Research paper on chernobyl disaster

Environment, Electricity

The Nature of the Environmental Problem

The accident at the Chernobyl nuclear power plant is the destruction of 26 April 1986 of the fourth unit of the Chernobyl nuclear power plant, located on the territory of the Ukrainian SSR (now - Ukraine). The destruction was of an explosive nature, the reactor was completely destroyed, and the environment was released large quantities of radioactive substances. The accident is regarded as the largest of its kind in the history of nuclear power, as alleged by the number of dead and injured from the consequences of its people and for economic loss. During the first three months after the accident, 31 people died, long-term effects of exposure identified for the next 15 years, caused the death of 60 to 80 people. 134 people suffered radiation sickness to varying degrees of severity, more than 115 thousand people from the 30- kilometer zone have been evacuated. To eliminate the effects of significant resources have been mobilized, more than 600 thousand people participated in the aftermath of the accident.

N. Karpan, a survivor of the Chernobyl Disaster, wrote, that “ in contrast to the bombing of Hiroshima and Nagasaki, a very powerful explosion resembled a " dirty bomb" - the main affecting factor was the radioactive contamination.”

The cloud from the burning reactor spread radioactive materials are different, and above all radionuclides of iodine and cesium over much of Europe. The greatest loss occurred in large parts of the Soviet Union, located near the reactor and are now relating to the territories of Belarus, the Russian Federation and Ukraine.

The Chernobyl accident was an event of great socio - political importance for the Soviet Union, its liquidation cost the Soviet Union in an amount close to 25 billion dollars. All this has left a definite imprint on the course of the investigation of its causes. Approach to the interpretation of the facts and circumstances of the accident has changed over time, and completely no consensus so far.

Characteristics of NPP and a Disaster

The Chernobyl nuclear power plant is located on the territory of Ukraine, 3 km from the town of Pripyat, 18 km from the town of Chernobyl, 16 km from the border with Belarus and 110 km from Kiev.

Chernobyl nuclear power plant shut down for good December 15, 2000.

At 01: 23 April 26, 1986 at Unit 4 of the Chernobyl nuclear power plant explosion, which completely destroyed the reactor. The building unit partially collapsed, killing two people - the operator of the MCP (the main circulating pumps) Valery Hodemchuk (the body is not found, littered with the rubble of two 130 -ton drum separators) and a member of commissioning enterprise Vladimir Shashenok (died of a spinal fracture and multiple burns at 6: 00 am in Pripyat MSU number 126 April 26). In the various rooms and the roof started the fire. Subsequently, the remnants of the core melted, the mixture of molten metal, sand, concrete and fuel fragments spread over the podreaktornym premises. The accident spewed into the environment of radioactive substances, including isotopes of uranium, plutonium, iodine - 131 (half-life - 8 days), cesium -134 (half-life - 2 years), cesium -137 (half-life - 30 years), strontium -90 (half-life - 28 years).

Cause of the Accident and the Investigation

There are at least two different approaches to explaining the causes of the Chernobyl accident, which can be called official, as well as several alternative versions of varying degrees of reliability.

The State Commission, formed in the Soviet Union to investigate the causes of the disaster, with primary responsibility for it to the operational staff and management disaster. Gross violations of the rules of nuclear power plant operation, committed by its personnel, according to this view, are the following :

- the experiment " at any price ", despite the change of state of the reactor;
- conclusion of the work of the healthy process protections that would have stopped the reactor even before he got into a dangerous regime ;
- silence on the scale of the accident in the early days of the leadership of the Chernobyl NPP.

In 1991, the Commission re- GAN USSR considered this issue and concluded that " because of the actions which began operating personnel Chernobyl accident has acquired them inadequate catastrophic proportions due to poor design of the reactor." In addition, the Commission has analyzed the force at the time of the accident regulations and did not confirm some of the previously advanced by the station staff to address the charges.

In 1993, INSAG has published an additional report, renewing " the part of the report INSAG- 1, which focuses on the causes of the accident " (P. Abbot, 2006) and paying more attention to the serious problems in the design of the reactor. The main factors which contributed to the occurrence of the accident, INSAG- 7 considers the following:

- reactor did not meet safety standards and had a dangerous design features ;

- poor quality of service regulations regarding safety ;

- ineffectiveness of the regulatory framework and supervision of the safety of nuclear power, a general lack of safety culture in nuclear issues at both the national and local level;

- there was no effective exchange of information on security as between operators and between operators and designers, the staff did not have sufficient understanding of the station features related to safety ;

- the staff made several mistakes and broke the existing regulations and testing program.

The circumstances of the accident investigation were that (then and now) to judge its causes and consequences have professionals whose organizations are directly or indirectly bear some of the responsibility for it. In this situation, the radical difference of opinion is quite natural. Also, it is natural that under these conditions, in addition to the recognized " authoritative" version, a host of marginalized based more on speculation than on facts. United in the authoritative version is only a general idea of the course of the accident scenarios. Its basis was the uncontrolled increase in reactor power, transformed into a thermal explosion of the nuclear nature. Breaking the accident phase began with the fact that the nuclear fuel from overheating destroyed fuel elements (cartridges) in a certain area at the bottom of the reactor core. This has led to the destruction of multiple channels shells in which these fuel elements, and the steam pressure of about 7 MPa was output in the reactor space in which atmospheric pressure is normally

maintained (0. 1 MPa). The pressure in the reactor space (RP) has increased dramatically, which caused further damage already reactor as a whole, in particular the separation of the upper cover plate (so-called " circuit E") with all the channels contained therein. Immersion (shell) of the reactor, and with it the main circulation circuit (MCC) has been broken, and there was dehydration reactor core. In the presence of the positive void (void) reactivity effect 4-5 β, this led to the dispersal prompt reactor (similar to a nuclear explosion) and the observed widespread destruction with all the ensuing consequences.

Versions fundamentally disagree on the question of what exactly the physical processes ran this script, and that was the starting event of an accident.

The Consequences of the Accident

Directly in the explosion at unit killed only one person (Valery Hodemchuk), another died on the morning of his injuries (Vladimir Shashenok). According to G. Medvedev (21) “ Subsequently, 134 employees and members of the Chernobyl rescue teams who were in the station at the time of the explosion, developed radiation sickness, 28 of them died within the next few months.”

The presence of high levels of radiation has been well established only for the 3: 30, since two of the available devices on the 1000 R / h one fails, the other can not be reached because of some rubble. Therefore, in the early hours of the accident were unknown real radiation levels smokers block and around it. Was unclear and the state of the reactor. Was the version that the reactor is safe and need to cool it.

Firefighters did not let the fire spread to the third block (in the third and 4th

units uniform transitions). Instead of fire-resistant coating, as was necessary under the instruction, the roof of the turbine hall was flooded with conventional fuel bitumen. By about 2 o'clock in the morning there were the first affected by the number of firefighters. They began to show weakness, vomiting, " nuclear tan ". Assistance rendered to them on the spot, in the infirmary station, and then transported to a city hospital of Pripyat. In April 27 the first group of 28 people injured was sent by plane to Moscow, in the 6th radiological hospital. Virtually no drivers suffered fire trucks.

In the first hours after the accident, many probably did not realize how badly damaged the reactor, so it was a wrong decision taken to ensure the flow of water into the reactor core to cool it. They needed to carry out works in areas with high radiation. These efforts have been futile as pipelines, and the very active area were destroyed. Other actions of plant personnel, such as quenching of fires in the station premises, the measures aimed at preventing a possible explosion, in contrast, were necessary. They may have prevented even more serious consequences. In carrying out these activities, many staff the station received large doses of radiation, and some even fatal.

The accident resulted from agricultural use was withdrawn about 5 million hectares of land around the plant created a 30- kilometer exclusion zone, destroyed and buried (buried by heavy machinery), hundreds of small towns.

The Future of the Problem

In terms of the impact on the population in the first weeks after the accident, the biggest danger is radioactive iodine, which has a relatively short half-life (eight days) and tellurium. At present (and in the next decade), the most dangerous isotopes of strontium and cesium, with a half-life of about 30

years. The highest concentrations of cesium -137 were found in the surface layer of the soil, where it enters the plant and fungi. Pollution are also subject to insects and animals that eat them. Radioactive isotopes of plutonium and americium remain in the soil for hundreds and perhaps thousands of years, but the number is small. However, some experts believe that the problems associated with pollution transuranic elements that require further study. As a result of the beta decay of Pu- 241 in the contaminated areas the formation of americium- 241. Currently input Am-241 in the total alpha activity of 50 %. Increased activity of soils contaminated with transuranic isotopes due to Am- 241 will continue until 2060 and his contribution will be 66. 8 %. In particular, in 2086 the alpha activity of soil contaminated by plutonium territories of the Republic of Belarus will be 2. 4 times higher than in the initial period after the accident.

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