

LEGISLATIVE FRAMEWORK OF NUCLEAR SECURITY IN THE REPUBLIC OF SERBIA

by

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The paper presents the concept and characteristics of nuclear security, the elements of the nuclear safety strategy, the legislative framework and the most important solutions from the Law on Radiation and Nuclear Safety and Security. At the international level, the most important entity in this field is the International Atomic Energy Agency, while at the national level, most important is the Directorate for Radiation and Nuclear Safety and Security of Serbia. An important role is played by the Vinča Institute of Nuclear Sciences as the most referential scientific institution in this field, as well as the operational bodies – Nuclear Facilities of Serbia, the Ministry of Internal Affairs, Ministry of Defence, and the Serbian Armed Forces. Engagement of these bodies is carried out in regular peacetime circumstances, emergency situations and wartime. The most important challenges, risks and threats to nuclear security of Serbia were pointed out as well as the need to harmonize norms, procedures and processes in purpose of the strengthening institutional mechanisms in the field of nuclear security.

Key words: nuclear security, legislative framework, national entity, Serbia, EU

INTRODUCTION

After World War II, the international community established a new world order and a bipolar division of the world between the USA and the USSR and their allies, who started an arms race, developed nuclear weapons and other potentials for mass destruction of military targets. After the Cuban crisis at the beginning of the 1960-th, the relations between the opposing sides were relaxed, the world began to use nuclear energy for peacetime purposes through the development of nuclear power plants and the application of products from the nuclear fuel cycle in industry and medicine. In the following period, there were war conflicts, but without the use of nuclear weapons. Control of nuclear weapons was foreseen within the framework of the agreement between the USA and the USSR, as well as other states that became users of nuclear weapons. The second half of the 20-th century was mainly spent in the economic and technical-technological development of countries, the growth of the petrochemical industry, the emergence of information technologies and telecommunication systems that today occupy a first-class place. After the fall of the Berlin Wall in the 90-th, the world entered a new phase of relations characterized by a unipolar security

system, led by the USA and its allies. The USSR was restructured and was succeeded by Russia and member states of the Commonwealth of Independent States, while some states opted for independent development. At the end of 2000, there was the restoration of the Russian Federation and a strong return to the world political scene, as well as a more significant presence of the People's Republic of China as a world economic and military power.

At the beginning of the 3-rd millennium, modern society has reached an extremely high level of science, technology and technological development that is taking place in the circumstances of globalisation, urbanisation, increased economic development and industrial production. On the other hand, technical development has also brought negative consequences, such as the growth of the crime rate and its most serious forms, such as organized crime and terrorism [1]. In addition to criminal acts, society is threatened by challenges, risks and threats that come from fires, explosions, accidents and other extraordinary situations, caused by human actions and natural events. An additional danger comes from “dirty” technologies in the chemical industry, energy sector and areas where modern technologies are used [2]. The danger is even greater due to nuclear accidents, errors in the use of radioactive sources of radiation, disposal of radioactive waste, hazardous waste, toxic fumes and other

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dangerous actions, which today are the greatest peacetime threat to the survival of civilization. Small countries, poor and in transition, do not have the technical and material capabilities of the nuclear powers USA, Russia, France, Great Britain, China and others, which implement preventive measures to prevent nuclear accidents.

Despite its modest economic potential, the Republic of Serbia has prepared a national response to the challenges, risks and threats that come from the use of nuclear energy. The subject matter is more significant if one takes into account that there are 19 nuclear power plants in the wider area, and that 4 of them are in the closest neighborhood (Slovenia, Bulgaria, Romania, Hungary). The first step in this direction was taken on the legislative level with the adoption of the new Law on Radiation and Nuclear Safety and Security, while at the operational level the most important step was the establishment of a specialized Directorate for Radiation and Nuclear Safety and Security.

SECURITY – CONCEPT, ELEMENTS, AND CHARACTERISTICS

Security is one of the oldest social phenomena that is related to man – an individual and human society as an organized community, for the fulfillment of their needs and vital interests. The concept that we encounter under the name of safety or security is “one of the most mentioned, but least explained concepts” [3]. The debate on the semantic aspects of the concepts of safety and security continues to this day and the prevailing view is that in a large number of cases they are mostly synonyms [4]. In an objective sense, security can be defined as a state of a subject – an individual, group, institution, community or state characterized by the absence of danger, while in a subjective sense it is a state of absence of fear of danger [5].

Depending on the content in doctrine and practice, the following security concepts are accepted: (a) state and public, (b) international, national and collective, (c) internal and international, and (d) safety of the individual (man) and the community [6]. On the internal level, the priority for each country is state and public security as parts of the broader concept of national security, while on the international level, in the modern world, collective security prevails, which is realized through the Security Council of United Nations. Another example is the Organization for European Security and Cooperation (OESK). The most important values that are protected by the system of national and collective security are the survival of nations and states, territorial integrity, political independence and the quality of life of the population [7]. The basic elements of the security system are: goal, forces and means for achieving goals, structure of the system, activities and functions of structural elements for the purpose of achieving goals [8].

The use of nuclear energy and especially the development of nuclear weapons led to the fact that the question of security is not just a matter of individual states, but the entire international community. Opinion of the authors is that, by analogy with the general term, nuclear security represents the absence of danger to people, states and the international community as a whole, due to misuse of nuclear energy, nuclear accidents, radiation [9], nuclear terrorism [10], testing of nuclear weapons and the use of warheads [11], which have enormous destructive power and exceed conventional weapons [12].

Contemporary security challenges, risks and threats are listed in national security and defense strategies and other documents that mention reference objects and values to be protected, such as the European Security Strategy [13] and the National Security Strategy of the Republic of Serbia – 2009 and 2019 [14]. The documents directly or indirectly mention the danger of nuclear accidents, nuclear terrorism and the use of nuclear weapons, as well as the need for constant education and trainings of response forces [15].

INTERNATIONAL LEGAL FRAMEWORK OF NUCLEAR SECURITY

The field of nuclear security is regulated to some extent, by the provisions of international and national law of each country. It refers to the legal regulation of nuclear security in general and certain segments such as: use of nuclear energy for peacetime purposes, proceedings in cases of nuclear accidents, procedures in cases of increased radioactivity in the working and living environment, suppression of acts of nuclear terrorism, control of production and traffic of nuclear weapons.

Legal regulation has shown its importance after the first major accidents in the operation of nuclear power plants, among which: in the nuclear power plant in Pennsylvania (USA, 3/28/1979), especially in Chernobyl (Ukraine, 4/26/1986) and Fukushima (Japan, 3/11/2011), which raised a number of issues such as the nuclear safety and security of waste transport and others [16].

The period before the accident at the Chernobyl nuclear power plant

The first in a series of accidents was at the Three Mile Island nuclear power plant in Pennsylvania, when the core of one of the two reactors partially melted. Due to mechanical and electrical problems, the steam generator stopped cooling the water in primary ring, and fuel rods were uncovered, and burned up at a high temperature of about 1000 °C. On the international scale for nuclear events (from 1 to 7) the accident was categorized as

a 5 because it had consequences for the reactor and the power plant, but not for the environment because only a smaller amount of radioactive substances reached the outside [17]. The accident was responded to by the IAEA, which adopted two technical documents: Instructions on Reportable Events, Integrated Planning and Information Exchange in the Case of Transboundary Emissions of Radioactive Material and Instructions on Joint Assistance in the Case of a Nuclear Accident or Extraordinary Radiological Event [18]. The significance of the documents lies in their operational applicability in practice, because they are legally non-binding acts for member states, and the reason is the lack of political will to adopt them as legally binding acts.

Convention on the Physical Protection of Nuclear Material (Vienna, 1979) [19] is an important international document in the field of physical protection of nuclear material used for peaceful purposes. This convention is dedicated to the protection of nuclear materials in transport (art. 2), during use, storage and transportation (art. 2. par. 3-4). Furthermore, in the case of the transport of nuclear material, the obligation of the states is to notify each other. At the end, there are appendices related to the level of material protection during transportation and the table of nuclear material by category (plutonium, uranium, spent nuclear fuel). During 2005, amendments to the convention were adopted and signed and ratified by the Republic of Serbia (2016). The aim is to improve measures for the physical protection of nuclear materials and nuclear facilities, to sanction violators and to prevent abuse by unauthorized entities.

Before the accident in Chernobyl, the issue of liability in the event of nuclear damage was governed by the provisions of the Vienna and Paris Conventions on Civil Liability for Damage [20]. These conventions were related to damages in cases of loss of life, bodily injury and loss or damage to property. The problem is realizing the right to compensation for damages for countries that have not signed and ratified these documents. The signatory countries had the same problem if they signed only one of these two conventions, so they could not apply as victims (damaged) for financial aid and support. The problem was also the short deadline (10 years) for submitting claims for damages and the fact that countries that are not contracting parties could not apply for damages. With the joint protocol on the application of the Vienna and Paris Conventions on Civil Liability for Damage, some of these problems have been solved to some extent.

The period after the accident at the Chernobyl nuclear power plant

The second in a series of accidents was the accident at the Chernobyl nuclear power plant near the city of Pripjat (Ukraine) in 1986, which is still the biggest

environmental disaster in the world. The accident occurred as a result of an explosion at the reactor, which caused a series of chain explosions, the release of a large amount of radioactive waste into the atmosphere and the creation of radioactive clouds that covered the whole of Europe. On that occasion, over 100 000 residents were evacuated from the area, while the city was abandoned and declared a prohibited zone. According to official sources, there are two versions of the cause of the disaster: according to the first (1986), the cause is the human factor – operator error, and according to the second (1991), the cause is errors in the design of the reactor and the vertical rods that control its operation. Due to the consequences of the accident, the Chernobyl nuclear power plant was closed on December 15, 2000 [21].

Convention on Early Notification of a Nuclear Accident (Vienna, 1986) was adopted as the first in a series of new international documents, adopted and ratified by the former Socialist Federative Republic of Yugoslavia (SFRY) [22]. The document envisages the obligation of states to inform other states on each accident that the event has an impact on or could have an impact on. The content of the information about the accident must include data on the following: time, location and nature of the event, the activity in question, the reason for the accident, the course of the event, hydro-meteorological conditions, environmental monitoring, undertaken and planned measures (art. 2-5). The disadvantage of the convention is that states are not legally obliged to inform others about accidents related to nuclear weapons, because nuclear military is reluctant to provide information of this kind for reasons of national security.

Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency (Vienna, 1986) [23] is a document adopted with the idea of quickly providing assistance, mitigating and removing the consequences of accidents. The general provisions envisage the possibility of states to request the involvement of the International Atomic Energy Agency (IAEA) in order to speed up and facilitate cooperation, as well as to mitigate the consequences (art. 2). Each signatory can turn to the IAEA and other states for help and support regardless of whether the accident occurred on its territory and specify the type of assistance it seeks. In order to coordinate work, the IAEA established a specialized network for response and assistance – RANET (Response and Assistance Network). Within the network, capacities for the following types of assistance can be applied for: (a) decontamination, (b) dose assessment, sampling and analysis of environmental samples, (c) medical support, (d) assessment and counseling regarding nuclear facilities, (e) radiological prospecting, (f) radiological evaluation and counseling, and (g) finding and placing sources under regulatory control. The convention predicts the direction and control of aid according to the

real danger, the establishment of contact points for receiving and sending aid (art. 4), the coordinating role of the IAEA in the provision of aid, reimbursement of costs within the procedure of receiving and providing aid (art. 7), privileges, immunities and relief for the staff of expert teams (art. 8), transit of personnel, equipment and property (art. 9), compliance with other agreements in this matter (art. 12). The convention was also signed and ratified by SFRY and incorporated into its legal system.

Convention on Nuclear Safety (Vienna, 1994) [24] is the most important document in this matter, which highlights the common interest of states in the field of nuclear security. From a legal and technical point of view, it is a relatively short (35 articles) and clear document, well accepted in the international community because there were no different interpretations by the great world powers. The need to create a high level of nuclear security and safety, the improvement of protection measures against radiation risks in nuclear facilities and the necessity of engaging in the prevention of accidents with radiological consequences were especially emphasized (art.1). Furthermore, the harmonization of national legislation (safety requirements and regulations, licensing) and the establishment of technical protection measures, supervision and inspection (art. 7-8) are foreseen. The standards and mechanisms in the field of nuclear safety are specifically mentioned: safety priority, adequate resources, quality assurance, radiation protection and preparedness for emergency situations. The safety of nuclear facilities is a first-class issue, and in this connection, the location, design and construction of facilities, as well as safety measures at the national level, are highlighted (art. 10-19). The signatories undertook to submit reports on the implementation of the obligations assumed from the convention. The SFRY ratified this document and incorporated it into the national legal order.

Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (Vienna, 1997) [25] is a document that applies to used nuclear fuel and radioactive waste from civilian nuclear reactors, as well as from military or defense programs when such materials are permanently transferred to civilian management and care (art.3). Advocacy for a high level of security and safety in the management of used fuel and radioactive waste, improvement of national protection measures, technical and international cooperation, effective defense against potential dangers, prevention of accidents and mitigation of consequences is proclaimed (art.1). The Convention also applies to planned and controlled releases of radioactive materials into the environment from controlled nuclear facilities. The manner and procedure of used nuclear fuel management (art. 4-10), the safety of radioactive waste management (art. 11-17) are regulated in more detail, and general safety and security provisions were adopted (chapter IV, art. 18-26) which foresee legislative, reg-

ulatory and administrative protection measures. The obligation of the signatory states to periodically submit a report on the implementation of the assumed obligations has been established. The convention was ratified by Serbia and it became an integral part of the internal legal system.

NATIONAL LEGAL FRAMEWORK OF NUCLEAR SECURITY

For the sake of better systematics, the legal regulations in the field of nuclear safety in the Republic of Serbia have been conditionally divided into: regulations adopted during the period of the common state SFRY and regulations adopted after the termination of the common state and the formation of independent states.

The period of the common state of Yugoslavia

The former common state existed from 1st of December 1918 and the end of World War I, until 1991. In a period of almost eight decades, social, political and economic changes took place that affected the form of socio-political organization and all areas of life and work. The changes were also reflected in the field of security, which also went through various development stages and changes, and after World War II, with the expansion of the use of nuclear energy, there was also the development of nuclear security.

The first in a series of documents in this area was the Rulebook on Protective Measures when Working with X-ray Devices and Radioactive Substances (1947) [26], which foresees protective measures when working with X-ray devices and radioactive substances. It is a document that had three sections regulating issues of protection against X-ray radiation with tables for calculating the values of characteristics for materials and measures of protection against radioactive radiation during radiotherapy.

Then, the Order on Limitation of the Traffic of Radioactive Isotopes (1948) was adopted, as an act of lower legal force, which was the starting point for the adoption of the first legal regulations in this area, in the post-war period [27].

The Law on Protection from Ionizing Radiation (1959) was the first legal text adopted in this area after World War II. The adoption of the regulations was greatly influenced by the accident that had previously occurred at one of the reactors in Vinča (October 15, 1958), when six employees were irradiated with high doses. In the function of protection from the harmful effects of ionizing radiation, it is foreseen to put radiation sources and persons, materials and objects exposed to radiation under the supervision (art.1). It is further envisaged to monitor buildings, parts of buildings and premises, atmosphere, soil, water, food (human and an-

imal) and waste material, protective equipment (personal and collective), employees who work with radiation sources, the population and individuals who came or can be under the influence of ionizing radiation (art. 3). As the competent authority for protection against ionizing radiation (art. 5), the Federal Commission for Nuclear Energy was foreseen, which monitored the activities related to: the location and construction of existing facilities; procurement, use and marketing of radiation sources; records; control of the atmosphere, water, food and soil. Significant provisions refer to the procedure and organization of the service for performing inspection tasks, duties and powers of inspectors, which were regulated in more detail by a special regulation of the Federal Executive Council [28].

The next in line was the Basic Law on Protection from Ionizing Radiation (1965) [29], which regulated a wider range of issues such as: protection against ionizing radiation; organization of the service for protection against ionizing radiation; categorization of employees' workplaces at risk, determination of received radiation doses and control of health status; determination of radiation doses received by the population; determination of contamination of food (human and animals), soil, water, air and work premises and implementation of decontamination; checking the correctness of measuring instruments and protective devices; dealing with radioactive waste. One of the most significant solutions of this law is the obligation to adopt a plan of measures for protection against potential accidents due to malfunctions of reactors, accelerators and other nuclear machines. Protection measures are particularly related to the radiation protection of personnel, the population in the immediate and distant surroundings, the prohibition of work with sources of ionizing radiation for those under the age of 18 and women during pregnancy. In the meantime, the jurisdiction of the Federal Commission for Nuclear Energy were reduced and transferred to other federal and republican bodies. The supervision and control of the implementation of ionizing radiation protection measures was transferred to the jurisdiction of the republics and their sanitary inspections (art. 31), while the tasks of ionizing radiation protection were transferred to the Federal Secretariat for Health and Social Policy, Civil Protection and other organizations (art. 40).

Then the Law on Protection from Ionizing Radiation (1976) [30] was adopted, which introduced expansion of the jurisdiction of the republics and provinces. Among other things, this law stipulates that republican and provincial authorities issue consent for the location, trial operation and commissioning of nuclear facilities. The implementation of measures for protection against ionizing radiation is under the control and supervision of republican and provincial authorities, except for the circulation of radiation sources across the border, when the supervision is carried out by the federal health authority.

Two years before the Chernobyl disaster, the Law on Protection from Ionizing Radiation and on Special Safety Measures in the Use of Nuclear Energy (1984) [31], was adopted under the influence of the construction of the only Yugoslav nuclear power plant Krško. Of particular importance are the provisions of the law relating to measures of protection against ionizing radiation and measures of safety of nuclear facilities and materials. Conditions for the location, construction and use of nuclear facilities, circulation of nuclear materials, their records and control are specified in more detail. For the first time, the physical protection of nuclear power plants, materials and radioactive waste is mentioned. The supervisory function is resolved as in the previous regulation.

After the Chernobyl accident, the Law on the Prohibition of the Construction of Nuclear Power Plants in the SFRY (1989) [32] was adopted, which prohibited the construction of nuclear power plants, fuel production facilities and the processing of used fuel from nuclear power plants. After the end of the SFRY, the Law on the Prohibition of the Construction of Nuclear Power Plants in the Federal Republic of Yugoslavia (FRY) (1995) was adopted, by which the new state accepted the earlier solutions under changed circumstances [33]. After 2020, under the influence of the energy crisis in the world, the idea of repealing this law and building the first nuclear power plant in Serbia, or a cooperative business with one of the surrounding countries, became actualized.

Immediately before the disintegration of the SFRY, the Law on Protection from Ionizing Radiation and on Nuclear Safety (1991) [34] was adopted, which was accepted by the FRY as a legal successor. At the same time, the processing, storage and disposal of radioactive waste originating from abroad, the installation of radioactive lightning rods and systematic X-ray examinations of persons under the age of 16 are prohibited. The law also provides for the formation of specialized bodies such as the Commission for Protection against Ionizing Radiation (art. 31) and the Commission for Nuclear Safety (art. 48). Supervision over the implementation of regulations is carried out by the federal administrative body responsible for nuclear energy affairs. The final provisions envisage the removal of sources of ionizing radiation from radioactive lightning rods that were installed earlier, within the time limit for their replacement and by the end of 1996 at the latest. (art. 90).

The period after the end of the common state of Yugoslavia

In the period after the termination of the existence of the joint state of the SFRY, the legal continuity of the FRY continued as a union of the Republic of Serbia and the Republic of Montenegro. During the pe-

riod of existence of the new joint state of the State Union of Serbia and Montenegro (2003-2006) and later of the independent states, new regulations in this area were adopted.

The Law on Protection from Ionizing Radiation (1996) [35] was adopted first in the series, which affirmed the basic principles of radiation protection such as justification, optimization and limitation of radiation exposure. Categories of effective and equivalent dose, radiation and tissue weight factors are defined. Supervision over the implementation of ionizing radiation protection measures and nuclear safety measures and security is carried out by federal authorities with inspectors. It is also predicted that at the federal level, the issue of disposal of radioactive waste will be resolved within 5 years, while sources from radioactive lightning rods must be removed within 3 years.

The Republic of Serbia (RS) adopted a new Law on Protection against Ionizing Radiation and on Nuclear Safety (2009) [36]. In addition to similarities with previous regulations, one of the most important novelties is the establishment of the Agency for Protection against Ionizing Radiation and Nuclear Safety of Serbia, as a specialized regulatory body. Supervision over the implementation of ionizing radiation protection measures and nuclear safety measures is carried out by inspections that are part of the competent ministries. An important novelty is the establishment of a public company for the management of nuclear facilities in the Republic of Serbia. The deadlines for removing radioactive lightning rods (5 years) and for ensuring the conditions for permanent disposal of radioactive waste (10 years) were also extended.

COMMENTARY ON THE LAW ON RADIATION AND NUCLEAR SAFETY AND SECURITY

The Law on Radiation and Nuclear Safety and Security [37], adopted in 2018 and amended in 2019, replaced the previous Law on Protection from Ionizing Radiation and on Nuclear Safety. Of the more important international reasons for its adoption, the accession negotiations for the admission of RS to the European Union (EU), the ratification of signed international conventions and the acceptance of international standards in this area stand out. For internal reasons, we highlight the harmonization of norms with international legal regulations and especially EU regulations (Directives of the European Commission and the Euroatom Council), provision of conditions for providing better protection against ionizing radiation and environmental protection, control of production, circulation and transportation of radioactive substances, safer performance of radiation and nuclear activities.

The current regulation has a relatively larger number of articles (250) which are systematized in a

total of XVI chapters, namely: basic provisions; radiation and nuclear safety and security strategies; Directorate; basic principles of protection against ionizing radiation; exempting activities from the obligation to report, reporting and issuing approval; radiation and nuclear safety; nuclear or radiological emergency – preparations and response; circulation of radiation sources; transportation of dangerous goods; information of public importance and transparency; liability of the licensee for nuclear damage; inspection supervision; penal, transitional and final provisions.

The strategies of: (a) radiation and nuclear safety, (b) management of used fuel and radioactive waste, (c) radiation and nuclear safety, and (d) situation management are covered in Chapter II. Strategies are prepared and proposed by the Directorate, adopted by the Government for a period of 7 years and review of periodic reports (art. 6). In terms of content, these documents contain an overview of the current state, the desired state, proposed measures and action plans (art. 7). The radiation and nuclear safety and security strategies (art. 9 and art. 11) are particularly important, which highlight the obligations of adopting a normative framework, determining the obligations and responsibilities of competent authorities.

Chapter III (art. 13-28) lists the most important subject – the Directorate for Radiation and Nuclear Safety and Security of Serbia, which will be discussed.

The following are the basic principles of protection against ionizing radiation (IV, art. 29) – justification, optimization and limitations of exposure.

In the following chapter V, exemption of activities from the obligation to register, registration and issuing of approvals (art. 30-65) are dealt with. A special place is occupied by the categorization of activities according to risk (per personnel, population and environment) and according to the type of activity performed – radiation activity of low, moderate and high risk and nuclear activity (art. 33). Furthermore, the approval procedure, activity registration, licensing, ionizing radiation jobs, reporting on radiation examinations, *etc.* are presented.

Chapter VI Radiation and nuclear safety (art. 66-181) is particularly important, in which important issues are addressed: dose limitation in professional exposure, population exposure and medical exposure; activities of services and experts; radioactive sources (categorization, disused source, orphan source); nuclear safety (programs, extraordinary events, construction and operation of nuclear facilities, decommissioning); remediation (location and rehabilitation of contaminated objects); safety of radioactive waste and spent nuclear fuel management (stages of management; obligations of approval holders; categorization, treatment, processing, storage, disposal; management plan; control of cross-border shipments).

Chapter VII regulates the record keeping and control of nuclear material, activities, special equip-

ment and non-nuclear material related to the non-nuclear fuel cycle (art. 182-184).

Radiation and nuclear safety are dealt with in chapter VIII (art. 185-191). Security measures of radiation sources and related facilities are specifically regulated, which include detection of a security event, response measures for the purpose of locating the source, and measures to suppress the possible consequences of sabotage or other malicious use of radiation sources (art. 185). This is followed by an assessment of the basic security threats made by a commission formed by the Government of the RS, a security plan, the development of international cooperation and assistance, and the protection of data confidentiality.

An important chapter refers to the preparation and response in case of a nuclear and radiation emergency (IX, art. 192-195). The action plan in these circumstances is adopted by the Directorate (art. 193) in cooperation with other state bodies and organizations. The most important parts of the plan are risk assessment, authority and responsibility of authorities, operation plan, coordination and cooperation with others, protective measures, situation assessment and evaluation, waste management, *etc.* According to art. 193.para.5, the management of nuclear and radiological emergency situations is carried out in accordance with the Law regulating emergency situations [38]. Cross-border nuclear or radiological emergency situations and international cooperation in that case are provided for in art. 195 of the Law.

Chapter X deals with the circulation of radiation sources in the context of radiation activity of low, moderate and high risk. Traffic is subject to a system of approvals and permits for import, export and transit, and measures of control and supervision in this area are foreseen (art. 196-202). In the phase of detecting and preventing the circulation of radiation sources (art. 202), the Customs Administration and the Border Police Administration of the Ministry of Internal Affairs have an important place.

In the following chapter XI, the transport of dangerous goods – radioactive materials is regulated (art. 203-205), where a system of approvals and permits for transport was also introduced, which is justified due to the nature of these materials and the potential consequences of inadequate transport and accidents. Developed countries for radiation monitoring use plastic scintillation detectors to detect illegal transport of radioactive materials, or potential radioactive contamination [39].

Due to the sensitivity of this topic, chapter XII, which deals with the issue of information of public importance and transparency, has an important place, so in connection with this, the activities of the Directorate include the establishment of certain procedures (art. 206).

Chapter XIII foresees the responsibility of license holders for nuclear damage caused by an extraordinary nuclear event, where a financial limit, insurance for nuclear damage, deadlines and court proceedings are provided (art. 207-210).

Inspection supervision in this area is carried out by the Inspectorate for Radiation and Nuclear Safety and Security, Chapter XIV (art. 211-232) in which procedural issues, powers of Inspectorate members, measures they undertake, types and forms of supervision, temporary confiscation of objects or applications are regulated.

The final part of the law includes penal provisions (XV) and transitional and final provisions (XVI).

Taking into account our commentary on the current Law, one can see a tendency that the legislator tried to better regulate radiation and nuclear safety and security, especially by adopting some international standards in this area. The law was adopted in accordance with the intention of harmonizing norms with the *acquis* of the EU (art. 237, Directive of the Euroatom Council), which is in the spirit of the previously adopted National Program for the Adoption of the European Union *Acquis* (NPAA) and in connection with the harmonization of norms in areas of nuclear safety (IV revised NPAA, 7/21/2022) [40]. Due to the short time since the adoption of the regulations, it is realistic to expect that after a longer period of time, conditions will be created for more serious and in-depth analyzes of the results of the application of the new norms.

MORE IMPORTANT SUBJECTS OF NUCLEAR SECURITY

With the aim of a more comprehensive analysis of the functioning of the nuclear safety and security systems, it is of great importance to highlight the more important entities that are the bearers of activities in this area both at the international and national level.

On the international level, the most important entity in the field of nuclear safety in the world is the IAEA, founded on the initiative of the USA on 7/29/1957 and based in Vienna as an autonomous organization in the UN system [41]. The agency was conceived as an international organization for the promotion of the peaceful use of nuclear technology, as well as with the aim of prohibiting its use for military purposes and the production of nuclear weapons. The main areas of work of the IAEA are (a) safety and security, (b) science and technology, and (c) safeguards and licensing.

The IAEA has a significant role in the control of nuclear weapons and the supervision of the use and storage of fissile material, while the joint activities and solidarity of the members of this international organi-

zation were particularly pronounced after the nuclear disaster in Chernobyl (1986) and later in Fukushima in (2011). Although the IAEA is an independent international organization, it has a significant status, role and place in the UN system, as it submits periodic reports to the General Assembly and the UN Security Council. The organization carries out the mission of safe and secure use of nuclear energy and technology in peacetime conditions.

The IAEA has three basic functions: (a) inspects nuclear facilities for the use of nuclear energy, (b) develops standards in the field of nuclear technology and energy, and (c) provides information for the safety of nuclear facilities. The scientific, professional and research work of experts in the field of nuclear safety and security has a significant place. A number of different programs have been developed, the most important of which are the Program of Action for Cancer Therapy (2004, PACT) for the needs of developing countries, which is implemented by the Integrated Nuclear Infrastructure Group (Indonesia, Thailand, Vietnam, Jordan) and the Program of the International Center for the Safety of Seismic Networks (2008), within which consultations are carried out on the seismic safety of nuclear facilities [42]. The Center has established safety standards and procedures regarding site selection, site evaluation, and seismic design [43]. In terms of structure and organization, the IAEA, according to the Statute, has three main bodies: the Governing Board, the General Board and the Secretariat [44].

European Atomic Energy Community (Euratom) is an international organization of EU states established by the Treaty of Rome (3/25/1957), which is a leader in this field in Europe. After the adoption of the Treaty on Integration (1967), Euroatom, the European Economic Community and the European Coal and Steel Community were merged into the European Community (EC), which preceded the EU. The goal of establishing Euroatom was to create a special market for nuclear energy in the EC area, which will be distributed to members and sold to non-members [45]. The architecture of the EU went through several changes after the signing of the treaties in Maastricht (1992), Amsterdam (1997), Nice (2001) and Lisbon (2009) [46], especially in the area of freedom, security and justice. Euratom functions as an independent specialized agency of the EU, which has its own specificity due to its scope of work. There has been an increase in the scope of work so that the organization deals not only with the use of nuclear energy, but also with the use of ionizing radiation, the protection of nuclear facilities and materials, radiation protection, the construction of an international fusion reactor (ITER – International Thermonuclear Experimental Reactor) [47].

The organization is independent from the European Commission and is not under the control of the European Parliament, while countries outside the EU

can participate in its work (example of Switzerland since 2014). After “Brexit”, Great Britain is no longer a member of Euroatom (after 31/1/2020), but has the legal status of an associate member according to the draft terms of the Agreement on trade and cooperation between Great Britain and the EU. The organization has active cooperation agreements with countries outside the EU such as: Australia, Japan, Armenia, South Africa, Canada, Kazakhstan, USA, Ukraine and Uzbekistan [48].

Today, Euratom is a special agency that covers the field of nuclear energy, because the EU has adopted the view that further nuclear development is needed, in order to fill the deficit caused by the enormous exploitation of coal and reduce dependence on oil producers. We especially emphasize the importance of Article 37 of the EU Treaty, which refers to Euroatom and cross-border obligations regarding the preservation of the environment and the protection of people [49]. The independence of Euratom in relation to the EC is also the result of the great anti-nuclear mood of EU citizens [50].

On the national level, the most important subject of nuclear safety is the Directorate for Radiation and Nuclear Safety and Security of Serbia, whose legal status is regulated by the provisions of the Law on Radiation and Nuclear Safety and Security (art. 13). The Directorate is the legal successor of the former Agency for Protection against Ionizing Radiation and Nuclear Safety, conceived as an independent, functional and independent regulatory body that answers to the RS Government for its work.

The tasks of the Directorate are defined in art. 22 par. 1-36, among which stand out: normative-legal tasks of preparation of acts (strategies, plans, regulations for the Government, program for monitoring radioactivity in the environment, proposal of a plan in case of a nuclear or radiological emergency); prescription of protection measures against the harmful effects of ionizing radiation and natural radioactive materials; issuing decisions on issuing, suspending or revoking approvals, authorizations and permits in this area; issuance of certificates in accordance with the law; records of radiation sources; prescribing criteria for exemption from the obligation to report and exemption from regulatory control; verification of radiation protection measures; determination of financial and other obligations of approval holders; business of professional cooperation; register and record-keeping activities; establishing a control system over radiation sources and devices; categorization of sources of radiation, nuclear and radioactive material and determination of protection measures; prescribes conditions for the safety of nuclear and radioactive material and facilities; cooperation with national authorities and international organizations (IAEA and authorities of foreign countries), especially in the case of a nuclear and radiological emergency; informs the public about is-

sues in his field of work; gives legal opinions on the harmonization of national regulations with international agreements and, if necessary, initiates the improvement of the national framework in this area; implements additional obligations to protect the population and the environment; performs regulatory control and inspection supervision over the implementation of radiation and nuclear safety and security measures; establishes and maintains a nuclear material control system.

The Directorate carries out regulatory inspection supervision through inspectors for radiation and nuclear safety and security (art. 211-232). When performing supervision over the implementation of radiation safety and security measures, inspectors have certain rights, duties and authorities in order to establish the facts and undertake radiation and nuclear safety and security measures. In exceptional cases, emergency measures can be ordered, like temporary closure of buildings, premises and equipment, then temporary confiscation of goods, documentation and objects in order to secure evidence and file a report for a criminal offense – criminal offense, economic offense, misdemeanor (art. 223-226).

The Public Company Nuclear Facilities of Serbia was founded in 2009 by the decision of the Government of the Republic of Serbia with the aim of managing nuclear facilities in the country [51]. The main activity of this entity is the management of facilities and the performance of other tasks: the implementation of nuclear activities and radiation activities; taking radiation and nuclear safety measures; provision of conditions for the location of nuclear facilities; radioactive waste management; implementation of measures to prevent environmental contamination; provision of physical and fire protection of nuclear facilities, materials and waste; decontamination of the living and working environment; systematic examination of radioactivity; cooperation with the IAEA and other subjects (art. 4). The public company uses a large part of the facilities, equipment, devices and facilities that previously belonged to the Vinča Institute for Nuclear Sciences and the Institute for Technology of Nuclear and Other Mineral Raw Materials (art. 5). The legal status of the company is defined by the Law on Public Companies of the RS (art. 2), which regulates activities of general interest [52], while a special decision specifies the harmonization of business operations with the provisions of the law [53].

The Vinča Institute of Nuclear Sciences is the leading scientific institution for multidisciplinary research in the field of nuclear and radiation safety and security, founded back in 1948 as a scientific institute of national importance for the research of the most relevant topics in the field of basic scientific disciplines and technical-technological sciences [54]. In the initial stage until 1968, the Institute primarily worked on the implementation of the state nuclear research pro-

gram, while today it includes a large number of scientific and technical-technological disciplines. Today, the institute has scientific research laboratories, scientific centers of excellence and supporting technical and administrative services. The Institute's researchers participate in projects financed by the relevant Ministry of Science, Technological Development and Innovation, where the Institute is the research coordinator for over 35 projects. A particularly important fact is the rich international cooperation that the Institute achieves with scientific institutions around the world and on over 60 international projects [55].

The Ministry of Internal Affairs of the RS is an important operational entity in the field of nuclear and radiation safety and security, especially the Emergency Situations Sector as a separate organizational unit. The most important rescue function of the Sector is in the event of fire, natural disasters, technical and technological accidents, effects of hazardous substances and other conditions, large-scale dangers to the health and lives of people and the environment, then taking preventive measures and providing assistance in eliminating damage and consequences due to extraordinary events events and situations [56]. The sector performs observation, notification and alerting tasks at the regional, provincial and national level, supervises public shelters, manages and coordinates the work of authorities in emergency situations and during the elimination of the consequences caused by extraordinary events and emergency situations. The legal basis for the work of the Ministry of Internal Affairs – Emergency Situations Sector is primarily the Law on Police [57] and the Law on Disaster Risk Reduction and Managing Emergency Situations [58], while the National Security Strategy [59] specifies challenges, risks and threats, policy and the national security system and other elements.

The Ministry of Defense and the Serbian Armed Forces are important subjects in this area because they have the potential in the event of emergency situations, technical-technological and other accidents, breakdowns and other situations that can lead to endangering people and objects on a larger scale. The legal status, scope of work and other issues of importance for the army are regulated by the Law on Defense [60] and the Law on the Army [61], while the Defense Strategy specifies challenges, risks and threats, policy and the defense system [62]. In the context of nuclear security, the CBRN (chemical, biological, radiological, and nuclear) Center, located within the Armed Forces Training Command, has an important place. This service has a long tradition since the time of the Kingdom of Yugoslavia, through SFRY, and until today as a Center for training and performing complex tasks in the defense of the country. The service has protective and other equipment intended for: (a) detection and identification of toxic chemicals present in contaminated environments, (b) detection and dosimetry of ionizing radiation and measurement of activity in vari-

ous types of nuclear contaminated samples (food, water, biological material), and (c) CBRN decontamination. The Center also possesses non-lethal chemical agents for temporary incapacitation, simulators and other equipment [63].

DISCUSSIONS AND CONCLUSIONS

Today, nuclear security is par excellence issue of the modern international community, because in the world there is an objective danger of abuse of nuclear energy, nuclear accidents, emissions of gases, radiation, acts of nuclear terrorism and the use of nuclear weapons of enormous destructive power, which is far beyond conventional weapons. That is why the international community has adopted several important international conventions in the field of nuclear safety and security, especially after the nuclear accident in Chernobyl (1986) and other accidents (Fukushima 2011).

In order to increase nuclear safety and security in the world, one of the current ideas is the licensing of nuclear reactors, as a method of assessing the safety of nuclear facilities [64]. Operational measures should further include: training of personnel for accidents, monitoring of the environment during accidents in nuclear power plants [65], control of sources and levels of radiation, assessment of the impact of secondary radiation on personnel during the removal and decontamination of contaminated nuclear equipment [66], management of mental fatigue of personnel in the workplace [67], reconstruction of sites after radiological disasters [68]. In some countries, for example in South Korea, a methodology for determining the alarm level and warning of accidents at nuclear reactors [69] has been developed, with the aim of preventing the uncontrolled release of radioactive material into the environment under uncontrolled conditions. Developed countries have gone a step further by designing protection in the form of a locking system [70], which warns users of unauthorized access to nuclear facilities.

In the authors' opinion, the idea of building a nuclear power plant in Serbia should be comprehensively considered and the expert opinion of the greatest scientific authorities in this field should be requested. In order to achieve the necessary level of nuclear safety and security, appropriate lessons should be drawn from the bad experience after the NATO bombing of the FRY, when there was an uncontrolled spread of depleted uranium [71], especially in the area of the southern Serbian province of Kosovo and Metohija and the need for the implementation of urgent measures to reduce harmful consequences for people and the environment.

The Republic of Serbia signed and ratified the adopted conventions and thus gave a clear signal that respects international law and obligations, even though it is a small country and does not have the nu-

clear potential of a developed country. In this context, Serbia adopted the Law on Radiation and Nuclear Safety and Security, which regulated earlier legislative solutions, established specialized entities for monitoring the situation and taking the necessary measures in this extremely important area. In the following period, the implementation of legal norms should be monitored and possible changes and additions to the legislative framework should be considered, as well as the strengthening of institutional mechanisms in the field of nuclear security.

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AUTHORS' CONTRIBUTIONS

All authors contributed equally to this manuscript.

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ЛЕГИСЛАТИВНИ ОКВИР НУКЛЕАРНЕ БЕЗБЕДНОСТИ У РЕПУБЛИЦИ СРБИЈИ

У раду су изложени појам и карактеристике нуклеарне и радијационе безбедности, елементи стратегије нуклеарне безбедности, легислативни оквир и важнија решења из Закона о радијационој и нуклеарној сигурности и безбедности. На међународном нивоу најважнији субјект у овој области је Међународна агенција за атомску енергију, док је на националном нивоу Директорат за радијациону и нуклеарну сигурност и безбедност Србије. Значајну улогу имају Министарство одбране, Војска Србије, Министарство унутрашњих послова Републике Србије, Институт за нуклеарне науке Винча као најреферентнија научна институција у овој области и Јавно предузеће Нуклеарни објекти Србије као оперативни орган. Ангажовање субјеката остварује се у редовним мирнодопским околностима, ванредним ситуацијама и ратним приликама. Указано је на најзначајније изазове, ризике и претње по нуклеарну безбедност у Србији, као и на потребу усаглашавања норми, процедура и процеса у циљу јачања институционалних механизма у области нуклеарне безбедности.

Кључне речи: нуклеарна безбедност, легислативни оквир, национални субјекти, Србија, ЕУ