We believe that protection from such accidents should be ensured by observing the principles of natural safety, that is by means of technical solutions based on the physical and chemical properties of fuel materials and other components. Today in Russia we have neither a reactor design nor a NPP that meet all these criteria. And it is very difficult to construct such a facility. However, work on safety analysis is being undertaken on the design of the first nuclear reactor with lead cooling and high density fuel. For that purpose a special loop was made in the BOR-60 reactor and pilot fuel rods were loaded with mixed uranium/plutonium nitrate fuel. Tests on equipment and research into the coolant technology have also been started.

I cannot yet be sure how successful this research will be. But I would like to emphasise that we started this very difficult work with the aim of finding a new level of safety.

I am sure that you know that we have developed in Russia new technology for reprocessing, a ‘ dry technology’ . This technology, a pyroelectrochemcial technology with molten salts, will satisfy safety requirements, and it is possible that it will prove much more attractive than currently existing technologies. In the next ten to fifteen years, we will continue with research and the development of technological equipment based on conceptual solutions that will meet the nuclear and radiation safety requirements that have been laid down. These requirements apply not only to the reactor and the NPP as a whole, but also to fuel cycle enterprises and facilities for long-term controlled storage of irradiated nuclear fuel and radioactive waste.

There is also, of course, the problem of non-proliferation. Problems of non-proliferation nowadays make cooperation between some States with nuclear industries difficult. In my view, current proposed solutions to this problem are not satisfactory because they are based solely on political mechanisms. We believe that it is necessary to introduce technological mechanisms in order to protect nuclear technology from proliferation. There are several requirements, the most maybe important of which is the development of fuel cycles from which it will be impossible to extract fissile material. We already have relevant experience with remote and automatic technology for the production of

plutonium and mixed fuel oxide our two fast reactors and, in my view in the future, our reprocessing technology is a good basis for appropriate technology in the future. As you will know, we have underway a project to construct a fast neutron reactor with gain factor nearly 1, the BREST-300.

I believe that it is possible to draw the following conclusions. The technological protection of fissile material during the production phase is a reliable solution, conceptually, for precluding nuclear proliferation. Such a solution may be possible with the use of a plant fuel cycle based on dry technologies for reprocessing irradiated nuclear fuel, remote automatic control and corresponding transport technologies. Other important requirements are the management of irradiated nuclear fuel and of radioactive waste, and protection of the environment.

Finally, I will conclude by saying that Russia has defined its long-term goals, and its conceptual decisions, and we have outlined ways to achieve those goals. The transition to a new generation of NPPs and fuel cycle enterprises will be smooth and evolutionary and will take more than two decades. However, optimum research results can be obtained only if a broad range of nations joins in our efforts.

Russia is ready and prepared to participate in such co-operation.

Thank you.

[NOTE: Appendices are available only on the HTML version]

