

Die untersuchte Variante der Unfallregulierung versorgt die Impulsturbinenabgabe (ITA), weil sich die Turbinenleistung nach der Signalreduzierung des EHW auf den bisherigen Wert zurücksetzen.

Die Benutzung der ITA für die Wahrung der dynamischen Systemsicherheit wird auf der Abbildung. 2, b gezeigt, wo die natürliche Bremsfläche geringer als die natürliche Beschleunigungsfläche ist. Wenn die ITA durchgeführt wird, reduziert sich die Turbinenleistung und die zusätzliche Bremsfläche  $S_{Tzus}$  entsteht, wodurch das Sicherheitssystem gewahrt wird.

## IMPROVING THE RELIABILITY AND SAFETY OF NPPS

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An essential requirement for nuclear power plant (NPP) is to guarantee the preservation of nuclear and radiation safety. This means that all normal and emergency operating modes, all internal and external impacts should be prevented for the release of radioactive products limits. NPP safety relevant today the problem is not only in Russia but throughout the world, because a lot of people are afraid to bind their lives with work on the nuclear power plant, due to a variety of accidents at nuclear power plants (eg, Fukushima-1 nuclear power plant "Mihama "The Chernobyl nuclear power plant, etc.); great loss of life, lived not only in the vicinity of nuclear power plants, but also in other cities and countries; with the stereotype that the territory of the nuclear power plant of high background radiation, although it is not so (for example, on the embankment of the Neva river (granite) in St. Petersburg 45.00 mR / h, and at the Leningrad nuclear power plant - 8.00 mR / hr).

During normal operation of nuclear power plants do not pose a risk to workers, the public and the environment. However, the safety of nuclear power plants may affect emergencies (incidents) and accidents related to:

- The human factor
- Errors in the design
- Natural disasters
- The problem of radiation safety
- The problem of radioactive waste disposal

### **Human factor**

In human nature inherent right to be wrong, as the man - not a machine, and he can not turn off the influence of his emotions and temperament, as well as the environment, etc. on their activities. The human factor is manifested at all stages of the life cycle of nuclear power plants, starting with the design of its creation, that is, when the set goals. So, we must try to create a system that minimizes human risks.

World experience shows that the best form of training and retraining of specialists is the organization of educational process on the basis of simulators - full-scale, analytical, local, multi-functional, which are equipped with training facilities

(UTC) at the plant. Full-scale simulator (TMT) NPP - software and hardware modeling system that was created using the design, commissioning and maintenance documentation unit, and is based on a complex mathematical model of variable speed unit, operating in real time. The simulator is designed for the professional preparation of joint operational staff block control point unit using his real full-scale model. Qualification of personnel, control of technological processes at the plant, there will always be one of the key factors in ensuring the safe operation of the plant, as accidental or caused by a lack of qualification operator error could nullify any effort to increase the reliability of the equipment and improving technology.

### **Design errors**

Lack of safety culture was inherent not only the operational phase but also, and to a lesser extent, activity in other phases of the life cycle of nuclear power plants, including design and engineering design. For example, one of the main causes of the accident at the Chernobyl nuclear power plant was the error in the design of the station, which led to a meltdown of the reactor containment RBMK-1000 and the release of a cloud of radioactive fallout.

Long-term success of the nuclear industry depends on whether it can take into account the consequences of accidents (such as Fukushima-1 and Chernobyl) in the planning of their activities, and how well it will be able to implement new large-scale projects and to upgrade existing facilities. Cornerstone in the field of nuclear safety should be a "design principle", which consists in the use of new design techniques and improved administrative procedures. Recommendations include more stringent requirements for the design and construction of nuclear power plants (more sophisticated instruments and equipment, reliable backup power sources) to help ensure their full protection against accidents. Designers and suppliers of equipment will have to work closely together to develop the specification of components and devices that meet the new requirements. Necessary to increase the stability of nuclear power plants and industry in general so that they can withstand any unforeseen events.

### **Natural disasters**

Source of random events that can lead to accidents at nuclear power plants can be natural influences. The accident at the nuclear power plant "Fukushima - 1" attracted special attention to the account of external influences, as it turned out, that the design decisions based on incomplete data on capacity tsunami in the area of nuclear power plant.

Preventing failures and violations of safe operation is ensured by choosing the safe area of the NPP, the use of conservative design principles, the availability of quality assurance system at the siting, design, construction and operation, as well as the safety culture. Selecting a safe area involves, in particular, the definition of the projected level of seismic action, which is calculated separately for each site and each block. In carrying out such work is taken into account the level of seismicity maximum design earthquake (SSE), which can occur with a probability of 1 every 10 thousand years (and no more than 8 points). Based on this forecast shall perform appropriate calculations for building structures, design of piping and equipment. If

necessary, equipment is fitted with hydraulic shock absorbers. Applicable regulations prohibited from posting NPP on sites located directly on the active faults; on sites with seismicity is characterized by intensity MDE more than 9 points on a scale of seismic activity Medvedev-Shponhoyera -Karnik; the territory within which the finding of the AU prohibited environmental legislation.

The confluence of natural disasters on the territory of the location of nuclear power plants in Russia, which may result in an accident, comparable to the accident at the plant "Fukushima-1" is not possible. Currently, all Russian nuclear power plants are located in areas of low seismic hazard. In the European part of the country, on the Great Russian stove, which is considered a stable array, earthquake or did not occur at all or occur, but with low intensity (not more than 5.6 on the Richter scale).

### **Radiation safety**

The problem of nuclear and radiation safety can be divided into two parts. The first - is to ensure trouble-free operation of current nuclear power facilities and other potential nuclear and radioactive facilities. Achieving this goal contributes to the licensing of all stages of design, construction and operation of such facilities, as well as companies involved in this State Corporation "Rosatom" and other organizations. The complex system of activities allows us to achieve a strong safety culture when working with nuclear materials and radioactive substances and good performance level of safety of the industry.

The second global issue of nuclear and radiation safety - this is a problem heritage "of the Soviet atomic project." In addition to the substantial cash outlay, it would require the State Corporation "Rosatom" new, often innovative approaches to address problems that have accumulated since the Soviet era: new methods for processing and storage of spent nuclear fuel (SNF) and radioactive waste (RW), new methods of rehabilitation of contaminated territories and so on. To solve these complex problems, the Government of the Russian Federation in 2007 approved the federal target program "Nuclear and Radiation Safety in 2008 and until 2015" with a budget of 145.3 billion rubles, including 131.8 billion rubles - from federal sources.

Just a set of nuclear and radiation safety of the State Corporation "Rosatom" includes a number of specialized federal state unitary enterprises. This enterprises engaged in processing and storage of spent nuclear fuel and radioactive waste. In order to ensure safe operation of the nuclear industry, the protection of personnel, population and territories from possible accidents and emergencies in the State Corporation "Rosatom" and created a system of prevention and liquidation of emergency situations (PSD), which is a functional subsystem of the unified state system of prevention and liquidation of emergency situations.

### **The problem of radioactive waste disposal**

The problem of radioactive waste is acute worldwide. It requires the attention of governments of all countries with nuclear power plants, research nuclear reactors. According to the Russian "Law on the Use of Atomic Energy" (dated November 21, 1995 № 170-FZ) radioactive waste - is nuclear materials and radioactive substances, further use is not provided.

Methods of disposal of radioactive waste:

- Transmutation

There are design reactors that consume waste as fuel, making them less hazardous waste, in particular, the integrated nuclear fast reactor without generating transuranic waste, and, in fact, consume them. Another proposal, more secure, but require additional research is processing subcritical reactor transuranic waste.

- There are projects disposal of radioactive waste in the oceans, among them - the burial under the abyssal zone of the seabed burial in a subduction zone, resulting in the waste will slowly descend to the earth's mantle, as well as the disposal of a natural or man-made island.

- In the 1990s, it was developed and patented several options conveyor disposal of radioactive waste in the bowels. The technology involves the following: starting drilled large-diameter wells to a depth of 1 km, falls into the capsule loaded concentrate radioactive waste weighing up to 10 tons, the capsule should be self-heating in the form of a "fireball" is melted terrestrial rocks. After the burial of the first "fireball" in the same well should fall a second capsule, then a third, and so on. E., Creating a pipeline.

- Sending waste into space is a tempting idea, because all waste removed from the environment. However, such projects have significant drawbacks, one of the most important - the ability to launch vehicle accident. In addition, a significant number of launches and most of them cost makes it impractical to offer. The case is also complicated by the fact that so far not achieved international agreement on this issue.

Thus, to improve the reliability and safety of nuclear power plants must comply with a set of specific rules. Also, I want to say that in our country security is at a very high level. Russian NPPs operated safely and reliably, as evidenced by the results of regular inspections as independent entities (RTN) and international organizations (WANO, etc.). Over the past 5 years at Russian nuclear power plants have been recorded no serious breach of security classified above zero ( minimum) level on the international INES scale. On the criterion of the reliability of the nuclear power plant Russia ranked second in the world among countries with the development of nuclear energy, ahead of such developed countries as the USA, UK and Germany.

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