УДК 614.8:621.039(091)

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ATOMIC ENERGY AND HUMANITY: HISTORICAL REVIEW OF NUCLEAR SAFETY

The nuclear tests have been done by the governments of different countries. They demonstrate not only the tremendous power of nuclear reaction, but immorality of nuclear weapons of mass destruction. The effects of such experiments have great destructive force and bad influence on the health of many generations of humankind and on the environment too. Accidents at nuclear power plants are really unpredictable. The consequences of such accidents on the examples of such nuclear power plants, as Chernobyl and Fukushima-1, are considered.

Key words: *Chernobyl, Fukushima-1, nuclear safety.*

The 20th century is renowned to be the nuclear age. New researches and experiments brought science to the new edge and made people think over their responsibilities for consequences and decisions been made. It came to know tiny atoms to carry a great hidden power, thus they must be treated with special cautiousness and respect. Only intelligent and people with high moral qualities are allowed to intrude into the universe fundamentals. It is proved by the history, how dangerous careless experiments with energy sources might be. Therefore Hiroshima and Nagasaki, Chernobyl and Fukushima catastrophes have to be not only remembered, but taken into conclusions.

So, when the end of the "peaceful story" about the atom began? The summer of 1945 ended up with creation of the nuclear weapon by the USA. America became the one and only owner of the nuclear bomb.

In the end of September of 1945 it was planned by American military staff to drop all in all 9 bombs (3 bombs per each operation) on Japanese islands to frighten a possible enemy. During the second meeting in Los Alamos on May 10-11, 1945, the Objectives Committee recommended few general targets to be attacked with nuclear weapons: Kyoto – the largest industrial center, Hiroshima – the military depot and port, Yokohama – the center of military industry, Kokur – the largest military arsenal and Niigata – the military port and engineering center. Nevertheless the immediate order to apply the weapon was given on August 1945, the USA had only 2 bombs ready. The military insisted to drop it on rice fields or the sea so that the enemy is scared. But the government was strict: bombs have to be applied against the cities with a great population density. [1]

On August 6, 1945, at 8:15 a.m., the nuclear bomb "Little Boy" was dropped on Hiroshima by an American B-29 bomber, the Enola Gay, flown by Colonel Paul Tibbets,. The explosion was equal to 13-18 TNT, it brought huge smog clouds of dust into the city and set the wooden buildings on fire. When the fire was finally stopped, the whole city was one big ruin. This was a terrific scene the world had

never seen before. The piles of burned to ashes bodies were everywhere. The tram remains were filled up with charred corpses still holding their arms onto the handrails. The howling and moans of those who left alive were heard everywhere.

The bomb erased 60% of Hiroshima overnight. However, some concrete buildings in Hiroshima were firm. The world-famous building, the Hiroshima Board of Trade, for example, that was located just 160 meters from the explosion center, has not collapsed, but it's copper dome has melted. Later, a Memorial Park was built near the it's ruins.

From more than three hundred thousand residents of Hiroshima hundred eighty thousand people have suffered from explosion. Ninety two thousand people have died and was missing, about ten thousand people have got severe wounds and twenty eight thousand people have got slight injuries. These data have been published in February, 1946 by headquarters of the American occupational army in Japan. Seeking to reduce the responsibility, Americans have underestimated number of the victims as far as it was possible. Besides, the number of the killed and wounded military personnel at calculation of losses hasn't been considered. Also it is necessary to consider that many victims with severe and insignificant wounds have died of radiation sickness in several days, months or even years. The buildings located in a radius of two kilometers from epicenter of explosion have been completely destroyed, and in a radius of twelve kilometers have undergone considerable destructions. As a result of explosion and the fires, 9 of 10 all houses of the city in which lived ninety five thousand inhabitants have been burned to ashes. Never in the past people could imagine such extent of damage and cruelty. In Tokyo there were notified that Hiroshima was bombed only in three hours in spite of the fact that the telegraph can convey information on long distances in only a few minutes.

Three days later, on August 9, 1945, the Fat Man atomic bomb an equivalent in 21 kilotons, has been dumped on the city of Nagasaki by the commander of the B-29 bomber «Bockscar». At 8:50 a.m. the plane which transported an atomic bomb has gone to Kokur, and has arrived there at 9:20 a.m.

However, it was difficult hard to direct approach bombing because the city was covered with clouds. After few unsuccessful approach landing at 10:32, B-29 superfortress hold a course for Nagasaki. Freak weather saved the city of Kokura from total destruction. But supreme command of USA had a lot of fall-back positions and on of that was Nagasaki.

At 10:56, B-29 flied at Nagasaki which was covered with clouds too. The pilot adopted a much less accurate visit to the goal by radar. For the last moment bomb-aimer delivered the bomb eye for the silhouette of the local stadium. The bomb exploded high over the industrial valley of Nagasaki.

The explosion occurred at 11:02 local time at a height of 500 m. In Nagasaki perished about 70 000 citizens, totally 36% houses were destruction.

Now, the Hypocenter Park in Nagasaki remind that nuclear catastrophe. At the center of this park situated black stone column where the bomb exploded. The bell rings at the local temple every day exactly at 11.02 a.m. Near located Nagasaki

Atomic Bomb Museum collected the most terrible exhibits which remind the explosion.

Instead Japanese official data on 31 March 2013, the number of survive an accident was 201 779 ‘hibakusha’- people who have suffered from the effects of the atomic bombings of Hiroshima and Nagasaki. This number includes woman who have given birth to theirs children were exposed radiation instead of explosion. 1 % of them, according to Japanese government, had oncological diseases caused by radiation exposure after the bombing. The number of dead at 31 August 2013 is about 450 000 in Hiroshima and 286,818 in Nagasaki [2].

Contamination concept did not exist in those years, therefore there was any raised question. People continued to live and rebuild the destroyed buildings in the same place. Even high mortality in the next years, diseases and children’s genetic disorder, born after the bombing, was not connected with radiation [11]. There was no evacuation of the population from contaminated areas, because no one knew about the existence of radiation.

Due to lack of information, it is quite difficult to give an assess of contamination degree. However, technically, the first atomic bombs were relatively thin and imperfect (for example, bomb «Little Boy» contained 64 kg of uranium, of which only about 700 grams of fission reaction happened), the level of area contamination couldn’t be significant, but in the same time represented serious danger. For comparison, during the Chernobyl accident, in the reactor core accumulated several tons of fission products and transuranic elements of different radioactive isotopes [3].

At first the USA denied that the atomic bombing caused any extended effect (radioactivity), calling such statements Japanese promotion.

Atomic bombings of Hiroshima and Nagasaki – the only examples in mankind history of militant use of nuclear weapons. However, it was necessary to test new types of mass destruction. It requires large areas.

In 1951 the Nevada desert, with its vast areas, was chosen as a proving ground for testing nuclear weapons. 928 nuclear explosions were carried out in the largest USA landfill Nevada. The first explosion in a kiloton power was held January 27, 1951. More than 50,000 US militaries were involved. In the 1950s the so called "nuclear tourism" was developed.

France conducted its first nuclear explosion February 13, 1960 at proving ground in Rehhan, Algeria. And the fourth nuclear test, in April 25, 1961, was held specially to study the effect of nuclear weapons on people. Recruits were sent at the proving ground. 45 minutes after the explosion infantries were ordered to approach to a distance of several hundred meters and stay there for 45 minutes. They had their usual uniform [2].

September 14, 1954 at Totskiy proving ground in Orenburg was prepared and conducted soviet military tactical exercises with the use of nuclear weapons under the leading of Marshal G.K. Zhukov (codenamed – "Snowball"). The task was to simulate defense capabilities by using nuclear weapons.

According to the tactical concept of exercise, an offensive side was given the task to breakthrough prepared tactical resistance of a conditional enemy using

nuclear weapons, for those who was defending – organization and conducting the defense in conditions of using nuclear weapons. The focus was on the offensive side, whose troops actually carried out nuclear, artillery and aviation resistance breakthrough and assailed the nuclear explosion district. Herewith the defending troops were beforehand evacuated at a safe distance.

All in all about 45 thousand personnel, a huge amount of aircraft and armored vehicles were involved in the operation. The preparation for the exercise lasted three months. By the end of the summer a huge battle field was literally mottled with tens of thousands miles of tank-cuts, trenches and anti-tank ditches. Hundreds of pillboxes, bunkers, blindages were built.

On the one of the hills, 15 km from the planned explosion epicentre, was built a government platform to observe the exercise. The highest command and even the Ministers of Defense of the countries with socialist vector began to arrive to field airdrome in the vicinity of Totskiy three days before the exercise beginning. They all headquartered in Government camp previously built in the area. A day before the exercise in Totskiy arrived Khrushchev, a member of the Politbureau, Bulhanìn and the creator of the nuclear weapons, Kurchatov.

In a day of the exercise on September 14, 1954 at 9:20 p.m. exercise control has made a decision about the nuclear weapon explosion. 10 minutes before applying a nuclear strike was given the "nuclear alarm", in which all troops settled in shelters. The crews of armored vehicles have taken their places within. At 9:34 p.m. a-carrying plane Tu-4 from a height of 8000 m dropped the atomic bomb RDS-2 with the yield of 40 KT, the explosion of which took place through the 48 seconds at an altitude of 350 meters above the surface of the Earth.

The result of the explosion was a radioactive dust cloud, which suddenly spread not through uninhabited steppe but went directly on the city of Orenburg and further in the direction of Krasnoyarsk.

To the explosion epicenter were sent out radiation detection patrols, who arrived to the area 40 minutes after. They found that radiation level intensity of the area in 1 hour after the explosion was 50 p/h, within a radius of up to 300 m – 25 p/h, within a radius of 500 m – 0.5 p/h and in a radius of 850 m – 0.1 f/h [4].

After removing the stamp "top secret" in 1993, there were allegations that as a result of nuclear weapons tests on 14 September 1954, 45 000 soldiers and 10,000 civilians were experimentally influenced by nuclear radiation in order to learn how radiation affects humans. And since the personnel and the citizens were ill-informed about the necessary actions and measures of protection against radiation, it has caused a sharp increase in cases of malignant growth and blood diseases among the participants of the exercise, chromosome mutation, mutilation and infant mortality among the local population. No inspections and surveys of participants at this inhuman experiment, with considerations of confidentiality, have been implemented.

As a result of training, thousands of its members have received different doses of radiation. Missing confirmed facts providing military personnel to the appropriate medical care. Out of 45 thousand soldiers who took part in the training, now alive

remains less than 2 thousand. All participants gave subscription non-military secret for 25 years. The bulk of materials about the exercises began to emerge only after the collapse of the Soviet Union. Losses among the civilian population are still unknown. Archives of Tots'koyi District Hospital from 1954 to 1980 were annihilated. Participants mentioned only after the events in Chernobyl, but many could not prove their participation in the exercise, the more you get compensated for lost health.

In Tots'kyi in 1994, at the epicenter of the blast was installed memorable sign: Stella with bells [5].

Also there is no credible statistical research affected by radiation on Semypalatansk, Novozemelsk, Kapustin-Yar and Ladoga testing areas. The USSR detonated on its own territory, populated own citizens, 125 of atomic bombs. As a result in 1955 by a group of famous scientists has been written antimilitary appeal-Manifesto of the Russell-Einstein. It marked the beginning of Pahuoshsk movement of scientists, international security and scientific cooperation. This manifesto was signed by eleven world-renowned scientists: A. Eynshteyn, B. Rassel, P.U. Brydzhmen, L. Infeld, H. Dzh. Meller, F. Zholio-Kyuri, L. Polinh, S.F. Pauell, Dzh. Rotblat, Kh. Yukava [6].

But we should not forget about the peaceful use of nuclear energy, including nuclear power plants, which in spite of positive feasibility study, often fraught with great danger. The accident at the Nuclear Power Plant has significant differences from nuclear explosions. They differ from nuclear explosions greater duration, change the direction of flow of the air masses, so virtually no ability to predict the sizes of the areas of infestation.

During the operation of the Nuclear Power Plant in the world has happened 4 crash: 1961 – Idaho Falls (United States), 1979 – Nuclear Power Plant "three mile island" in Harrisburg (United States), 1986. – Chernobyl, 2011 – Japanese Fukushima station.

At the beginning of the eighties in the USSR began to explore the possibility of a rapid increase and decrease power reactors. This method of control was in theory much easier and more profitable to all others. On April 25, 1986 was a scheduled stop on the fourth of the scheduled warning repairs. During these stops, usually held a variety of test equipment maintenance and custom made for individual programs. This time, the purpose one of them, it was a test of the so-called mode “turbogenerator rotor leak" proposed by General Designer (Institute of OAO Hydroproject Institute) as a supplementary system of emergency power supply. " Leak" allows to use the kinetic energy of the rotor turbo generator to ensure the power supply and the main circulating pumps in case of de-energizing electrical own needs. However, this option was not used or implemented at the plant. April 26th 1986, the destruction of the fourth power unit of Chernobyl nuclear power plant [8].

The Chernobyl disaster stands in the first row of the most serious technogenic accidents in all history of mankind. Not a single catastrophe of XX century had such heavy ecological consequences, as Chernobyl. This tragedy is not regional, not

national, but global scale. The fall of radionuclides was traced in the states of Western Europe, a background radiation rose in Scandinavia, Japan and the USA. This accident has so ruinous consequences, that and now – 30 years after – a situation remains very difficult.

The explosion of the reactor led to a horrific in size radioactive contamination of locality. In a reactor at the moment of the accident were about 180 tons of nuclear fuel and 9 to 60 tons from that were thrown out in an atmosphere as aerosols. An enormous radioactive cloud rose above NPP and settled on a large territory. As a result, from pollution suffered large areas of Ukraine, Belarus and some territories in Russia. During 1991 – 1995, in accordance with the requirements of applicable legislation, were defined borders of the radioactively contaminated zone. To them attributed 2293 settlements of 74 districts in 12 regions of Ukraine, which have suffered the greatest pollution are Vinnytsya, Volyn, Zhytomyr, Ivano-Frankivsk, Kyiv, Rivne, Sumy, Ternopil, Khmelnytsk, Cherkasy, Chernivtsi, Chernihiv regions [7].

At first o'clock after a casualty her scales remained unknown, but already in the day-time on the majority of a population of city Pripyat has hastily evacuated at April 27, in subsequent days people were taken out at first from ten kilometers zone around Chernobyl NPP, and then – and from thirty kilometers zone. On rough estimates, more than from one hundred settlements for throughout the 1986 year about 115 thousand were evacuated and over 220 thousand persons were transmigrated in next years. Without regard to a catastrophe, Chernobyl NPP from the autumn of 1986 renewed its work: already on October 1 there was a start of power unit № 1, and on November 5 started its work power unit № 2. It was difficult to start the third power unit because he was in a direct closeness from wrecking fourth, that is why he began work only on November 24, 1987. In the evening on October 11, 1991, at the second power unit happened serious fire which actually summed up an exploitation of the station. In turn, all blocks stopped the work. And on December 15, 2000, there was the stopped work of all Chernobyl station by the decree of the president of Ukraine. And until this moment building of new sarcophagus goes above NPP, which is planned to be completed in 2018.

The Chernobyl disaster forced the reactor to review regulations and strengthen nuclear safety requirements. So the truly serious security measures at nuclear power plants were introduced only after 1986. Prior to this, it was thought that the question of reliability of NUCLEAR POWER resolved a long time ago (back in the stages of their design and testing).

According to the press, we have the relative reliability of the world's nuclear power plants [9], that Japanese stations were given the best performance. However, the Japanese earthquake of 2011 dot the i’s. Absolute security does not exist!

March 11, 2011 magnitude earthquake 9.0 shaken Japan and caused a tsunami that rain down on the East coast of the country, destroying buildings and communication, taking away the lives of hundreds of thousands of people. Also NPP Fukushima-1 was destroyed.

The earthquake was the cause of power failure at a nuclear plant Fukushima-1, which consisted of six nuclear reactors. The tsunami flooded the backup diesel

generators, and the station remained without electricity, which is necessary for the cooling of reactors. As a result, the nuclear fuel of the first, second and third reactors began to melt.

Because of the accumulation of hydrogen in the buildings, where the reactors located, the devastating explosions happened. Nuclear accident was awarded the seventh level, which is the highest according to the International Nuclear Event Scale (INES). According to the calculations of the Nuclear and Industrial Safety Agency-NISA, the amount of radioactive cesium-137 which was released to the atmosphere during the time of the crash, can be compared with 168 bombs, which were dropped on Hiroshima in 1945. The research results of the scientists from the Woods Hole Oceanographic Society, Fukushima disaster became the reason of "the largest release of radiation in the world's oceans." The results of the expertise conducted by Agency for Nuclear and Industrial Safety in Japan, published in June 7, 2011, showed that the amount of radioactive elements, which released in the atmosphere in the first days of the accident at the Fukushima nuclear power plant, exceeded the estimated earlier level in twice.

Many governments instructed their departments to check whether they are able to survive after nuclear or natural disaster. Germany has closed several nuclear power plants and promised in the near future to refuse completely from nuclear energy. Japan does not interested in the development of nuclear power, and conducts research in the field of alternative energy. At the moment, in Japan 90% of 54 nuclear reactors are shut off until May 2012. Nuclear industry promises the problems with the power supply, but Japan argues that it is possible to live without "the peaceful atom".

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The article was received 15.03.2016.

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АТОМНА ЕНЕРГЕТИКА ТА ЛЮДСТВО: ІСТОРИЧНИЙ ОГЛЯД ЯДЕРНОЇ БЕЗПЕКИ

Численні ядерні випробування, проведені урядами різних країн, довели не тільки величезну силу ядерної реакції, а й аморальність зброї масового знищення. Наслідки таких експериментів не тільки мають велику руйнівну силу, але й впливають на здоров'я багатьох поколінь людства, на екологію в цілому. Ще більш непередбачуваними бувають наслідки аварій на мирних об'єктах атомної енергетики. На прикладах аварій на Чорнобильській АЕС і станції Фукусіма-1 розглянуто наслідки таких катастроф.

***Ключові слова**: Чорнобильська АЕС, Фукусіма-1, ядерна безпека.*

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АТОМНАЯ ЭНЕРГЕТИКА И ЧЕЛОВЕЧЕСТВО: ИСТОРИЧЕСКИЙ ОБЗОР ЯДЕРНОЙ БЕЗОПАСНОСТИ

Многочисленные ядерные испытания, проводимые правительствами разных стран, доказали не только огромную силу ядерной реакции, но и аморальность оружия массового уничтожения. Последствия таких экспериментов не только имеют большую разрушительную силу, но и влияют на здоровье многих поколений человечества, на экологию в целом. Еще более непредсказуемыми бывают последствия аварий на мирных объектах атомной энергетики. На примерах аварий на Чернобыльской АЭС и станции Фукусима-1 рассмотрены последствия таких катастроф.

***Ключевые слова:** Чорнобыльская АЭС, Фукусима-1, ядерная безопасность.*