

Report on the situation at the "Shelter" facility in the first half of 1990

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Secret

Reference note regarding the situation at the Shelter facility in the first half of 1990

Following the accident at Unit 4 of the Chernobyl Nuclear Power Plant, as a result of work carried out by enterprises and institutions of the Ministry of Medium Machine Building, the Ministry of Energy, and the USSR Ministry of Defence, construction of the Shelter facility was completed in December 1986, after which it was transferred to permanent operation of the Chernobyl Nuclear Power Plant.

During the development of the design documentation for the Shelter, the All-Union Scientific Research and Design Institute of Power Technologies (VNIPIET, Leningrad) envisaged that the facility would provide the following functions:

- protection of personnel working at the plant and the surrounding area, as well as the environment, from radiation, and limiting the release of radioactive fission products into the atmosphere;
- monitoring for possible changes in the fuel mass during reactor breakdown, as well as residual heat removal;
- prevention of a self-sustaining chain reaction (SSCR) and other nuclear-hazardous conditions.

To ensure continuous monitoring of the condition of the facility's walls and foundation, a system of special measurements using reference marks has been developed and implemented.

The condition inside the facility is monitored using the specially developed "Shater" information and diagnostic system (developed by the Institute of Nuclear Research of the Ukrainian Academy of Sciences), which measures the following parameters:

- neutron flux density above the collapsed structure and in the rooms adjacent to the reactor shaft;
- exposure dose rate at various points;
- temperature near the fuel masses;
- vibration, displacement, and subsidence.

However, according to experts, the "Shater" information and diagnostic system does not fully meet existing requirements for monitoring the collapsed state of a power unit.

Neutron flux and gamma radiation readings are recorded an hour after measurements, preventing prompt information about the facility's condition. The absolute measurement limits used for neutron flux and gamma radiation do not allow for an objective assessment of the situation, if a self-sustaining chain reaction occurs. Temperature monitoring equipment does not provide a true picture of heat distribution throughout the facility (reported to the 6th Directorate KGB – 6/3–549 of February 14, 1989).

During the targeted work of specialists from the Kurchatov Institute of Atomic Energy's Integrated Expedition from 1987 to 1989, some clarity was brought to the issues related to determining the locations of fuel concentrations and its physicochemical characteristics. A virtually unambiguous conclusion was reached regarding the deep subcriticality of the remaining fuel and, consequently, the absence of conditions for a self-sustaining chain reaction.

Surveys of areas accessible to radiation safety specialists allowed us to assess the actual condition of the building structures and obtain reliable data for further work in this area.

However, according to specialists, the system for monitoring the condition of building structures is not perfect. The laser systems currently in use are ineffective and do not provide the necessary objectivity. The current method for setting reference marks is outdated.

All this necessitates the development of a unified concept for organising monitoring of the condition of building structures, ensuring the timeliness, informativeness, and objectivity of data on the Shelter.

One of the main factors currently determining the safety of the Shelter is the condition of the reactor's upper lid (Scheme "E"). The lower part of the nearly vertical lid is clearly visible from drilled boreholes at 20 and 24 meters. It has been established that the space inside the reactor does not contain any significant structures that could support it.

According to experts' calculations, the collapse of the reactor's upper lid would result in the release of large volumes of radioactive aerosols, contaminating the plant's territory, which in turn would have negative moral and psychological consequences incomparable with the technical and material costs.

This conclusion is supported by the fact that the Shelter does not fully meet the requirements for preventing radionuclide release.

According to existing estimates, the flow rate of dust-air mixture through leaks in the facility could reach 10,000,000 cubic meters per hour. The existing ventilation system, which does not provide the necessary vacuum inside the structure, is not being used. However, work to improve the facility's airtightness is not being carried out.

Two comprehensive safety concepts for the Shelter are currently being considered:

- complete dismantling of Unit 4 with disposal of its components in the "Burial Sites" (the "Green Lawn" concept);
- complete isolation of the Unit 4 reactor by constructing an additional structure, "Shelter-2," over the Shelter facility (the "Shelter-2" concept).

Currently, experts believe that the first concept is promising, albeit more expensive, due to the lack of realistic capabilities for the complete dismantling of Unit 4, as well as the shut-down Units 1, 2, and 3, using existing technical means (a 7-8-year timeframe).

As part of the second concept, a dust suppression system has been installed at the facility, capable of dispersing 35 tons of dust-absorbing solution in 15 minutes. However, according to

experts, this system is technically insufficient, as it cannot operate automatically due to the lack of dust control sensors (the system is activated manually). Furthermore, its maintenance requires a significant number of specialists.

It should be noted that at a meeting of scientists from the Kurchatov Institute of Atomic Energy, the Institute of Nuclear Energy of the Academy of Sciences of the Byelorussian SSR, and the Kola Scientific Centre, the results of calculations on the possible increase in the temperature of residual fuel masses after concreting the reactor shaft (one option for strengthening the reactor's upper lid) were reviewed. It was recognised that, at the current rate of temperature decline, concreting work could only begin by 1991, as the shaft is one of the primary channels for excess heat removal.

Furthermore, specialists from the Kurchatov Institute of Atomic Energy's Integrated Expedition encountered difficulties working with "hot" cores (activity of 2,000,000 or more microSieverts per hour), which prevents them from effectively examining the structure of the destroyed reactor.

In terms of implementing the Shelter-2 construction project, according to specialists from the USSR Ministry of Atomic Energy, it is necessary to:

- identify a specific organisation to carry out and coordinate all work at the facility, as well as to be responsible for its quality, reliability, and safety (Currently, by order of the USSR MAEP No. 328 of December 19, 1989, the Shelter has been transferred to the jurisdiction of the NPO Pripyat; the creation of a separate Shelter organisation is planned);
- determine the status of the Shelter facility:
 1. Radioactive waste storage facility;
 2. Spent nuclear fuel storage facility;
 3. Repository;
- conduct a full expert assessment of the facility;
- issue certificates authorising work to a particular organisation at the Shelter facility.

At the Second All-Union Conference on the Results of the Four-Year Post-Accident Recovery Period (held from May 22 to 24 this year in Chernobyl), E.A. Yakovlev, a representative of GlavUkrGeologiya, expressed concern regarding the prospects for constructing Shelter-2 due to the complex hydrological conditions in the area of the second stage of the Chernobyl Nuclear Power Plant. He believes that additional loads on the foundations could lead to a loss of its strength and stability, which could have extremely negative consequences.

It should be noted that decontamination work at the facility until April 15 of this year (as determined by the Resolution of the Central Committee of the CPSU, the Council of Ministers of the USSR, and the All-Union Central Council of Trade Unions, as well as by the instruction of the USSR MAEP) was carried out around the clock by military personnel of the USSR Civil Defence Task Force (approximately 260 people). This created acceptable conditions for the research of the Kurchatov Institute of Atomic Energy and also contributed to maintaining a normal radiation environment in the premises of the adjacent 3rd Power Unit.

The cessation of these works led to an increase in surface contamination to 10,000–20,000 beta particles/min/cm² and alpha activity of airborne aerosols to 0.37 Bq/m³.

It's telling that representatives of the Japanese television company NHK, who visited the plant on May 24, after measuring radiation levels with their own dosimeters in the former control room of Unit 4, urgently stopped filming and left the site. The curtailment of the safety work reduced the amount of information about the safety status of the Shelter.

According to experts, the current situation at the Shelter facility, the existence of a number of programs for monitoring its condition, and the organisational difficulties that have arisen require the creation of an independent enterprise for the facility that will coordinate all work aimed at improving its safety. This will likely be implemented after the transfer of the Shelter facility to the Pripyat Scientific and Production Association (Order of the USSR Ministry of Atomic Energy No. 328 of December 19, 1989).

6th Department of the UKGB