

АКТУАЛЬНА ТЕМА

UDC 349.6 : 614.8

E. V. Tolkachenko

Candidate of Juridical Sciences, associate professor
Odessa I. I. Mechnikov National University,
The Department of Civil Law Disciplines
Frantsuzskiy Boulevard, 24/26, Odessa, 65058, Ukraine

THE CONCEPT OF THE RADIATION POLLUTION AND PROBLEM OF BURIAL OF RADIOACTIVE WASTE

The questions bound to consequences of using of atom in military and peace purposes are considered in the article, the national legislation within the definition of radiation pollution concept is analyzed, and there are also characterized the legal measures of nuclear and radiation safety ensuring with the radioactive waste handling.

Key words: nuclear energy, radiation pollution, radiation safety, radioactive waste, burial of radioactive waste.

Problem statement. Thus the beginning of the nuclear age was marked by sad events which became history by the explosions of the first atomic bombs made by the USA over the Japanese cities — Hiroshima and Nagasaki, the existence of military atom still determines the level of defense capability of the country, and often also the extent of its influence on the solution of the international issues.

In the middle of the last century the Soviet Union, after the USA, declared about the creation of a nuclear bomb and carrying out the series of nuclear detonations in the exploring purposes, it was followed by England, France and China.

However, the harmful effects from atmospheric nuclear detonations became so apparent, that is more, and in 1963 the Moscow contract on prohibition of the nuclear weapon tests in the atmosphere, space and under water [1] was signed. This Contract provided a ban on carrying out nuclear detonations in three environments, and also in any other environment if such explosion causes radioactive fallout outside the territory of the state borders, under jurisdiction or monitoring of which explosion is conducted.

Along with the military nuclear developments, the investigation of peaceful atom was carried out. It originates since 1954 from the starting of the USSR's first nuclear power plant. This fact formed the basis of economic development of many countries. Besides the using of nuclear energy on the

NPP, its new applied properties even more often are found: it is used in medicine in quality diagnostic aids and treatments; in agriculture for selection of cultures and fight against parasites; as an energy source for engines on sea vessels, space objects and submarines; when studying earth's environment, including for research of distribution of pollutants in a surrounding medium, and also for other purposes.

It should be noted that the beginning of an era of peaceful atom was met with enthusiasm and hopes of disposal of mankind poverty and poverty due to receiving a brand new, potent energy source.

However, the development of the nuclear industry led to various ambiguous consequences. On the one hand, it brought mankind to the new level of economic development, on the other hand, it led to a number of the environmental disasters dangerous as for the certain region, and all mankind in general [2, p. 10–11].

The accidents which happened for the last decades and accidents on nuclear power plants (today there are more than 20), application of atomic weapons and consequence of these events, an aggravation of terrorist activity show the level of danger to which all population of Earth and its nature is exposed.

Certainly, for improvement of effectiveness of legal regulation in the field of ensuring nuclear and radiation safety which is directly bound to emergence of a new type of pollution — radiation, there is a need for definition of concept of radiation pollution, establishment of criteria for evaluation of this concept, and also legal measures for safety with radioactive waste handling.

Analysis of recent researches and publications. The theoretical basis of research of a perspective of ensuring nuclear and radiation safety and some other questions, the bound to a radiation wastage handling were made by works of such scientists as A. M. Agapov, V. I. Andreytsev, G. I. Balyuk, L. I. Mikitenko, V. A. Turlak, O. O. Fedorenko, Yu. S. Shemshuchenko, etc.

The paper purpose is the analysis of the current national legislation for definition of the radiation pollution concept, and also consideration of questions, bound to a burial of radioactive waste and ensuring nuclear and radiation safety.

Paper main body. At the present stage of atomic energy using, Ukraine takes the 10th place in the world, has 15 reactors, including the largest nuclear power plant in Europe, and also the NPP, the second for power in the world — the nuclear power plant of Zaporozhye.

In territories uncontrollable by Ukraine, fortunately, does not have nuclear installations, there are only nuclear materials at small amounts in the form of a radiation protection of containers for transportation and storage of sources of the ionizing radiation and devices of radiation therapy in oncological clinics, and also highly active sources of the ionizing radiation.

At the same time, it is necessary to tell that there is an opinion that when keeping the close check and unconditional keeping of requirements of ecological safety, the nuclear power is more pollution-free and cheaper now, than thermal. In the developed countries it provides from 15 to 70 percent of all developed electric power (France — 70 percent, the USA — 17, Swede — 50,

Canada — 15 percent). Of course, if to speak about emissions of ozone-depleting substances which strengthen greenhouse effect then this opinion is valid. However, in our opinion, absolutely safe and ecologically expedient type of an energy source capable to replace both nuclear and thermal power plants is already found. The developed countries in sufficient volume use today such alternative energy sources. As an example it is possible to give Germany, which, after accident on the Fukushima plant-1, having 19 (as of 2011 year) nuclear power plants, for the small period of time reduced them to 8, and till 2020 plans to refuse remained. Everybody knows that in case of accident nuclear power plants represent serious danger to people and environment. During operation of the NPP in the world there was a number of a major accident: 1961 — in the Idaho Falls (USA); 1979 — on the NPP ‘Trimayl-Ireland’ in Garisberzi (USA), 1986 — the Chernobyl NPP, 2011 — on the NPP ‘Fukushima-1’ in Oakum (Japan). And it is not the complete list.

All aforesaid says that problems of nuclear power led to emergence of a new type of pollution — radiation, which is classified by experts as the most dangerous, and threatens ‘existence of all alive on Earth’ [3, p. 9].

On the one hand, radiation was always a human life component, for example, influence of sunshine, production and use of coal and so forth. On the other hand, it is rather intensive type of pollution which is characterized both by specifics of influence of radiations, and activity of use of radioactive elements in life of the modern person.

The radioactive contamination is bound to excess of a natural radioactivity background and the level which are contained in an environment of radioactive elements and substances (in this case the radioactive contamination at the same time can be considered both as physical, and as chemical pollution) [4, p. 14].

However, today in the national legislation there is no legible definition of the concept ‘radiation pollution’, and also there is no system of types of pollution and criteria of their assessment.

So, Art. 1 of the Law of Ukraine ‘About Using of Nuclear Energy and Radiation Safety’ [5] and Art. 1 of the Law of Ukraine ‘About the Radioactive Waste Handling’ [6] only mentions the term ‘radioactive contamination’ in the context of definition of the concept ‘radioactive waste’. Article 81 of the above-mentioned Law ‘About the Radioactive Waste Handling’ fixes ‘responsibility for non-performance of official duties in critical situations that brought or could lead to loss of life or a radioactive contamination of an environment’ and ‘concealment of information on a condition of a radioactive contamination of environment, and also granting deliberately false information about a condition of a radiation situation’ [6].

Protection of lands from pollution by chemical and radioactive substances is provided in the Code of land laws of Ukraine [7, Art. 164]. The concepts ‘radiation hazard’, and ‘radioactive polluted’ occur in the Order of the State committee of Ukraine on the land resources ‘About an Order of Preservation of Lands’ [8]. Immediately definition of concept of radiation hazard lands fixes the Law of Ukraine ‘About a Legal Regime of the Territory which underwent

a Radioactive Contamination as a Result of the Chernobyl Accident'. These are lands which are needed in carrying out actions of a radiation protection and other express funds allocated for restriction of the padding radiation caused by the Chernobyl accident and ensuring normal economic activity [9, Art. 4].

Proceeding from the definition of the territories which underwent a radioactive contamination owing to the Chernobyl accident within Ukraine, territories in which there was a permanent environmental by radioactive substances over pre-accident level that taking into account the climatic and complex ecological characteristic of concrete territories, can lead to radiation of the population over 1,0 mSv (0,1 rem) in a year and which demands acceptance of actions for a radiation protection of the population and other express interventions directed to need of restriction of padding radiation of the population caused by the Chernobyl accident and ensuring its normal economic activity belong to them.

It should be noted that radiation environmental affects the person by external and internal radiation.

Analyzing the Order of the Ministry of health protection of Ukraine No. 54 of 02.02.05 'About the Statement of the State Health Regulations 'The Ground Health Regulations of Ensuring Radiation Safety of Ukraine'' [10], it is possible to note that external radiation is a radiation at the expense of a district radioactive contamination. It is subjected to monitoring and depends on radiation level on the district. Internal radiation happens generally at the use of food and the waters polluted by radioactive nuclides which systematic consumption leads to accumulation them in a human body.

That is, radiation pollution represents distribution of radiations which, depending on quantity, become dangerous to any alive organism, whether it is a person or other biological individual. The feature of radiation is its ability to accumulation and transfer through the soil, water, air, etc. Besides, its danger also that it is practically not felt as any alive organism and its action begins only at excess of permissible doses.

Summing up the result of the aforesaid, it is possible to formulate definition of concept of radiation pollution which represents distribution of the radiations exceeding a natural radioactive background and level, radioactive elements, which are contained in an environment, and substances, which depending on quantity, become dangerous to any alive organism, they can collect and be transmitted through the soil, water, air, etc., at the same time are not felt and exert negative impact only at excess of permissible doses.

Proceeding from the fact that the environment owing to use of military and peaceful atom in a varying degree constantly is exposed to pollution, such concept as radiation safety was introduced in the ecological law.

The term radiation safety was strongly included into regulatory base [5, Art. 1]. A number of scientists have already proved such concept as 'the nuclear law' which implies complex branch of law and actively has been recently developed [11, p. 47]. The need of recognition of such law, creation and development of the modern Concept of the nuclear law have been spoken about today in many foreign countries, including the countries of the former Soviet Union and the USA.

In the conditions of further development of nuclear power and its wide use, the questions of legal regulation of ensuring radiation safety acquire the increasing relevance. One of such questions is a question of a burial of radioactive waste.

In the territory of Ukraine more than 5 billion of toxic wastage are saved up, which occupy the space of 164 thousand hectares. There are stored about 32 thousands m³ of the low-fissile, 1,7 thousand m³ of medium-active and 166 m³ of a highly active solid radiation waste, and also 19 thousand m³ of fluid waste material. Destruction of the burial of radioactive waste is carried out by their isolation from the biosphere for a time for which there will be a disintegration of radioactive nuclides. In practice there are used two ways of isolation of burial of radioactive waste — storage and burial, which choice depends on economic and socio-political factors [12, p. 125].

Temporary storage of radioactive waste assumes monitoring and service of storages that is followed by radiation of staff, and also risk of casual leak of radioactive substances and radiation environmental.

Today in Ukraine there is a large number of storages and burial grounds of radioactive waste. Our country takes the fourth place in Europe on volume basis of this wastage. So, for temporary storage of spent fuel in the territory of Ukraine two storages are operated: wet type (in the territory of the Chernobyl NPP) and dry type (the Zaporozhye NPP). In addition, in Ukraine two more storages are under construction: dry type in the territory of the Chernobyl NPP and the central storage of wastage of nuclear fuel (CSWNF) for wastage of the Rovno, Khmelnytsky and Southern Ukrainian NPP. And the last has to be constructed till 2017 under the contract signed with the American firm 'Holtec International' in an exclusion zone of territories which underwent a radioactive contamination owing to the Chernobyl accident. That is, actually, today, spent nuclear fuel is stored in NPP territories.

In addition, in the country waste physical objects which, without being nuclear installations, contain radioactive substances, and also devices which under certain conditions can create ionizing radiation (for example, medical inventory).

These waste objects transfer to the category of radioactive waste and the further treatment of them is carried out according to requirements of radiation safety [5]. In this regard, in the territory of Ukraine work six specialized combine state corporations 'UkrDO 'Radon': Kiev, Kharkov, Dnepropetrovsk, Odessa, Lvov, Donetsk state interregional specialized combines.

They provide collecting, transportation and safe placement of radioactive waste in express storages for container storage before their transfer to the Central storage of long-term storage "Vector" in an exclusion zone [13].

There is one more way of burial of radioactive waste — it is their burial in geological breeds. This way is conventional at the international level, including IAEA, and is more economic and ecologically justified. It consists in final burial of radioactive waste in burial grounds of geological formations at a depth not less than 300–500 meters with implementation of requirements of the principle of multibarrier protection. Experience carrying out underground

nuclear tests proved that at the particular choice of geological structures there is no leakage of radioactive nuclides from underground space in an environment. Many countries of the world have already mastered this method of burial of radioactive waste. The experience of implementation of the Swedish program of creation of geological storage is important for Ukraine. The Swedish platforms are placed in a geological formation (Baltic Shield) that allows (taking into account particular features) almost completely to use the corresponding developments concerning definition of requirements to the geological environment and its advantages [14].

In general, legal measures of ensuring nuclear and radiation safety in Ukraine are enshrined in the above-mentioned Law of Ukraine ‘About Using of Nuclear Energy and Radiation Safety’ and include: creation of legal bases of a control system in the sphere of using of nuclear energy and regulating system of safety when using nuclear energy; establishment of the rights, duties and responsibility of public authorities, enterprises, establishments and organizations, officials and staff, and also citizens concerning their activity, bounded with using of nuclear energy; keeping of norms, rules and standards on nuclear and radiation safety at implementation of any kind of activity in the sphere of using of nuclear energy, etc. [5].

And according to the Law of Ukraine ‘About the Radioactive Waste Handling’ the purposes of radiation safety are: priority of protection of life and health of staff, population and environment; differentiation of functions of the state monitoring and management in the sphere of the radioactive waste handling; realization of a state policy in the sphere of the radioactive waste handling by development and implementation of the long-term Nation-wide target ecological program of the radioactive waste handling [6].

Summing up, it can be said, that nuclear and radiation safety is reached by keeping at all stages of a complex sanitary and hygienic, technical and the organizational legal requirements, providing protection of staff, population, and also an environment against their negative influence.

It should be noted, that one more important component of a package of measures for ensuring nuclear and radiation safety is financing of this kind of activity. According to made earlier mentioned Nation-wide target ecological program of the radiation wastage handling, it has to be carried out at the expense of the State budget of Ukraine, means of the State fund of the radioactive waste handling, etc. However, in such financial state, into which there is our country now, implementing of this program remains undecided. In our opinion, the solution of this question consists in creation of express independent funds. Especially as creation of independent structures and financial funds for the implementing of radioactive waste, is an indispensable condition for the countries of the Central and Eastern Europe which declared the intention to enter terms of the EU.

‘Successful example of the solution of a question of financing of a burial of radioactive waste in geological formations is the USA in which the Fund of a nuclear wastage is created. The essence consists in establishment of a tax on each kilowatt-hour of the electric power developed on nuclear power plants

of the USA which makes 0,1 %. It did not cause essential body height of cost of the electric power, but guaranteed the material security of all works on a construction of storages of a highly active nuclear wastage in deep geological formations' [15, p. 6–7].

Conclusions. Thus, during research definition of concept of radiation pollution which represents distribution of the radiations exceeding a natural radioactive background and level, which are contained radioactive elements and substances in an environment, which depending on quantity of becoming dangerous to any alive organism was offered can collect and be transmitted through the soil, water, air, etc., at the same time are not felt and exert negative impact only at excess of permissible doses.

During the research, it is specified that nuclear and radiation safety is reached by keeping at all stages of a complex of the sanitary and hygienic, technical, organizational and legal and financial requirements providing protection of staff, population, and also an environment against their negative influence.

In geological breeds it is offered to make use of experience of the USA which consists in creation of the Fund of a nuclear wastage receiving tools in a type of tax for each kilowatt-hour of the electric power developed on nuclear power plants of the USA and which guarantees the material security of burial of a nuclear wastage in deep geological formations for financing of a burial of radioactive waste.

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Стаття надійшла до редакції 21.04.2016

О. В. Толкаченко

Одеський національний університет імені І. І. Мечникова,
кафедра цивільно-правових дисциплін
Французький бульвар, 24/26, Одеса, 65058, Україна

ПОНЯТТЯ РАДІАЦІЙНОГО ЗАБРУДНЕННЯ І ПРОБЛЕМА ЗАХОРОНЕННЯ РАДІОАКТИВНИХ ВІДХОДІВ

Резюме

У статті розглянуто питання, пов'язані з наслідками використання атому у військових і мирних цілях, здійснено аналіз національного законодавства у ракурсі визначення поняття радіаційного забруднення, а також дана характеристика правових засобів забезпечення ядерної та радіаційної безпеки при поводженні з радіоактивними відходами.

Автор дійшов висновку, що радіаційне забруднення являє собою розповсюдження випромінювань, що перевищують природний радіоактивний фон і рівень радіоактивних елементів та речовин, що містяться у оточуючому середовищі, які залежно від кількості стають шкідливими для будь-якого живого організму, можуть накопичуватись і передаватись через ґрунт, воду, повітря тощо, при цьому не відчуються і здійснюють негативний вплив лише при перевищенні допустимих доз.

На думку автора, ядерана і радіаційна безпека досягаються шляхом дотримання на всіх етапах комплексу санітарно-гігієнічних, інженерно-технічних і організаційно-правових вимог, що забезпечують захист персоналу, населення, а також оточуючого середовища від їх негативного впливу.

Ключові слова: ядерна енергія, радіаційне забруднення, радіаційна безпека, радіоактивні відходи, захоронення радіоактивних відходів.

Е. В. Толкаченко

Одесский национальный университет имени И. И. Мечникова,
кафедра гражданско-правовых дисциплин
Французский бульвар, 24/26, Одесса, 65058, Украина

ПОНЯТИЕ РАДИАЦИОННОГО ЗАГРЯЗНЕНИЯ И ПРОБЛЕМА ЗАХОРОНЕНИЯ РАДИОАКТИВНЫХ ОТХОДОВ

Резюме

В статье рассмотрены вопросы, связанные с последствиями использования атома в военных и мирных целях, проведен анализ национального законодательства в ракурсе определения понятия радиационного загрязнения, а также дана характеристика правовых мер обеспечения ядерной и радиационной безопасности при обращении с радиоактивными отходами.

Автор пришел к выводу, что радиационное загрязнение представляет собой распространение излучений, превышающих естественный радиоактивный фон и уровень содержащихся в окружающей среде радиоактивных элементов и веществ, которые в зависимости от количества становятся опасными для любого живого организма, могут накапливаться и передаваться через почву, воду, воздух и т.д., при этом не ощущаются и оказывают негативное влияние только при превышении допустимых доз.

По мнению автора, ядерная и радиационная безопасность достигаются путем соблюдения на всех этапах комплекса санитарно-гигиенических, инженерно-технических и организационно-правовых требований, обеспечивающих защиту персонала, населения, а также окружающей среды от их негативного влияния.

Ключевые слова: ядерная энергия, радиационное загрязнение, радиационная безопасность, радиоактивные отходы, захоронение радиоактивных отходов.