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Spatial Aspects of International Security in the Nuclear Context

The concept «nuclear safety» is generalized. The evolution of the influence of the nuclear factor on international security is explored. The nuclear potential of official and unofficial nuclear club member states has been characterized. The spatial features of the proliferation of nuclear weapons from the standpoint of international security are analyzed. The negative influence of nuclear energy and the use of nuclear technologies on the environment and human life are exposed. The main problems concerning the prohibition of the use of nuclear weapons and illicit proliferation of nuclear technologies in the modern multipolar world are described. Security attention is focused on the inadmissibility of the use of nuclear weapons in international conflict situations.

Key words: «nuclear safety», nuclear club countries, nuclear weapons, spatial aspects of security, radioactive contamination, international processes, international conflicts.

Formulation of Scientific Problem and its Significance. The main threats to international security were and remain those that are primarily related to the possibility of the emergence of the Third World War and the use of weapons of mass destruction, including nuclear weapons. Therefore, the prevention of the use of nuclear weapons is the main global security task of the present. The nuclear weapons is characterized by high power and striking effects, which is determined by the impact on the environment, light radiation, penetrating radiation, radioactive contamination and electromagnetic pulse, which can lead to the death of humanity on the planet as a whole. According to unofficial statistics, more than 90 countries in the world are involved in nuclear processes, including the production of nuclear power, extraction and uranium enrichment technologies and other radioactive substances, or are trying to create or illegally obtain their own nuclear weapons. According to experts, the preservation and utilization of nuclear weapons, and even more – its tests have very negative consequences for the environment [17; 22]. Technological accidents at nuclear power stations, such as Chornobyl (1986) and Fukushima (2011), also caused a lot of damage to the world's population and the ecology of the regions. Despite the existing ban on nuclear non-proliferation, some countries in the world (eg Israel, North Korea, etc.) regularly carry out illegal nuclear tests in distant regions such as the South Atlantic, the Pacific, the North Sea, etc. In addition, the industrial production of many countries of the world has a negative radioactive impact on the environment. Therefore, processes of contamination of the atmosphere and surrounding areas with nuclear waste are life-threatening and cause scientific interest. The relevance of the study is also in the fact that nuclear weapons still remain a significant factor in the balance of international security. Despite the tight international control over nuclear testing, there is a danger and the possibility of nuclear weapons emerging in politically unstable regions or states, especially those who are involved into protracted political and ethno-religious conflicts. This is a serious threat to international collective and national security, which requires the scientific study and consideration of the spatial security aspects that are related to the nuclear factor, which led to the choice of the subject of this scientific publication.

Analysis of Research on this Problem. The growing threat from nuclear-weapon States necessitates the scientific study of these processes and the development of strategies at the interstate level to prevent the use of nuclear arsenals in the countries. Theoretical developments in the field of nuclear safety were dealt with by foreign and domestic scientists such as T. Andreyev [1], A. Arbatov [2], E. Akhtamzyan [3], Kh. Born [5], S. Galka [6], G Gardner [7], V. Lipkan [10], G. Novitsky [13], O. Mayer, V. Chumak [19],

V. Shevchuk and others. They explore the internal and external context of the formation of international nuclear safety. Scientists such as D. Grodzinsky, E. Ivanov [9], I. Chasnikov [17], A. Yablokov [22] and others studied some aspects of spatial pollution of the environment by radioactive elements and their impact on the environment. However, there is no clear picture of the spatial aspects of international security in the nuclear context.

The object of research is global international security in the nuclear context. **The subject of the study** is the spatial features of the proliferation of nuclear weapons from the standpoint of international security. The main purpose of the paper is to study the peculiarities of spatial distribution of nuclear weapons in the context of international security and possible nuclear threats of the present. The main tasks of the publication are the characteristics of the nuclear potentials of the countries – the official and unofficial members of the nuclear club.

Presentation of the Main maTerial and the Substantiation of the Results of the Study. The first preconditions for the emergence of nuclear weapons appeared in the nineteenth century. In the middle of the twentieth century, USA, having captured Nazi nuclear developments as a result of hostilities on the Western Front, in July 1945, conducted the first nuclear weapons test at the landfill (in the Alamogordo desert), and then dropped nuclear bombs on Japanese cities of Hiroshima and Nagasaki on August 2 and 9. Thus began the nuclear era in the history of mankind and it was the first attempt to use nuclear weapons in order to frighten other states, which significantly undermined the security balance in the postwar world. All the world's geopolitical centers of this period – the United States, France, Great Britain and other states – began a nuclear arms race, including the USSR, which in 1949 created its own nuclear bomb. The presence of a nuclear weapon in the country gave it the status of a superpower and guaranteed military security and stability. In 1952, a nuclear bomb was created in the UK, and in 1960 – in France. In 1964 China joined the nuclear-weapon states, and in 1974 – India (tabl. 1). Thus began a collective political nuclear psychosis, which led to the pursuit of technologies for the enrichment of uranium and other radioactive material and on their basis – the creation of their own nuclear weapons. Often, such processes were accompanied by mass espionage in order to illegally obtain nuclear secrets and materials for the creation of nuclear weapons.

In 1954 the first atomic power plant in the world was opened in the city of Obninsk in the USSR. Later, such power plants appeared in many European countries (France, Great Britain, Germany, Belgium, Spain, Sweden, Belgium, Czech Republic, etc.) and other regions of the world (Canada, USA, Japan, China, India, Pakistan, Iran, Israel, South Africa, Brazil, Argentina, Mexico, South Korea).

By 2013, 30 countries produced their own electricity at existing nuclear power plants (fig. 1). There is a balance between military use of nuclear energy and the peaceful use of nuclear processes. The international community raised the question of preventing the proliferation of nuclear weapons, as this could lead to increased instability in the world, and at the same time open the way to the use of nuclear energy for peaceful purposes. However, already in the 1960's it became clear that as a result of the use of nuclear weapons winners will not be in such a war, because its application leads to global pollution, the total destruction of infrastructure and threatens the destruction of humanity on the planet in general.

Table 1

Nuclear Countries of the World and Their Main Characteristics *

№ p/p	Country	The First Test of Nuclear Weapons, *a Year*	Number of Tests	Strategic Stocks, *Number of Warheads*	The Total Number of Warhead
1	**USA**	1945	1054	1950	6800
2	**Russia**	1949	715	2430	7000
3	**UK**	1952	45	200	215
4	**France**	1960	210	290	300
5	**China**	1964	45	240	270
6	**India**	1974	5-6	120	130
7	**Israel**	about 1979	fairly unknown	80	is unknown
8	**Pakistan**	1998	3-6	130	140
9	**North Korea**	2006	4	10	20
10	**Iran**	not exactly known	3-4	less than 10	is unknown

**Composed by: [21].*

Therefore, an assessment of the possible consequences of the use of nuclear weapons in the course of an armed conflict has led the UN member states to agree on the need to ban the free access to nuclear weapons and the need for international control over nuclear technology and the use of nuclear energy. Therefore, on its initiative in 1957, a special organization for controlling the use of nuclear energy was created – the IAEA (International Atomic Energy Agency) [30]. It annually presents a report on its activities to the General Assembly of the United Nations and, if necessary, to the UN Security Council. The IAEA convenes international scientific forums to discuss the development of nuclear energy, sends its specialists to different countries for assistance in research, provides intermediary interstate services for the transfer of nuclear equipment and materials. Currently, this organization includes 146 states of the world [29]. In the 60s of the last century, the active work of international institutions for the development of legal norms for the limitation of nuclear weapons began, which in the final form have been called «Treaty on the Non-Proliferation of Nuclear Weapons» [8].

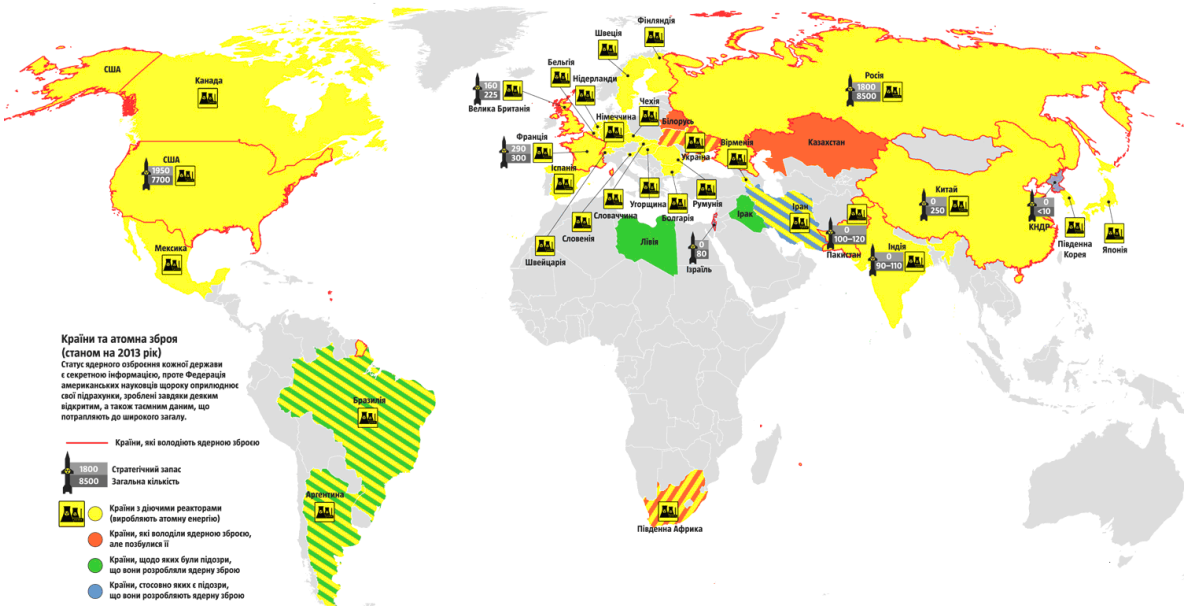

Fig. 1. *Geography of the Proliferation of Nuclear Power Plants and Nuclear Weapons by the End of 2013 [23]*

This treaty was drafted by the United Nations Disarmament Committee to prevent the increasing the number of countries possessing nuclear weapons, providing the necessary international control over the fulfillment by States of their obligations in order to limit the possibility of an armed conflict with the use of such weapons, as well as creation of wide opportunities for the peaceful use of atomic energy.

Following the approval of the UN General Assembly, the Treaty on the Non-Proliferation of Nuclear Weapons was opened for signature in 1968 and came into force in 1970. Almost all the independent states of the world are the parties of the treaty. It is the mainstay of the non-proliferation regime and serves as the basis for the nuclear disarmament process. Countries that signed the treaty voluntarily refuse to develop and create nuclear weapons, as well as their acquisition, and commit themselves to use nuclear fuel only for peaceful purposes [8]. The treaty establishes that a nuclear-weapon state is considered to be the one who created and tested such weapons before 1 January 1967. The treaty was signed by such countries as USSR (now its successor is the Russian Federation), the USA, Great Britain, France, China [12]. They became official members of the so-called «nuclear club» and formed the UN Security Council. Among the modern nuclear powers, Israel, India, Pakistan and the DPRK are not parties to the treaty. In South Africa, a nuclear weapons program was launched, but later this country voluntarily refused it, destroying its small nuclear arsenal. Official Israel refuses to confirm or refute allegations about their nuclear developments. The DPRK ratified the Treaty, but withdrew its signature after a conflict with the IAEA. Iran has also signed the Treaty, but since 2004 it has been suspected of breaching the Treaty and developing a nuclear weapon [14].

The exact number of nuclear weapons and ammunition that are present on the planet is unknown and kept in strict secrecy by the states that have them. However, various intelligence units and research organizations

use different data. For example, according to the Stockholm International Peace Research Institute (SIPRI), the total nuclear weapons power on the planet is now about 7,000 megatons (about 1 ton per each inhabitant). According to this organization, at the end of 2017, Russia possesses 7,000 nuclear weapons, the United States has 6800, China – 270, France 300, United Kingdom 215, Pakistan 140, India 130, Israel 80, North Korea 20 (fig. 2). Even less reliable data on the nuclear arsenals of countries that are not formally belonging to the «nuclear club».

Fig. 2. *Total Nuclear Weapons Stocks in Nuclear Countries by the End of 2016 [16]*

According to current statistics, the United States currently has 6,800 nuclear weapons, including 1411 strategic warheads are in deployed state, according to the agreement on reduction of strategic armaments in April 2017 [24]. They are located on 673 intercontinental missiles, submarines and strategic bombers. According to FAS experts, the United States has 2300 undeveloped strategic warheads and 500 – deployed and undeveloped tactical warheads, as well as 2,800 warheads in accordance with US strategic arms reduction plans – expect to be dismantled [15].

Russia is the successor to the nuclear arsenal of the USSR. It owns 7,000 nuclear weapons, and 2430 of them are in deployed state. It has powerful launchers for launching cruise missiles, and has nuclear boats running in the waters of the ocean and has numerous fighters and bombers capable of bringing nuclear warheads to any part of the planet.

France and the United Kingdom are the official nuclear-weapon states. France has 300 warheads with a nuclear charge, most of which are located on the submarines of the French navy. Others are armed with strategic bombers.

The United Kingdom have 215 strategic warheads, 200 of which are deployed on submarines. Britain pays particular attention to naval forces in the field of nuclear safety and gives them an advantage, although it has well-developed military aircraft and air defense.

China officially does not disclose information about its nuclear arsenal. However, researchers say they have 240 nuclear warheads. Thus, experts point out that this country has a much larger number of nuclear charges, including strategic ones, and pay attention to the fact that it constantly increases their number [26]. China also has all three main ways of delivering nuclear weapons – land-based installations, nuclear submarines and strategic bombers. According to available information, in 2017, this country placed one of its latest nuclear developments, the intercontinental ballistic missile Dongfeng-41 (DF41) on the border with Russia [30]. After all, Beijing now has a tense political relationship with Moscow, as well as with neighboring India. It is believed that China is helping North Korea in developing its nuclear program [10].

A complicated foreign-policy situation is also observed between India and Pakistan, which possess nuclear weapons and are not official members of the «nuclear club». Both countries have long hostility, are regularly threatening each other with the use of force, and armed incidents are regularly occurring on the Indo-Pakistani border. In addition, these two countries have also other conflicting relations with other states

of the region. India has a tense relationship with China, and Pakistan – with Israel. Both countries do not conceal the fact that they have nuclear weapons and their own nuclear programs, but their details are not publicly disclosed.

According to experts, India has 120–130 nuclear warheads and is constantly developing its nuclear arsenal. This country has its own uranium deposits. Recently, she tested the intercontinental missiles «Agni-5» and «Agni-6», capable of delivering a warhead for a distance of 5000–6000 km. Since 1984, India has been developing its own ballistic and cruise missiles of long range, in addition, research is being carried out on the development of ballistic missile submarines. According to the press, at the end of 2016, India has embraced its first atomic submarine, Arihant. India also planning to upgrade its air fleet by 2019, which consists mainly of outdated Russian Su-30s, French «Mirages» and Anglo-French «Jaguars», having purchased 36 warplanes «Raphael» in France, capable of carrying nuclear weapons. [30]. With Russia's support, India is also developing its own anti-missile defense system. Almost all nuclear facilities in India have not been inspected by the IAEA.

Pakistan has weapons ranging from 130 to 140 nuclear warheads. The country began to develop its nuclear program after the first nuclear test was conducted in 1974 by India. According to experts, it created his own «Islamic atomic bomb» in the late 80's [29]. There are rich uranium deposits on the territory of Pakistan. This country, like its main competitors, is constantly increasing its nuclear potential. In addition, with the support of China, Pakistan is actively developing a missile program. In particular, it created a ballistic missile «Half-3» (radius of up to 600 kilometers) and a rocket «Ghauri» (range up to 2 thousand kilometers). The last one is the prototype of the North Korean missile «No-Dong», which was created on the basis of the Soviet rocket «Skad». In addition, Pakistan owns rockets «Shaheen» (version of Chinese missile «Great Hike» / «DF-15»), the range of which is up to 2,5 thousand km. Now Pakistan has begun to develop intercontinental missiles such as Taimur with a radius of up to 7000 km. Also, the country intends to build its own atomic submarine. The French «Mirage» and American F-16s, which are in Pakistan, were modified to carry nuclear weapons [14]. Almost all nuclear facilities in Pakistan were not inspected by the IAEA.

SIPRI, FAS and other international organizations that monitor the development of nuclear weapons in the world, claim that Israel has 80 nuclear warheads [16]. In addition, it has stockpiles of fissile material for the production of another 200 warheads. Israel, like India and Pakistan, has not signed an agreement on the non-proliferation of nuclear weapons while retaining the right to develop it. But unlike India and Pakistan, he has never announced his nuclear program and pursues a so-called deliberate ambiguity policy in this regard. In practice, this means that Israel never confirms, but does not refute the assumption that it has nuclear weapons. Israel's nuclear policy is maneuvering and often criticized by those who consider it a manifestation of double standards. It is believed that Israel has developed nuclear warheads in a secreted underground plant located in the middle of the desert. He has a diverse range of nuclear warheads, from modern warplanes (mainly American ones) capable of carrying nuclear weapons, as well as nuclear submarines and ballistic missiles of their own production. For example, such as «Jericho-1» (range 660 km) and «Jericho-2» (range 1,5 thousand km). In addition, Israel owns a Shavit rocket, originally designed to bring satellites to space. However, according to estimates by American experts, it is able to deliver an atomic warhead weighing up to 500 kg at distances of up to 8,000 km. The Israeli nuclear program was launched in 1956 in cooperation with France and with the unanimous approval of the United States [27]. France has provided Israel with assistance in building a secret nuclear reactor in Dimon. In September 1979, in the Southern Atlantic, a successful test of a tactical nuclear charge was conducted by Israel (according to some reports, it was already the third test). Israel has its own anti-missile defense system successfully tested in 1997. Israeli nuclear facilities have not been inspected by the IAEA.

The fact that Iran has been developing its nuclear weapons has repeatedly been reported by US, Israeli, British and German intelligence agencies. The peaceful nuclear program of Iran began in 1974, when Soviet atomic workers built nuclear power plants in Bushehr. However, after the Islamic revolution in 1978, it was discontinued, because its spiritual leader, Ayatollah, considered atomic energy and weapons immoral [27]. In the late 1980s, Iran began actively rebuilding its nuclear infrastructure and complying with the requirements of the IAEA. However, subsequently the inspectors of this organization were denied entry to Iran until 2003, when under pressure from international organizations he was forced to open his nuclear facilities for inspection. The inspection showed that this country is capable of making its own nuclear missiles in the near future. Iran has uranium deposits. Experts note that Iran possesses several ballistic missiles that were created with the help of the former USSR, North Korea and China. According to experts, Iran has

ballistic missiles «Shahab-4» (created on the basis of the Soviet «SS-4»), the range of which is 2 thousand kilometers and Shahab-5 missiles – up to 6 thousand kilometers [4]. Iran has powerful Air Forces, whose armament is equipped with aircraft capable of carrying nuclear weapons. In addition, Iran is working on the creation of intercontinental missiles and ballistic missiles underwater.

North Korea has announced that it is working to create an atomic bomb to protect the «conquest of socialism» [10]. Most experts believe that in the arsenals of North Korea there are 1–2 nuclear charges. According to experts, the radius of their action reaches 2 thousand km. Nuclear programs in North Korea began in the early 1950s with the help of Chinese and Soviet nuclear power plants workers. Plutonium, which can be used to create an atomic bomb, began to be enriched in this country. According to international organizations, North Korea is one of the largest illegal exporters of missile technologies worldwide. Experts believe that Egypt, Iran, Libya, Pakistan, Syria and Yemen were trying to create their missiles with the help of North Korea [27]. North Korea owns outdated Soviet combat aircraft that can carry nuclear weapons. In addition, since 2006, she has been trying to test its own ballistic starting launchers.

In 1969, with the help of the USSR, Libya built the first nuclear reactor. This country began nuclear work in the 1970's when it first tried to illegally buy nuclear weapons in China. However, for unknown reasons, this deal was torn. In 1977 Libya offered Pakistan financial assistance and sent uranium from neighboring Nigeria in exchange for nuclear and missile technology. However, Pakistan has received material assistance, but has not fulfilled its obligations to Libya. As a result of this – Libya began the independent development of nuclear weapons. She has entered into all international agreements limiting the proliferation of nuclear weapons, but secretly continued to engage in the creation of their own nuclear bomb. At the same time, Libyan leader Muammar Gaddafi repeatedly called on Muslim countries to create «Islamic nuclear weapons» to put an end to Israeli hegemony. At the end of 2002, IAEA inspectors have been admitted to Libyan nuclear facilities where it has been established that it already has its own advanced technology of uranium enrichment and plutonium production. Under the pressure of international organizations, in January 2004, 25 tons of documents were transmitted from Libya to the United States relating to secret Libyan programs in the field of weapons of mass destruction and production of ballistic missiles, called «Libyan dossiers». The latter confirmed that Pakistan and North Korea passed their nuclear secrets to third countries. Experts came to the conclusion that Libya was able to make an atomic bomb in 10–15 years [20]. After the fall of the regime of M. Gaddafi, nuclear programs in Libya were suspended.

According to experts, in general, between 1945 and 2000, the United States conducted 1054 nuclear tests, the former USSR (later Russia) – 715, France – 210, Britain and China – 45 (tab. 1). According to available statistics, from 1945 to 1980 more than 400 nuclear explosions were carried out in the atmosphere [4]. The maximum of these trials had two periods: the first one was in 1954–1958, when nuclear explosions were conducted by the United States, Great Britain and the USSR. The second stage was much more intense (1961–1962), since it occurred during the peak of the nuclear arms race between the US and the USSR. During the first period, most of the tests were conducted by the United States, and during the second – by the USSR. During these periods there were 128 explosions of atomic bombs, including neutron ones, among which there were also extremely powerful ones. According to experts, the total activity of radionuclides from further tests was four times less than the radioactivity of nuclear weapons explosions in corresponding periods [17; 22]. This is due to the fact that in 1963 the USSR, the United States and United Kingdom signed the «Treaty on the Limitation of the Testing of Nuclear Weapons», in which these countries pledged not to test it in the air, under water and in space. After that, only France and China conducted a series of nuclear explosions in the atmosphere, but their power was much smaller, and the tests were rarely performed (the last one in 1980).

Radioactive contamination from many nuclear tests extends across the entire globe, so it is particularly dangerous. Testing nuclear weapons is accompanied by emissions of a large number of different radionuclides arising from the separation of uranium, as well as nuclear reactions involving neutrons. Radio nuclides, which fell into the atmosphere as a result of atomic bomb explosions, were spread by winds all over the globe and fell on the surface of the oceans and continents, contaminating water, soils, vegetation. These radioactive deposits belong to the so-called global ones. In the last half century, every inhabitant of the planet has been exposed to radiation from radioactive fallouts resulting from nuclear explosions. An important source of information on the impact of nuclear weapons tests is statistics on the health status of the population of countries and regions affected by radiation in small doses. After the explosion of the neutron bomber in the air, part of the radioactively contaminated material fell near the polygons, while part of it rose to the troposphere, where it was caught up with winds and moved at considerable distances,

remaining in about one geographical latitude. Radionuclides that fell into the troposphere, spread over the course of a month and gradually fell to the earth's surface. However, there is another part of the radioactive elements that reached the upper layers of the stratosphere, where they were stored for many years, gradually scattering throughout the surface, contaminating the ecosystems of the planet even today. The most intensely contaminated areas are within the middle latitudes of the Northern Hemisphere (mainly the USSR), the least – in the regions of the Southern Hemisphere and near the poles (mainly the USA). The density of surface contamination of the territories of the continents (for the northern activity) is expressed in becherelas per square meter (Bq/m2). Since the loss of radionuclides on the Earth's surface was closely linked to meteorological conditions during the propagation of radioactive clouds, the intensity of global radioactive rainfall in one place or another was uneven. Therefore, the pollution was arenally-spotted in nature. Storing ore and other materials that are formed during the removal of uranium are also accompanied by radioactive contamination of the atmosphere. In particular, the remnants of uranium-containing rocks after the flotation separation of enriched uranium fractions are a rather viable source of radioactive substances that dissipate in the environment in the regions of uranium-mining industry development. The most dangerous elements that enter the environment during these technological processes are radon, 210Pu and 2I0Pb.

Only a small fraction of spent nuclear fuel is processed. The rest is stored in temporary storage facilities (until decisions are made on the technology of long-term storage of radioactive materials). Staying more and more radioactive waste from nuclear energy in temporary storage facilities and the unresolved issues of their reliable and long-term storage – are acute problems with environmental and political aspects. Equally urgent is the problem of transportation of radioactive materials for the nuclear fuel cycle.

Experts say that in the atmosphere and after several decades after the explosion, long-existing hazardous radionuclides fall out [17]. According to geophysical reasons, the level and nature of such loss depend not so much on the distance of the landfills, but on the geographical latitude of their location (fig. 3). The maximum indices of the loss of strontium-90 (90 Sr) were detected in the belt of 45 ° north latitude (I. Garmonov, 1996). Radioecological studies by V. Yablokov (2002) provide original comparisons of data on the impact of small doses of radiation from neutron bomb tests on the health of the population and their correlation with the geographical breadth of their habitat (fig. 3).

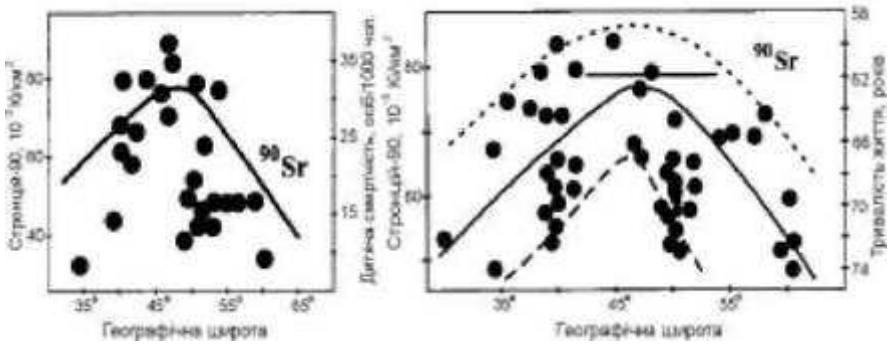

Fig. 3. *Correlation Between 90Sr Contamination Level, Geographical Latitude and State of Health of the Population (I. Garantsov, 1996, V. Yablokov, 2002)*

Underground testing of neutron bombs is carried out to this day, but they are practically not accompanied by the formation of radioactive rainfall. Several large nuclear landfills were set up to carry out mass testing of nuclear weapons. The five nuclear powers: the United States, the former USSR, Britain, China, and France conducted tests on the largest landfills in the world: Nevada (US and UK, according to the contract); Semipalatinsk and Novozemelsky (USSR); Lob Norsk (China) and Polynesian (France) (fig. 4). In addition to these US landfills, a series of blasts was carried out at the Bikini, Eniwetok, Johnston atolls in the Pacific, as well as in New Mexico and Alaska. The main nuclear landfills of the former USSR were Semipalatinsk and a powerful testing ground nuclear testing ground on Novaya Zemlya. In the USSR mass military exercises were conducted using a neutron bomb in the area of Totka (Orenburg region) and Chelyabinsk. Britain experienced nuclear weapons near the west coast in the south of Australia, and France used its landfills in the Sahara (Algeria) and Aturum Mururoa (Polynesia). Since 1998, India and Pakistan have also started testing nuclear weapons.

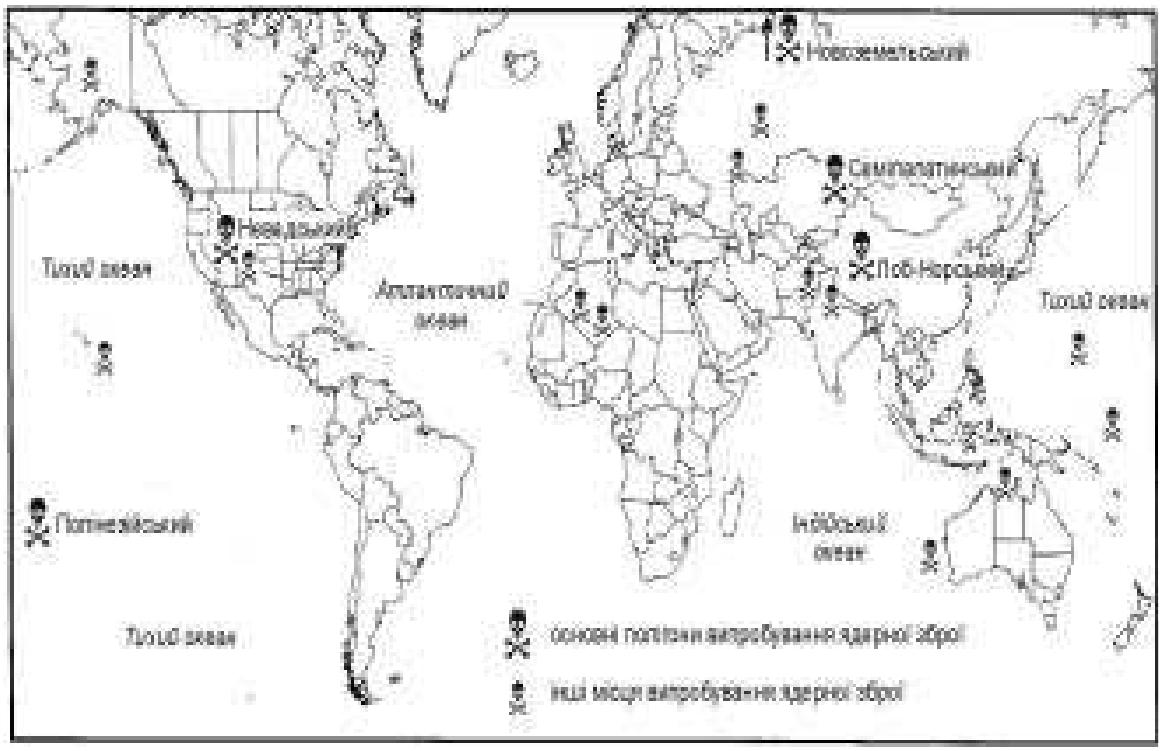

Fig. 4. *Geography of Nuclear Landfills in the World [9]*

Pollution of the environment is possible due to the operation of nuclear power plants and man-made emissions from them, as well as possible accidents. Nuclear power generation is increasing annually in the world and in Europe. For example, according to data published by the IAEA, the total share of nuclear energy in the EU countries in 2016 continued to increase. In the nine countries of the European Union – Belgium, Bulgaria, Czech Republic, France, Hungary, Slovakia, Slovenia, Sweden and Switzerland – more than 30 % of electricity was produced in 2016 at nuclear power plants (fig. 5). The other five countries in general, at nuclear power plants, produced about 20 % of electricity [23].

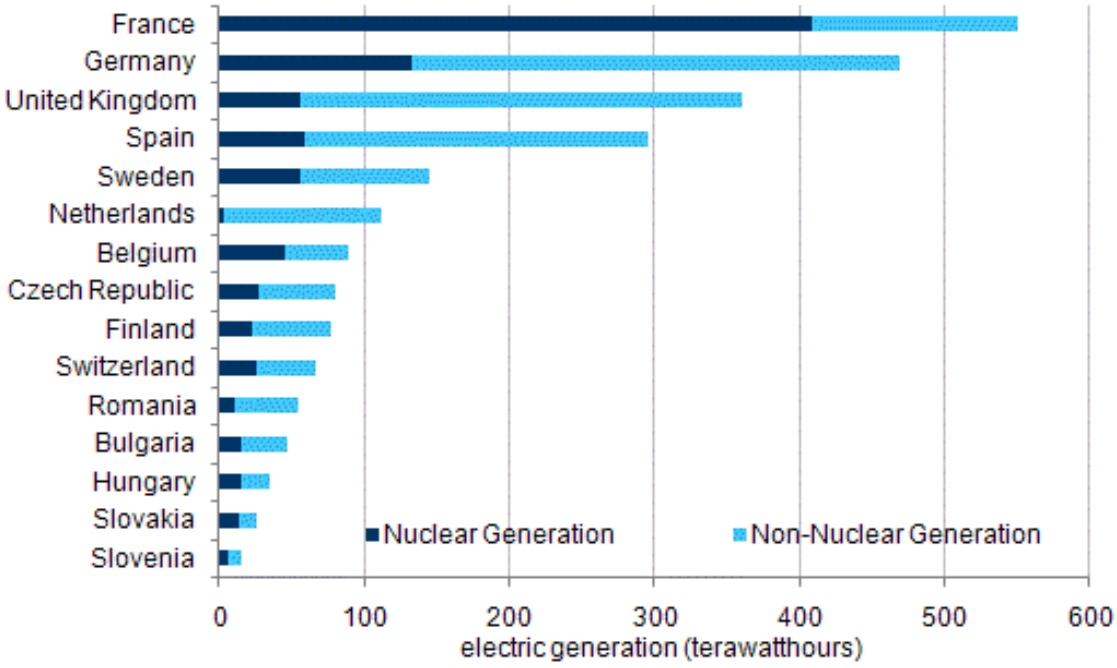

Fig. 5. *The ratio of Production of Nuclear and Other Types of Electricity in the EU Countries in 2016 [30]*

Due to the possibilities of nuclear leaks and pollution of the environment by radioactive isotopes, some EU countries began to refuse to produce nuclear energy. For example, Germany, ranked second in Europe for nuclear power generation and consumption, announced the decision to withdraw all nuclear power units by 2022. Other countries, such as France and the United Kingdom (the so-called «European coalition of Europe»), on the contrary, have expressed their desire to further develop nuclear power and, accordingly, build new nuclear facilities in their own territories. Switzerland, which currently produces a third of its electricity at nuclear power plants, also intends to withdraw nuclear power blocks from active operation by 2034. Italy and Austria do not have their own commercial nuclear reactors. However, in a recent referendum, Italian citizens opposed their possible construction. The Austrian government decided in 2015 to stop purchasing electricity from foreign nuclear power plants. The figures and trends indicated give grounds for concluding that the struggle of the EU member states for the future of nuclear energy is continuing.

As for the current state of nuclear safety and disarmament, it should be pointed out that this issue remains ambiguous and open. After all, all countries are constantly increasing their armed potential, including nuclear weapons. For example, in 2010, B. Obama and D. Medvedev signed an agreement on the reduction of strategic weapons, also known as the «New Start». However, the US leadership is constantly encouraging the deployment of missile defense systems in the United States and Europe, as well as developing new technologies for deploying ground rocket launchers for intercontinental missiles. The current administration of D. Trump extends the plans for the process of modernization of armaments, including nuclear weapons, and considers the possibility of its transfer to a near-Earth orbit, which, according to all international instruments, is a zone of peace. D. Trump requires North Korea to get rid of its nuclear program, and in case of refusal, it threatens to force. He urges the North Korean leader to meet for immediate negotiations. The modern American leadership is also threatened by Japan, which tries to withdraw from the «American nuclear umbrella», and also encourages the countries of Central and Eastern Europe to deploy missile defense systems [18]. Former US President Washington Security Council advisers advise the current president not to withdraw nuclear weapons in Europe, as Russia plays «dual games» in security matters [26]. Russia, in return, threatens to develop new types of weapons, including seismic and cybernetic.

Nuclear arsenals of other nuclear powers are much smaller, but all these countries are developing and deploying new weapons, or have declared such plans. China has launched a long-term modernization program with the goal of qualitatively improving its nuclear forces, instead of significantly increasing them. India and Pakistan are increasing their nuclear weapons stockpiles, as well as developing land, sea and aviation delivery systems. Israel, which does not recognize the presence of nuclear weapons, is testing a long-range ballistic missile capable of carrying nuclear warheads. North Korea continues to implement its nuclear program as a priority, but it is unknown whether it created a combat nuclear warhead for ballistic missile delivery. The availability of reliable information on the state of nuclear arsenals and the capabilities of nuclear powers is very diverse. The United States provides incomplete information on its nuclear stockpiles and forces. The United Kingdom and France do not always provide information on the actual state of nuclear weapons in them. Russia provides such information only to the United States, but does not disclose details of the composition of its forces that are subject to reduction.

The UN considers nuclear-free zones to be one of the most effective methods of combating nuclear threats. On the basis of international treaties the Antarctica (1959), Latin America (1967) and the southern part of the Pacific Ocean (1986) declared the nuclear-free zone. In 1996, the nuclear-free zone appeared in Africa [16]. This agreement applies to the whole of the African continent and a number of adjacent islands (only 54 states), but this convention has not yet entered into force. Participating States, among other things, are prohibited from threatening the use of nuclear weapons. In addition, a ban on any type of attack on peaceful nuclear facilities located in the territory of the zone was imposed. The South African Republic is the only country in the world that has a nuclear weapon and has voluntarily abandoned it. Ukraine also acted in this way in the mid-1990s, relying on its security guarantors, which encouraged it to abandon its right to own nuclear weapons at the Budapest Memorandum, which was a major security mistake, as experts now point out [11]. In 2006, the Semipalatinsk Treaty, which declared the nuclear-weapon zone Central Asia, was concluded. In 1992, Mongolia declared its status as a nuclear-free zone [24]. However, nuclear-free zones are still not defined in terms of international law, since they do not explicitly justify their attitude to the issue of transit of nuclear weapons through their territory or the appearance of nuclear-weapon-friendly warplanes in the airspace.

In 1967, the Convention on the Exploration and Use of Near Spaces was concluded and entered into force. Areas adjacent to the Earth are allowed to be used only for peaceful purposes [21]. The treaty prohibits the creation of military bases, structures and fortifications on the Earth's orbits and on the Moon, conducting any kind of military tests and military exercises. The participating states pledged not to bring into the earth's orbit any object carrying nuclear weapons or any other weapons of mass destruction. In 1971, an international agreement was signed «An agreement on the prohibition of the deployment of nuclear weapons at the bottom of the seas and oceans» (came into force in 1972). It prohibits the deployment of nuclear weapons on the ocean bottom, as well as facilities used for launching, testing or using it [22]. However, US President Reagan in the spring of 1983, during the peak of the Cold War from the USSR, announced a new long-term security strategy called «Strategic Defense Initiative», the so-called «Star Wars». The latter envisaged the installation of military satellites in the near-Earth orbit for the destruction of hostile nuclear missiles, which could be directed to the territory of the United States and its allies. These satellites were supposed to be equipped with laser weapons and other means to dismantle missiles (at that time mostly Soviet). Its ultimate goal is the conquest of domination in space, the creation of a US missile shield to safely cover the entire territory of North America through the deployment of several echelons of shock space weapons capable of intercepting and destroying ballistic missiles and their combat units at all areas of the flight. It raised a protest not only in the USSR and its allies, but also in many Western countries, including France and other European countries. Thus, nuclear safety remains a significant factor in contemporary global stability and affects political and spatial processes.

Conclusions and Perspectives of Further Research. Nuclear weapons have been and still remain a major contributor to international and regional security. It belongs to the components of solidarity in international politics and is the key to the military might of the states. However, the consequences of using nuclear weapons can lead to a global catastrophe. In addition, the use of atomic energy for peaceful purposes also poses significant threats to humankind and can cause unwanted man-made emissions of radioactive substances to the environment and pollute it. Regarding the spatial security aspects of the nuclear factor, it should be noted that the main owners of nuclear weapons and nuclear power plants are located in the Northern Hemisphere, and nuclear landfills – in the South and near the North Pole. However, the most contaminated with radioactive elements are moderate latitudes, where there is an increased concentration of processing plants and nuclear power plants, which requires further scientific monitoring.

Sources and Literature

1. Андреева Т. Г. Безопасность Западной Европы и независимые ядерные силы Великобритании и Франции / Т. Г. Андреева // Мировая экономика и международные отношения. – 2004. – № 1. – С. 51–61.
2. Арбатов А. Г. Здравый смысл и разоружение // Россия в глобальной политике [Электронний ресурс]. – Режим доступа : http://www.globalaffairs.ru/number/Zdravyi-smysl-i-razoruzhenie-14971.
3. Ахтамзян Э. ЯОГ : ядерные программы, военные доктрины, политика в области ядерного нераспространения [Электронний ресурс]. – Режим доступа : edu.pircenter.org.
4. Без'ядерні зони: від морського дна до Місяця [Електронний ресурс]. – Режим доступу : http://www.moldova.ru/index.php?tabName=articles&owner=39&id=749.
5. Борн Х. Державне управління ядерною зброєю : можливості та обмеження / Х. Борн // Щорічник СІПРІ: озброєння, роззброєння, безпека. – 2006. – С. 245–265.
6. Галака С. П. Проблема нерозповсюдження ядерної зброї у міжнародних відносинах : монографія / С. П. Галака. – Київ : Київський ун-т, 2002. – 278 с.
7. Гарднер Г. Ядерное нераспространение / под ред. Г. К. Хромова. – Москва : МИФИ, 1995. – 184 с.
8. Договір про нерозповсюдження ядерних озброєнь 1968 р. [Електронний ресурс]. – Режим доступу : http://www.armscontrol.ru/start/rus/docs/npt.htm.
9. Іванов Є. А. Радіоекологічні дослідження : навч. посіб. / Є. А. Іванов. – Львів : Вид. центр ЛНУ ім. Івана Франка, 2004. – 149 с.
10. КНДР и ее ядерная программа [Електронний ресурс]. – Режим доступу : http://zvezda.ru/geo/2008/09/15/korea.htm.
11. Ліпкан В. А. Національна безпека України [Електронний ресурс]. – Режим доступу : http://westudents.com.ua/knigi/368-natsonalna-bezpeka-ukrani-lpkan-va.html.
12. Неравновесие страха [Электронный ресурс]. – Режим доступа : http://www.inosmi.ru/translation/227155.html.
13. Новицький Г. В. Теоретико-правові основи забезпечення національної безпеки України : монографія [Електронний ресурс]. – Режим доступу : http://www.litsovet.ru/index.php/material.read?material_id=351176.
14. Питання роззброєння [Електронний ресурс]. – Режим доступу : http://www.un.org/russian/peace/disarmament/massdestr.html.

15. Планы США по сокращению стратегических вооружений [Электронный ресурс]. – Режим доступа : http://www.rian.ru/world/20050216/ 31284293.html.
16. СІПРІ 2016 : Щорічник : Озброєння, роззброєння та міжнародна безпека : пер. з англ. / Стокгольм. міжнар. ін-т дослідж. миру; Укр. центр екон. і політ. Дослідж. ім. О. Разумкова; редкол. укр. вид. : Л. Шангіна (голов. ред.) та ін. – Київ : Заповіт, 2018. – 768 с.
17. Часников И. Я. Эхо ядерных взрывов / И. Я. Часников. – Алматы, 1996. – 98 с.
18. Членство в НАТО надає його членам потужні ядерні гарантії [Електронний ресурс]. – Режим доступу : http30/odii.com. ua/world/ 2006/10/09/084656.
19. Чумак В. М. Ядерна стратегія США: від перевершення до нерозповсюдження : монографія / В. М. Чумак. – Київ : НІСД, 1999. – 304 с.
20. Шеннон К. Н. Контроль над ядерними озброєннями та нерозповсюдження / К. Н. Шеннон // Щорічник СІПРІ : озброєння, роззброєння, безпека. – 2007. – С. 451–490.
21. Щорічник СІПРІ за 2016: озброєння, роззброєння, та міжнародна безпека [Електронний ресурс]. – Режим доступу : www.sipriyearbook.org.
22. Яблоков А. В. Миф о безопасности малих доз радиации [Электронный ресурс]. – Режим доступа : http://www.csgi.ru/gi/gi5/06.htm.
23. Ядерна зброя США у Європі [Електронний ресурс]. – Режим доступу : https://uatom.org/index.php/2014/08/19/yaderna-zbroya-ssha-u-yevropi/.
24. Ядерна зброя потрібна Америці для залякування [Електронний ресурс]. – Режим доступу : http://www.orientalica.com/index. php? showtopic= 4250 &st=0&gopid=22654&#entry22654.
25. Ядерне стримування і Альянс у XXI сторіччі [Електронний ресурс]. – Режим доступу : https://www.nato.int/docu/review/2016/Also-in-2016/nuclear-deterrence-alliance-21st-century-nato/UK/index.htm
26. Ядерная триада [Электронный ресурс]. – Режим доступа : http30/odii.com.ua/world/ 2006/10/09/084656.
27. Ядерное распространение: новые технологии, вооружения и договоры / под ред. А. Арбатова, В. Дворкина. – Москва : РОССПЭН, 2009. – 272 с.
28. National Strategy to Combat Weapons of Mass Destruction [Electronic resource]. – Mode of access : http://www.whitehouse.gov/news/.
29. Nuclear Posture Review, Excerpts from the classified report to Congress [Electronic resource]. – Mode of access : http://www.inosmi.ru /translation/ 227155.html.
30. US Central Intelligence Agency, Nonproliferation Center, Unclassified report to Congress on the acquisition of technology relating to weapons of mass destruction and advanced conventional munitions [Electronic resource]. – Mode of access : http://www.odci.gov/cia/publications/bian/bian.html.

Referens

1. Andreeva T. H. Bezopasnost Zapadnoi Evropы y nezavysymыe yadernыe sylы Velykobrytanyy y Frantsyy / T. H. Andreeva // Myrovaia эkonomyka y mezhdunarodnыe otnoshenyia. – 2004. – № 1. – S. 51–61.
2. Arbatov A. H. Zdravyi smisl y razoruzhenye // Rossyia v hlobalnoi polytyke [Эlektronnyi resurs]. – Rezhym dostupa : http://www.globalaffairs.ru/number/Zdravyi-smysl-i-razoruzhenie-14971.
3. Akhtamzian Э. YaOH : yadernie prohrammi, voennie doktryni, polytyka v oblasty yadernoho nerasprostranenyia [Эlektronnyi resurs]. – Rezhym dostupa : edu.pircenter.org.
4. Bez'iaderni zony : vid morskoho dna do Misiatsia [Elektronnyi resurs]. – Rezhym dostupu : http://www.moldova.ru/index.php?tabName=articles&owner=39&id=749.
5. Born Kh. Derzhavne upravlinnia yadernoiu zbroieiu : mozhlyvosti ta obmezhennia / Kh. Born // Shchorichnyk SIPRI : ozbroiennia, rozzbroiennia, bezpeka. – 2006. – S. 245–265.
6. Halaka S. P. Problema nerozpovsiudzhennia yadernoi zbroi u mizhnarodnykh vidnosynakh : monohrafiia / S. P. Halaka. – K. : Kyivskyi universytet, 2002. – 278 s.
7. Hardner H. Yadernoe nerasprostranenye / pod red. H. K. Khromova. – M. : MYFY, 1995. – 184 c.
8. Dohovir pro nerozpovsiudzhennia yadernykh ozbroien 1968 r. [Elektronnyi resurs]. – Rezhym dostupu : http://www.armscontrol.ru/start/rus/docs/npt.htm.
9. Ivanov Ye. A. Radioekolohichni doslidzhennia : navch. posib. / Ye. A. Ivanov. – Lviv : Vydavnychyi tsentr LNU imeni Ivana Franka, 2004. – 149 s.
10. KNDR y ee yadernaia prohramma [Elektronnyi resurs]. – Rezhym dostupu : http://zvezda.ru/geo/2008/09/15/korea.htm.
11. Lipkan V. A. Natsionalna bezpeka Ukrainy [Elektronnyi resurs]. – Rezhym dostupu : http://westudents.com.ua/knigi/368-natsonalna-bezpeka-ukrani-lpkan-va.html.
12. Neravnovesye strakha [Эlektronnyi resurs]. – Rezhym dostupa : http://www.inosmi.ru/ translation/227155.html.
13. Novytskyi H. V. Teoretyko-pravovi osnovy zabezpechennia natsionalnoi bezpeky Ukrainy : monohrafiia [Elektronnyi resurs]. – Rezhym dostupu : http://www.litsovet.ru/index.php/material.read?material_id=351176.

14. Pytannia rozzbroiennia [Elektronnyi resurs]. – Rezhym dostupu : http://www.un.org/russian/peace/ disarmament/ massdestr.html.
15. Planы SShA po sokrashchenyiu stratehycheskykh vooruzhenyi [Эlektronnyi resurs]. – Rezhym dostupa : http://www.rian.ru/world/20050216/ 31284293.html.
16. SIPRI 2016 : Shchorichnyk : Ozbroiennia, rozzbroiennia ta mizhnarodna bezpeka : Per. z anhl. / Stokholm. mizhnar. in-t doslidzhennia myru; Ukr. tsentr ekon. i polit. doslidzhen im. O. Razumkova; Redkol. ukr. vyd. : L. Shanhina (holovnyi redaktor) ta in. – K. : Zapovit, 2018. – 768 s.
17. Chasnykov Y. Ya. Эkho yadernыkh vzrыvov / Y. Ya. Chasnykov. – Almatы, 1996. – 98 s.
18. Chlenstvo v NATO nadaie yoho chlenam potuzhni yaderni harantii [Elektronnyi resurs]. – Rezhym dostupu : http30/odii.com. ua/world/ 2006/10/09/084656.
19. Chumak V. M. Yaderna stratehiia SShA : vid pereversheннia do nerozpovsiudzhennia : monohrafiia / V. M. Chumak. – K. : NISD, 1999. – 304 s.
20. Shennon K. N. Kontrol nad yadernymy ozbroienniamy ta nerozpovsiudzhennia / K. N. Shennon // Shchorichnyk SIPRI : ozbroiennia, rozzbroiennia, bezpeka. – 2007. – S. 451–490.
21. Shchorichnyk SIPRI za 2016 : Ozbroiennia, rozzbroiennia, ta mizhnarodna bezpeka [Elektronnyi resurs]. – Rezhym dostupu : www.sipriyearbook.org.
22. Yablokov A. V. Myf o bezopasnosty malykh doz radyatsyy [Эlektronnyi resurs]. – Rezhym dostupa : http://www.csgi.ru/gi/gi5/06.htm.
23. Yaderna zbroia SShA u Yevropi [Elektronnyi resurs]. – Rezhym dostupu : https://uatom.org/index.php/ 2014/08/19/yaderna-zbroya-ssha-u-yevropi/.
24. Yaderna zbroia potribna Amerytsi dlia zaliakuvannia [Elektronnyi resurs]. – Rezhym dostupu : http://www.orientalica.com/index. php? showtopic= 4250 &st=0&gopid=22654&#entry22654.
25. Yaderne strymuvannia i Alians u KhKhI storichchi [Elektronnyi resurs]. – Rezhym dostupu : https://www.nato.int/docu/review/2016/Also-in-2016/nuclear-deterrence-alliance-21st-century-nato/UK/index.htm
26. Yadernaia tryada [Эlektronnyi resurs]. – Rezhym dostupa : ttp30/odii.com.ua/world/ 2006/10/09/084656.
27. Yadernoe rasprostranenye: novыe tekhnolohyy, vooruzhenyia y dohovorы / pod red. A. Arbatova, V. Dvorkyna. – M. : ROSSPЭN, 2009. – 272 s.
28. National Strategy to Combat Weapons of Mass Destruction [Electronic resource]. – Mode of access : http://www. безпекову увагу на недопустимість використання ядерної зброї у міжнародних конфліктних ситуаціях. whitehouse.gov/news/.
29. Nuclear Posture Review, Excerpts from the classified report to Congress [Electronic resource]. – Access mode : http://www.inosmi.ru /translation/ 227155.html.
30. US Central Intelligence Agency, Nonproliferation Center, Unclassified report to Congress on the acquisition of technology relating to weapons of mass destruction and advanced conventional munitions [Electronic resource]. – Mode of access : http://www.odci.gov/cia/publications/bian/bian.html.

Патийчук Виктор. Пространственные аспекты международной безопасности в ядерном контексте. Обобщается содержание понятия «ядерная безопасность». Исследуется эволюция влияния ядерного фактора на международную безопасность. Дается характеристика ядерного потенциала официальных и неофициальных государств-членов ядерного клуба. Анализируются пространственные особенности распространения ядерных вооружений с позиции международной безопасности. Раскрывается негативное влияние атомной энергетики и использования ядерных технологий на окружающую среду и жизнь человека. Описываются основные проблемы о запрете использования ядерного оружия и незаконное распространение ядерных технологий в современном многополюсном мире. Акцентируются внимание с позиции безопасности на недопустимость использования ядерного оружия в международных конфликтных ситуациях.

Ключевые слова: «ядерная безопасность», страны ядерного клуба, ядерное оружие, пространственные аспекты безопасности, радиоактивное загрязнение, международные процессы, международные конфликты.

Патійчук Віктор. Просторові аспекти міжнародної безпеки в ядерному контексті. Узагальнено зміст поняття «ядерна безпека». Досліджено еволюцію впливу ядерного чинника на міжнародну безпеку. Охарактеризовано ядерний потенціал офіційних та неофіційних держав-членів ядерного клубу. Проаналізовано просторові особливості поширення ядерних озброєнь із позиції міжнародної безпеки. Розкрито негативний вплив атомної енергетики та використання ядерних технологій на навколишнє середовище та життя людини. Описано основні проблеми щодо заборони використання ядерної зброї й незаконне поширення ядерних технологій у сучасному багатополюсному світі. Акцентовано увагу з позиції безпеки на недопущенні використання ядерної зброї в міжнародних конфліктних ситуаціях.

Ключові слова: «ядерна безпека», країни ядерного клубу, ядерна зброя, просторові аспекти безпеки, радіоактивне забруднення, міжнародні процеси, міжнародні конфлікти.

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