IV. МЕЖДУНАРОДНО-ПРАВОВЫЕ НАУКИ

Информация для цитирования:

Kazemi Shariat Panahi L. International Nuclear Law: The Nature and Complexities // Вестник Пермского университета. Юридические науки. 2025. Вып. 2(68). С. 251–276. DOI: 10.17072/1995-4190-2025-68-251-276.

Kazemi Shariat Panahi L. International Nuclear Law: The Nature and Complexities. *Vestnik Permskogo universiteta. Juridicheskie nauki* – Perm University Herald. Juridical Sciences. 2025. Issue 2(68). Pp. 251–276. (In In Eng.). DOI: 10.17072/1995-4190-2025-68-251-276.

УДК 341.2
DOI: 10.17072/1995-4190-2025-68-251-276

International Nuclear Law: The Nature and Complexities

L. Kazemi Shariat Panahi
RUDN University
E-mail: louise.kazemi@gmail.com

Received 20 Dec 2024

Introduction: *reflecting the discussion on the position of nuclear/atomic law within the system of international law, this article argues that international nuclear law has developed into an independent branch of public international law, being a set of principles and norms acknowledged by the international community of States. The article also discusses certain aspects of mutual relationships between nuclear law and other legal disciplines, such as international security law, international environmental law, law of international relations.* ***Purpose****: the author seeks to analyze various aspects of international nuclear law.* ***Methods:*** *the author uses a comparative analysis to study legal documents in order to discover the origin, nature, potentials, and complexities of international nuclear law.* ***Results:*** *the paper examines how distinct principles and frameworks of nuclear law evolved to govern the peaceful use of nuclear energy, while also addressing the complex interactions of nuclear law with other legal domains that have some intersections with nuclear activities.* ***Conclusion:*** *the author highlights the growing significance of nuclear law as a specialized field of research and practice, driven by the expanding global reliance on nuclear power and the need for comprehensive legal oversight in this critical energy sector.*

Keywords: international law; international nuclear law; international environmental law, ICJ; nuclear security; nuclear safety; nuclear liability; state responsibility; transboundary harms

Международное ядерное право: природа и сложности

Л. Каземи Шариат Панахи
Российский университет дружбы народов имени Патриса Лумумбы
E-mail: louise.kazemi@gmail.com

Статья поступила в редакцию 20.12.2024

Введение: *в статье анализируется положение ядерного/атомного права в системе международного права. Утверждается, что международное ядерное право прошло путь развития до оформления в самостоятельную отрасль публичного международного права, представляя собой совокупность принципов и норм, признанных международным сообществом государств. Также обсуждаются некоторые аспекты взаимоотношений между ядерным правом и другими правовыми дисциплинами, такими как право международной безопасности, международное экологическое право, право международных отношений.* ***Цель:*** *проанализировать различные аспекты международного ядерного права.* ***Методы:*** *автор использует метод сравнительного анализа применительно к содержанию правовых документов, чтобы выявить происхождение, природу, потенциал и сложности международного ядерного права.* ***Результаты:*** *в статье проанализировано, как развивались отдельные принципы и основы ядерного права, чтобы в итоге обеспечить регулирование мирного использования ядерной энергии; рассмотрены сложные взаимосвязи ядерного права с другими областями права, которые имеют те или иные пересечения с вопросами деятельности в области ядерной энергетики.* ***Вывод:*** *автор подчеркивает возрастающую значимость ядерного права как специализированной области исследований и практической деятельности, обусловленную растущей зависимостью от ядерной энергетики в общемировом масштабе и необходимостью всеобъемлющего правового надзора в этом критически важном энергетическом секторе.*

Ключевые слова: международное право; международное ядерное право; международное экологическое право, Международный Суд; ядерная безопасность; ядерная ответственность; ответственность государства; трансграничный вред

Introduction

The 21st century commenced with scientific advancements and innovations in the field of nuclear energy, which pull the trigger of global concerns over the regulation of nuclear activities within international legal frameworks. These introduce a set of rules for all types of nuclear activities conducted by international entities that are subject to international law. Nuclear innovation and expansion have faced the world community with serious challenges resulting from nuclear incidents, clandestine nuclear programs, and international terrorist attacks.

To address such challenges, the International Atomic Energy Agency (IAEA) was founded, whose objective is to introduce standards, guidelines, and initiatives to keep the nuclear activity peaceful and avoid the proliferation of nuclear weapons by means of international legal framework on nuclear safety, security, safeguards, and civil liability for nuclear damage. International nuclear legal framework plays a key role in establishing and improving legal instruments on nuclear energy. This study starts with examining the origin, scope, and definition of the term 'international nuclear law', then focuses on the principles and sources of international nuclear law, and finally explores the potentials and complexities in its main domains, these comprising nuclear safety, security, and safeguards in relation to nuclear weapon proliferation and nuclear liability in the form of state responsibility for nuclear damage. Through a historical comparison the research strives to analyze the development of international nuclear law in doctrine and legal practice as well as to reveal the complexities, barriers, and lacunas it has encountered so far and to address these problems.

1. The Origin and Scope of the 'International Nuclear Law' Concept

The formation of international regulations on the use of nuclear energy is a complicated process, and this modern phenomenon is yet to be clearly and precisely defined in international law.

'On the issue of terminology. In the legal literature, the terms 'atomic' law or 'nuclear' law, 'atomic' energy or 'nuclear' energy, or a mixture of both are used indiscriminately. So, which term is correct from a legal point of view?' [56] To respond to this question, it is necessary to remark that in early scientific works devoted to the normalization and regulation of the use of nuclear energy, there were hardly any disputes over the name of this new branch of international law – 'international atomic law'.

'As a matter of fact, both the terms 'atomic law' and 'nuclear law' lack any definition in the binding instruments of international law. Consequently, these terms have to a large extent been the result of legal scholarship that developed since the late 1950s when referring to a certain body of the corresponding legal norms. At the same time, this terminology has only rarely become subject to a detailed academic scrutiny and proper clarification' [36, p. 138]. Apparently, to antecedent legal experts and lawmakers the terms 'international nuclear law' and 'international atomic law' were often interchangeable. They utilized these two terms depending on their relevance to the context and specific usage.

In the early days of legal research on these issues, legal authors aimed to elucidate nuanced distinctions. The recognition of the term 'international nuclear law'

has been endorsed with the scientific fact that 'the energy in question is generated either as a result of a fission reaction of nuclei (nuclear reaction) or from their fusion (thermonuclear reaction)' [76].

Alongside the scientific implication, from the point of view of legal doctrine, 'international nuclear law' is an area of expertise on subjects of international law, particularly states and intergovernmental organizations, aimed at defining their rights, duties, and responsibilities in the field of 'nuclear arms limitation' [4] and 'peaceful use of nuclear energy' [95]. Thus, the term 'nuclear' primarily emphasizes the energy generation and weapons aspects of nuclear technology. It often involves discussions about nuclear weapons, arms control treaties (e.g. Treaty on the Non-Proliferation of Nuclear Weapons (NPT), Comprehensive Nuclear-Test-Ban Treaty (CTBT)), and the regulation of nuclear materials used in military contexts.

The NPT is crucial in establishing legal norms governing nuclear activities internationally. It prevents the spread of nuclear weapons and promotes peaceful nuclear cooperation. According to Western legal scholars like Daniel Joyner, the NPT creates a framework within which nuclear contracts must be negotiated, adherence to its obligations shapes national legislation [41].

The CTBT represents a significant effort to create a legal framework around nuclear testing, affecting the atmosphere for negotiating nuclear contracts. BRICS Cooperation, representing Brazil, Russia, India, China, and South Africa, emphasizes that regional frameworks may align with international norms established by treaties like the CTBT[1].

Of the authors in the field of international nuclear law, Ch. J. Moxley, Jr., shows that the deterrent approach is unlawful as the development of nuclear weapons would be unlawful. 'When the United States goes to apply international law to potential nuclear weapons uses, it distorts the law as it has itself articulated it, overlooks law in such areas as causation, risk analysis, *mens rea*, and *per se* rules, and disregards known risks as to nuclear weapons effects, including radioactive fallout, nuclear winter, electromagnetic pulses, and potential escalation' [20]. A prominent figure in the field of Russian international law, particularly that concerning nuclear law, is G. I. Tunkin. He has contributed significantly to the understanding of international legal frameworks, including those related to nuclear energy and weapons. In Tunkin's view, international nuclear law comprises 'the set of international legal norms that govern the creation, use, and control of nuclear energy and weapons, focusing on issues such as non-proliferation, disarmament, and the peaceful use of nuclear technology' [92].

While both terms 'nuclear law' and 'atomic law' used to intersect significantly and often referred to similar legal principles and standards, at present 'international nuclear law' tends to focus more on issues related to nuclear weapons, non-proliferation, and peaceful use of nuclear technology.

In practice, the choice between the terms may depend on the specific context of the discussion or the focus of the legal frameworks being considered. 'As to legal practice and theory, in the recent years the terms 'nuclear law', 'nuclear weapons', and 'nuclear energy' have begun to dominate. According to Professor R. M. Valeev and a group of his associates, if we proceed from the legal regulation of modern high technologies for energy production and their use, then it would be more logical and fairer to call this industry international nuclear law' [56].

Fundamental principles of international nuclear law were formulated in the Statute of the International Atomic Energy Agency, which entered into force in 1957. The IAEA defines international nuclear law as 'the body of special legal norms created to regulate the conduct of legal or natural persons engaged in activities related to fissionable materials, ionizing radiation and exposure to natural sources of radiation'[2].

The formation of the international organization specializing in monitoring and controlling nuclear activities as well as authorized to directly appeal to the UN Security Council in the event of a threat to peace shows the significance of nuclear industry in the field of international law.

International nuclear law as a contemporary branch of international law plays an essential role in safeguarding humanitarian values, international security, and world peace. In his work *Nuclear Ethics*, J. Nye discusses 'the ethical implications of nuclear proliferation' and emphasizes the importance of treaties like the NPT 'in preventing the spread of nuclear weapons' [70]. Russian author A. V. Kukushkina highlights the significance of international treaties in reinforcing non-proliferation norms in her research on Russian nuclear policy [44].

Another key aspect of international nuclear law is the emphasis on disarmament efforts. L. Scheinman notes that international nuclear law creates a legal framework that is essential for disarmament initiatives, highlighting their role in global security [86]. S. M. Belozertsev argues that 'legal frameworks are fundamental for international cooperation on disarmament and arms reduction' [10].

As regards nuclear safety and security, a Western author David Fischer emphasizes in his work *Nuclear*

[1] Problematika nerasprostraneniya oruzhiya massovogo unichtozheniya v deyatel'nosti BRIKS. Obzor dokumentov BRIKS 2009 – 2023 gg. i rekomendatsii na blizhayshuyu perspektivu [The issues of non-proliferation of weapons of mass destruction in the activities of BRICS. Review of BRICS documents 2009 – 2023 and recommendations for the near future]. Moscow, 2024. 39 p. (In Russ.). Available at: https://pircenter.org/editions/39-2024-problematika-nerasprostranenija-oruzhija-massovogo-unichtozhenija-v-dejatelnosti-briks-obzor-dokumentov-briks-2009-2023-gg-i-rekomendacii-na-blizhajshuju-perspektivu-izdanie-pervoe/.

[2] *IAEA AT A GLANCE: atoms for peace & development*. 2023. Available at: https://www.iaea.org/sites/default/files/23/09/iaea-at-a-glance.pdf.

Governance the necessity of international regulatory frameworks to 'enhance safety, reduce costs and discourage nuclear proliferation' [27, p. 226]. Among Russian legal authors, N. N. Lyakh discusses the risks associated with nuclear energy and the need for stringent international legal standards to ensure safety [54].

Environmental protection is also a cruciality of international nuclear law. C. Raetzke, a representative of the Western school of thought, undertakes an analysis at the intersection of nuclear law and environmental protection [83]. A group of Russian legal researchers explores how international nuclear regulations ought to take into account environmental considerations in the context of nuclear waste management [9].

The last aspect of international nuclear law worth mentioning is conflict resolution. S. Chemmalar notes the role of international law in providing a framework for peacefully resolving disputes related to nuclear issues. 'International law recognizes self-defense and the same is acknowledged by International Court of Justice (ICJ)… Hence it is clear that international law allows only preemptive self-defense and not preventive self-defense' [19]. Parallelly it is noted that 'the regulation of international conflicts and the management of international relations rests upon an intricate network of legal frameworks, diplomatic endeavors, and coercive mechanisms, each playing a pivotal role in the resolution of global disputes. A fundamental component of this system is the body of international law, comprising treaties, conventions, and customary laws that delineate the boundaries for state behavior and conflict resolution. Nevertheless, the efficacy of these mechanisms frequently raises concerns about the efficiency of global politics, the sovereignty of nation-states, and the diverse interests of international actors' [62].

Comparing the Russian and Western perspectives, the present study sheds light on the multifaceted importance of international nuclear law, underlining its contribution to promoting security, safety, and cooperation in the nuclear realm.

At the same time, international nuclear law has its own weaknesses, lacunas, obscures, and challenges that prompt further investigation.

The most important issue is the proliferation of nuclear weapons. The availability of nuclear materials, such as highly enriched uranium and plutonium, can lead to their acquisition by states or non-state actors seeking to develop nuclear weapons. This poses a risk of nuclear proliferation and can increase the threat of nuclear conflict.

That is why G. I. Tunkin emphasized the significance of international cooperation in the realm of disarmament and non-proliferation, asserting that 'the effectiveness of international law in managing nuclear proliferation depends on the collective will of states to comply with the treaties' [93]. M. N. Lysenko argues that 'the Non-Proliferation Treaty (NPT) represents a cornerstone of international legal efforts to prevent the spread of nuclear weapons and promotes peaceful uses of nuclear energy' [57].

For comparison, discussing the challenges faced by international law, M. J. Glennon states that 'practical moral intuitions have been reified through accepted lawmaking processes into authoritative legalist norms, their uncertainty, manipulability, and adaptability to incompatible claims render those impulses deficient as a basis for decision-making on use of force. Such intuitions do not provide a stable decisional framework adequate for resolving the question whether force may be used against Iran's or North Korea's nuclear programmes' [33]. Some Western legal authors wonder whether 'negative security assurances' 'constitute legally binding commitments or mere political declarations', suggesting a spectrum: 'at one end there are states that have made comprehensive commitments; in the middle are those that have made a range of qualified commitments; and at the other end, there are those states who have not made any commitments to refrain from threatening to use nuclear weapons' [38]. R. Thakur remarks that the NPT faces challenges such as 'failure of nuclear disarmament by the five NPT-licit nuclear powers; possible cheating by non-nuclear signatories like North Korea and Iran; India, Israel, and Pakistan remaining outside the NPT; terrorists' interest in acquiring and using nuclear weapons; and the safety, security and proliferation risks of the increased interest in nuclear energy to offset the financial and environmental costs of fossil fuel' [94].

Nuclear materials can be targeted by terrorist groups seeking to construct modern weapons of mass destruction, including nuclear weapons. The theft of or unauthorized access to nuclear technology can lead to catastrophic outcomes if it falls into the wrong hands. This has long been noted in Western literature on contemporary international law. M. O'Connell notes overlaps between the concepts of self-defense and security, stating that 'armed attacks, did occur on September 11th, however, so the United States had the right to take self-defensive measures following that day. It certainly has no right of self-defense to attack a state to eliminate persons who might be planning to possess weapons of mass destruction' [73]. In discussing the complexities of international legal frameworks surrounding terrorism, it is important to note: 'While it remains sensitive, as seen from the fact that negotiations toward a nuclear terrorism convention have been stymied by differences of view on this critical point – differences that have also manifested themselves in the Draft Comprehensive Convention – the majority of provisions regarding 'international terrorism' do not address state terrorism as such' [23].

The issue of terrorism and security risks has also long been the focus of Russian legal authors. As experts continue to analyze the intersection of terrorism and national security, it is noteworthy that: 'Currently, the internal affairs bodies and troops of the Ministry of Internal Affairs of Russia are guided by the provisions of over ten international normative legal acts concluded within the framework of the United Nations, the Council of Europe, and the Shanghai Cooperation Organization, these

defining the main directions and procedures for cooperation between the competent authorities of states in the field of prevention, detection, and suppression of terrorist crimes' [1]. Another Russian legal researcher discusses the challenges of international law in addressing terrorism, stating: 'In particular, the questions of creating an international organizational mechanism for counter-terrorism efforts, of developing a unified global strategy to combat terrorism that would appropriately combine political and legal aspects, as well as of clarifying the subjects involved in terrorist activities, have remained relevant for a long time' [17].

Demonstrating the intersection of proliferation of nuclear weapons, terrorism, security, and international law, the Russian and Western perspectives pay attention to environment protection against radioactive hazards caused by accidental releases, nuclear wastes, and so on. Accidental releases occur in the handling and storage of nuclear materials due to human error, system failures, or natural disasters (e.g., earthquakes, floods), which can result in significant environmental contamination and health risks for human population and living beings in general. From the international law angle, this issue pertains to legal implications of accidental releases, covering preventive measures, regulatory gaps, and the need for international cooperation.

M. A. Ermolina emphasizes that 'It is essential that environmental human rights and international cooperation in the field of environmental protection, which were legally enshrined at the international level in the past century, are considered in the modern period as the legal basis for the concept of sustainable development, and the international legal responsibility of states for the state of the environment – as a necessary condition for its practical implementation' [25]. In light of ongoing challenges in the field of international law, it is important to recognize that: 'The underdevelopment of the legal regulatory framework, the lack of a unified methodological basis for assessing the harm caused, and the imperfection of methods for restoring offenses undermine the effectiveness of international law in protecting public safety' [68]. Western experts are also concerned about environmental contamination. The Transportation Research Board (TRB) warn that 'a mutual aid responder if found to be negligent in some way can be held liable for the assistance lent during a hazardous materials incident. The participants in the agreement should also agree on the communications system and procedures to be employed in notifying one another. Although mutual aid agreements can temporarily expand emergency response capabilities, their limitations should be known'[1]. Highlighting the limitations of current frameworks, it is asserted that: 'Although international environmental law provides some tools for addressing accidental releases, there is an urgent need for more cohesive and effective mechanisms for response and prevention' [39]. A decade before, M. Robinson emphasized the role of international relations with 'considerations of major nuclear powers who comprise the core of the membership' [80].

Concerns about environmental hazards such as habitat destruction, air and water pollution, and other ecological impacts resulting from the various steps of nuclear manufacture, including extraction, enrichment, transporting, and application, have detrimental effects on the international environmental law.

Nuclear waste management is the other dimension of environment protection in the sphere of international law. The generation of nuclear waste poses a long-term management challenge. High-level radioactive waste remains hazardous for thousands of years, and inadequate disposal methods can lead to contamination of land and water resources.

U. V. Lebedeva argues for the importance of international cooperation in nuclear waste management, stating: 'Effective management of nuclear waste requires not only national legislation but also a robust international legal framework that facilitates cooperation and ensures safety' [59]. Russia's National Operator for Radioactive Waste Management 'NO RAO' discusses the threats posed by improper nuclear waste management, asserting that the lack of a unified global strategy for nuclear waste management undermines environmental protection, necessitating stronger international legal commitments[2].

A number of authors emphasize the need for effective regulatory frameworks, stating: 'Nuclear forensics is iterative, following the requirements of law enforcement, and accomplishes only the agreed-upon analytical plan to provide the necessary data aiming to answer a defined question. All results are produced by using methods verified and approved within a legally recognized quality framework' [74]. M. Johnson notes that 'the challenges of managing nuclear waste transcend national borders, highlighting the necessity of international treaties and collaborations to ensure safety and responsibility' [42]. Hence, a number of legal researchers remark the role of the IAEA in nuclear waste management, stemming from 'a joint effort of the IAEA's Nuclear Energy and Nuclear Safety departments done in a wide consultation with the international community via IAEA Member State representatives' [24].

As nuclear technology is dual-use technology, which means it has both civilian and military applications, there is always a possibility of its being diverted for military purposes, i.e., its being used for nuclear weapons production. Thus, there is a need for a preventive and prohibitive

[1] Transportation of Hazardous Materials: Planning and Accident Analysis. *Transportation Research Record 977.* Transportation Research Board (TRB). 1984. 43 p. Available at: https://onlinepubs.trb.org/Onlinepubs/trr/1984/977/977.pdf

[2] *Obzor zarubezhnykh praktik obrashcheniya s OYaT i RAO* [Overview of foreign practices in the management of spent nuclear fuel and radioactive waste]. Federal State Unitary Enterprise 'National Operator for Radioactive Waste Management'. Moscow, 2022. 140 p. Available at: norao.ru/upload/Свод обзора практик ОЯТ и РАО_2022.pdf.

framework in international nuclear law to control and monitor nuclear activities. This is quite evident from both Western and Russian legal literature. I. Khripunov warns that 'without an effective, enforceable legal framework and relevant measures at the state level, international efforts to prevent nuclear terrorism and ensure the security of nuclear materials and facilities will be well-intentioned, but largely ineffective. The existing legal framework in its entirety has provisions whereby state parties should identify actions threatening nuclear security and establish them as criminal offenses in national law, with appropriate criminal or civil penalties commensurate with the serious nature of these offenses' [47]. G. Berdennikov discusses the role of international law in curbing nuclear proliferation, stating that non-proliferation regimes 'can effectively counter proliferation risks on a non-discriminatory basis and without prejudice to international cooperation in the peaceful uses of atomic energy' [11].

As far as Western legal literature concerns, P. Witherspoon and G. Bodvarsson emphasize the importance of transparency and cooperation 'including active public involvement:

• Phase 1: Development of a site-selection procedure and corresponding criteria.

• Phase 2: Political/legal obligatory establishment of a site-selection procedure.

• Phase 3: Implementation of the site-selection procedure' [98].

W. Wan notes that 'nuclear risk reduction must be recast in a more systematic manner… identifying four risk of use scenarios: doctrinal, escalatory, unauthorized, and accidental… to reduce the risk of each, establishing general objectives and offering illustrative measures' [97]. E. Moniz argues for a collective approach, asserting that 'countries must put forward ambitious climate commitments. Safe, secure, and peaceful nuclear technology will be an important part of addressing this challenge. The Agency's financial resources, political support, and legal authorities must be commensurate with the task at hand' [63].

Regulatory and compliance challenges can be examined from both Russian and Western viewpoints regarding international nuclear law. The complex landscape of international nuclear law and varying national regulations can hinder effective oversight and compliance. Weak enforcement mechanisms may allow illicit trade or inadequate safety practices. While nuclear material and technology can offer significant benefits, especially in energy production and medical applications, they also pose serious risks that require robust international cooperation, stringent regulations, and effective safety measures to mitigate. In international legal research, the advent of nuclear industry is considered in connection with the emergence of interstate relations on the use of atomic energy, a new dual-use source of energy, this leading to the possible application for military purposes and for peaceful uses.

The contingent risks in the use of nuclear technology are associated with radioactive contamination, resulting from violations of standards applicable to shipping, enrichment process, construction of nuclear power plants and other facilities. Such hazards have raised the urgent question of specific and clear-cut legal regulation of relations on the use of nuclear energy.

International nuclear law as a new branch of contemporary international law makes efforts to address such problems and resolve them. Essentially, at the end of the 20th century, there emerged a set of international legal frameworks and protocols intended to regulate relations between states in connection with nuclear energy, which embodied new prospects for the development of mankind.

The main goal of legal regulation of the states' relations in the domestic sphere as well as at the international level was the peaceful development of nuclear energy, ensuring the safety of nuclear materials, installations and facilities, radiation protection and nuclear safety for citizens, environmental protection, etc.

E. B. Mikhailenko emphasizes that 'one of the primary objectives of international nuclear law is to promote the peaceful use of nuclear energy while ensuring the highest standards of safety and security to protect human health and the environment' [65]. A. Aramyan also states that 'Security solutions in the peaceful use of nuclear energy are possible only through the joint efforts of all members of the international community. The issue of nuclear safety arises during any nuclear activity that in any way uses nuclear materials, and strict adherence to all of the rules under international standards and treaties is a basic condition for safe use of nuclear material for peaceful purposes' [2].

Russian and Western authors see the goal of international nuclear law in promoting the peaceful development of nuclear energy while ensuring safety and security.

'Since its beginnings, international nuclear law has slowly diversified, first to support and promote the use of nuclear energy, and second, to prevent and mitigate the risks of nuclear power in order to counterbalance increasingly sceptical attitudes'[1]. The primary objective of international nuclear law is to ensure that 'the global nuclear safety regime provides a framework for the peaceful uses of nuclear energy and ionizing radiation. Nuclear safety measures ensure that activities are conducted to achieve the highest standards of safety'[2]. As is highlighted by B. G. Gordon, 'the international legal regime governing nuclear energy fundamentally seeks to achieve a balance between advancing peaceful nuclear

[1] Nuclear Law Bulletin. No. 108/109. Volume 2022/1&2. Nuclear Energy Agency (NEA). 151 p. Available at: https://www.oecd.org/content/dam/oecd/en/publications/reports/2023/06/nuclear-law-bulletin_46cd2ea2/7454f143-en.pdf

[2] International Legal Framework for Nuclear Safety. IAEA. January 2022. 4 p. Available at: https://www.iaea.org/sites/default/files/22/04/international-legal-framework-for-nuclear-safety.pdf.

technology and ensuring stringent safety and security protocols' [30].

All these points of view reflect a shared understanding among scholars that one of the fundamental goals of international nuclear law is to promote the peaceful development of nuclear energy while ensuring that the associated safety and security measures are enhanced.

As the 21st century unfolded upon international law, the articulation of international nuclear law as an autonomous branch of legal science triggered debates among legal academics. Different schools of thought have developed their own ideas concerning the legal nature and status of international nuclear law within the broader bodies of public and private international law.

When raising the question of singling out atomic legislation, A. I. Ioyrysh, one of the first to study the legal aspects of nuclear energy uses, noted that 'relations associated with the use of atomic energy are of comprehensive character. Legal norms governing these relations are divided into internal (national) law and norms included in international (public and private) law' [40, p. 31]. In his view, nuclear law has emerged as an independent specific area of legal regulation due to the relationships formed concerning the use of atomic energy.

While this view defends the formation of Soviet atomic law, legal scholars put forward a point of view about the formation of a new branch in international law – international atomic law, the subject of regulation of which is the relations that develop through international cooperation in the field of nuclear disarmament and the practical use of atomic energy for peaceful purposes.

Hence Russian and Western legal schools of thought assert that 'international atomic law as an independent branch of international law is in its infancy' [56]. A. Chekov notes that 'the system of arms control treaties, whose foundation was laid by Gorbachev and Reagan, has been practically dismantled, giving way to escalation. The Ukraine crisis drew attention away from the consequences of the INF Treaty's termination, but they are now resurfacing and will be of primary importance not only for Russia and the U.S., but also for China' [21].

A. Malyshev and B. Gordon explore the intricacies of nuclear legislation, emphasizing that 'international nuclear law has evolved into a distinct legal domain reflecting specific norms and principles dedicated to nuclear safety and non-proliferation' [66]. They identify and analyze various international treaties and agreements that contribute to the distinctive principles of nuclear law, reinforcing the idea that this area merits distinct legal recognition within international law.

In Western overview, A. Schmid outlines changes of meaning reflected in various typologies of terrorism, including 'nuclear terrorism', posing the question of 'what would be considered 'war crimes' under international humanitarian law if they were committed during conventional armed conflicts or during guerrilla warfare'. He discusses the unique challenges deriving from various ideas of 'what terrorism should be meant to mean in international legal terms' [87].

K. Fyhr provides an analysis of international legal regulations concerning nuclear weapons and energy, positing that 'generally, nuclear law has its objectives and principles, and it can be regarded as falling somewhere between public and private law with a major degree of interaction between national and international levels'. He argues that 'the notion of the distinctiveness of nuclear law from other sectors of law has been increasingly abandoned' [28].

R. M. Grossi examines the emerging field of international nuclear law and its legal distinctions from general international law, particularly regarding the implications of treaties such as the NPT and the Comprehensive Nuclear-Test-Ban Treaty (CTBT). The author argues that 'a basic feature of nuclear law is its focus on weighing the benefits of nuclear technology while minimizing risks. Its objective is to furnish a legal framework for conducting activities related to nuclear energy and ionizing radiation in a manner that adequately protects individuals, property and the environment in order that the public may obtain the benefits of this technology. This is done through complementary regimes dealing with safety, security, safeguards and liability' [32, p. 4.].

The need for international legal regulations on nuclear industry arose when the manufacture, development, and application of nuclear technology started to pose problems for global security, peace, and also environment. In doing so, the establishment of international framework and the adoption of international agreements and protocols for regulating the activities of states in the nuclear sphere become legally vital.

In his work on modern challenges facing international nuclear law, legal scholar V. P. Parkhitko put forward a compelling argument for recognizing this field as a distinct discipline. He noted that even in the realm of 'the peaceful use of nuclear energy' [76], beyond military applications, there are numerous complex issues that require substantial effort and expertise from international lawyers specializing in this domain.

Parkhitko also ventured into the realm of predictions, envisioning the potential emergence of a new type of interstate agreement, which he likened to a nuclear-focused 'Lend-Lease' [76] arrangement, reminiscent of the collaborative models employed during World War II. As it turned out, Parkhitko's foresight proved to be prescient, as by the start of the 21st century, a significant number of multilateral and bilateral agreements had been adopted, significantly impacting the activities of states and international organizations in the management of nuclear energy. These agreements, to a considerable extent, constitute a semi-autonomous system of international legal norms governing this specialized domain.

Furthermore, international nuclear law, as a subdivision of public international law, is inherently intertwined with the concept of security. However, as was noted by legal scholar S. A. Malinin, the doctrinal underpinnings of 'international security' [67] remain neither

well-defined nor legally clear, even within the framework of the United Nations Charter. Malinin regarded 'humanitarian area of cooperation, …, as a factor in strengthening international security' [67, p. 41]. For him, 'the human dimension is an obligatory component of a comprehensive approach to international security' [67, p. 41].

The complex and evolving nature of international nuclear law, along with the ambiguities surrounding the core concept of international security, underscores the ongoing need for rigorous scholarly investigation and the development of a robust and coherent legal framework to govern the use and regulation of nuclear energy in the global arena.

By the present moment, international nuclear law has emerged as a distinct domain in 'the system of international law' [58], with the purpose of establishing a set of commonly agreed legal norms aimed at governing the relations between states and international organizations in the possession, development, and utilization of nuclear technology and materials.

This specialized branch of international law aims to provide a cohesive system of rules that regulate interstate relations in the areas of nuclear disarmament, as well as the peaceful application of nuclear energy. These domains are intrinsically linked to various other spheres of international law, including environmental protection, international security, the use of outer space, and the governance of the world's seas and oceans.

The complexity of international nuclear law stems from its multifaceted nature, as it encompasses the subjects, resources, and norms that are inherent in numerous other branches of international law. As argued by legal scholar M. A. Likhachev, the international relations underlying this field are inherently complicated, necessitating a comprehensive and well-defined regulatory framework. Likhachev notes that: 'The current state of international relations undoubtedly indicates the trends, these gaining momentum, consisting in the expansion of the circle of subjects of international law as a result of not only international law regulation covering new areas of international cooperation and interstate relations by but also an increasingly confident spread of non-regulative influence of international law standards' [61].

Legal expert V. P. Parkhitko characterized international nuclear law as a set of rules that facilitate international cooperation among states and international organizations in two key areas: the reduction of the threat or use of nuclear weapons and the regulation of collaborative efforts in the peaceful utilization of nuclear energy [76].

In essence, international nuclear law represents a distinct and evolving system of legal norms within the contemporary international legal order, designed to govern the relations between states and international organizations with respect to the military and civil applications of nuclear technology, in accordance with the generally recognized principles of international law.

The continued development and refinement of this specialized branch of international law remain an area of ongoing investigation and scholarly discourse, as the international community seeks to navigate the complex and multifaceted challenges posed by the use and regulation of nuclear energy.

2. The Principles and Sources of International Nuclear Law

The scholarly debate surrounding the doctrinal status of international nuclear law is multifaceted. One school of thought argues that it should be considered a complex legal institution, characterized by the diverse array of norms and the multiplicity of sources from which they are derived, ranging from international treaties and customary law to the resolutions of international organizations[1]. This view emphasizes the sui generis and multidisciplinary nature of the legal frameworks governing nuclear activities, which intersect with various fields of law, including energy, environment, maritime law, and the law of the sea.

In contrast, another group of scholars contends that international nuclear law should be treated as a stand-alone field of law, parallel to other fundamental branches [18]. Proponents of this position describe international nuclear law as a distinct system of principles and norms that govern a wide spectrum of relations between states and other subjects of international law, from the introduction and implementation of nuclear technology to the delineation of rights, protection, and guarantees, as well as dispute settlement procedures [18]. As they argue, the primary objective of this specialized legal domain is to 'accelerate and enlarge the contribution of atomic energy to peace, health and prosperity throughout the world' [18].

Yet, a third perspective approaches international nuclear law as a subfield of international environmental law. Adherents to this view consider international nuclear law as 'an indispensable tool for achieving the global sustainable development agenda. It has a key role to play in decarbonizing the energy sector but also supports the attainment of all the Sustainable Development Goals (SDGs) – including the elimination of poverty, zero hunger, clean water, affordable energy, economic growth, and industry innovation. Innovation as well as improved government policy and public perception will enable nuclear energy to overcome traditional barriers to growth and expand into new markets. Fully integrating uranium-as-a-service into the UNFC[2] and UNRMS[3] framework highlights the important role of

[1] IAEA. First International Conference on Nuclear Law: The Global Debate (ICNL 2022). Vienna, Austria, 2022.
[2] United Nations Framework Classification for Resources.
[3] United Nations Resource Management System.

nuclear energy as a resource contributing to sustainable development'[1] in virtue of the facts that the demand for nuclear technology to be used in solving climate crisis as a tool for the attainment of the global sustainable development goals has grown and 'the choice to develop nuclear energy rests with sovereign countries, together with the responsibility to use it safely and securely'[2].

Underlying these divergent viewpoints is a broader debate concerning the position of international nuclear law within the expansive realm of public international law. Scholars continue to grapple with the question of where this specialized legal domain is situated within the overall structure of international law: 'Which is the position of nuclear law in the wide realm of law?' [49]

The nuclear industry occupies a unique space where international law and domestic legislation intersect. Nuclear law operates at both the global and national levels, with international treaties and conventions being implemented through domestic legal frameworks.

As W. Boulanger answers the question, nuclear law 'is, and has been right from its beginning, national law, and international law' [14]. It encompasses various domains, including public law aspects such as 'constitutional, administrative, criminal, and public health'[3] considerations, as well as private law elements that regulate liability for nuclear damages. Moreover, nuclear law can transcend the traditional boundaries between public and private spheres, 'by reserving certain kinds of source or other radioactive materials to public property' [49]. At the international level, nuclear law also manifests itself in the creation of intergovernmental organizations and the establishment of authorities to oversee the peaceful use of nuclear materials and installations. Additionally, international nuclear law regulates the civil liability for nuclear accidents across different conventions. This multifaceted nature of nuclear law, spanning numerous fields, has led to it being recognized as a distinct legal domain worthy of specialized consideration, even if it remains a relatively niche area within the broader realm of jurisprudence.

The international nuclear legal framework is continuously evolving to address emerging issues, such as the increasing role of private actors, technological advancements, and new security threats. This dynamic nature requires ongoing coordination and adaptation within the broader system of international law. At the same time, national nuclear laws and regulations ought to be harmonized with the overarching international legal framework.

2.1. Nuclear Contract Law and International Legal Framework

The connection between nuclear contract law and the international legal framework is well-documented in both Russian and Western legal literature. This relationship involves a comprehensive interplay of treaties, national regulations, liability frameworks, and regulatory oversight, all aimed at promoting the safe and peaceful use of nuclear energy.

International legal systems establish procedures for settling disputes that emerge from nuclear agreements typically utilizing arbitration methods detailed in treaties or domestic laws. Russian authors R. Gottemoeller and D. Zhukov argue that there are 'three key areas for advancing risk reduction efforts: building confidence and predictability through dialogue; increasing clarity, communication, and understanding; and effective crisis prevention and crisis management tools'[35].

The interplay of nuclear law and international agreements is becoming increasingly important as there grow concerns regarding climate change and energy security. B. A. Alexandrovich discusses how this evolving dialogue impacts nuclear legislation in both Russia and the West [3].

'The largest volume of legal work in the civil nuclear industry relates to private law relationships, including negotiating and managing contracts' [71, p. 496]. Nuclear contract law is a specialized subfield within the broader domain of nuclear law, dealing specifically with the commercial and business aspects of the nuclear sector. It encompasses all the traditional areas of nuclear law, including nuclear safety, regulation and licensing, security and transport, safeguards and nonproliferation, environmental and radiological protection, and nuclear liability and compensation.

However, nuclear contracts differ from 'conventional' [71] contracts for other types of power generation or large infrastructure projects in several ways, likely stemming from the heightened safety, security, and environmental concerns associated with nuclear technology, as well as the intricate international frameworks governing nuclear activities.

Nuclear contract law is inextricably linked to the international legal framework governing nuclear activities, particularly the principles and requirements established by the 1960 Paris Convention on Third Party Liability in the Field of Nuclear Energy. This convention is a key component of the broader system of global governance mechanisms that involve cooperation between states, international organizations, and other stakeholders to address the unique challenges posed by nuclear technology. By adopting nuclear contracts in accordance with

[1] Application of the United Nations Framework Classification for Resources and the United Nations Resource Management System: The Role of Nuclear Energy in Sustainable Development – Entry Pathways. 2023. Available at: https://unece.org/fileadmin/DAM/energy/se/pdfs/UNFC/UNFC_The_Role_of_Nuclear_Energy_in_Sustainable_Development_Public_Comment/The_Role_of_Nuclear_Energy_in_Sustainable_Development.pdf.

[2] Ibid.

[3] Ibid.

the Paris Convention, the legal system can ensure harmony and facilitate the effective implementation of the international nuclear liability regime. 'A nuclear operator should not be held liable for damage caused by a nuclear incident to nuclear substances in course of carriage belonging to other operators, unless he has assumed third party liability pursuant to a contract in writing or of which he has taken charge' [81].

The 1960 Paris Convention on Third Party Liability aims to provide 'adequate and equitable compensation for persons who suffer damage caused by nuclear incidents whilst taking the necessary steps to ensure that the development of the production and uses of nuclear energy for peaceful purposes is not thereby hindered'[1]. As one of the first international conventions to address liability issues in the nuclear field, it has established the nuclear liability regime for the majority of Western European countries under the auspices of the Organization for Economic Co-operation and Development (OECD).

In addition, national laws related to nuclear energy often reflect commitments made under international treaties. A. Yu. Kurashvili points out 'how Russian nuclear law incorporates obligations from international treaties, thus demonstrating the reciprocal influence between international and national legal frameworks' [46]. In discussing the importance of efficient contract management, it is essential to recognize that: 'While good contract administration practices in linear contracts can lead to collaboration, they may not be sufficient. To this end, standardization will be necessary to ensure predictability in tender documents and contract conditions, acceptability of the tender process and contract conditions by the industry, red tape reduction by developing the appropriate contract form, and reduction of tendering cost by using agile contract management processes' [82].

Oversighting the role of IAEA is critical. V. I. Osanov and L. P. Punko highlight that within the IAEA framework, 'Russia proposed implementing, with the participation of the IAEA, an international project that would facilitate the implementation of a long-term supply of energy to humanity in a safe and environmentally acceptable manner based on nuclear technologies and the prevention of the use of these technologies for the purpose of creating nuclear weapons' [72].

The global legal landscape surrounding the nuclear industry continues to evolve, with individual nations adapting their domestic frameworks to align with international conventions. 'In 2005, Russia ratified the Vienna Convention on Civil Liability for Nuclear Damage' [60]. The ratification of this convention establishes a legal framework for the compensation for nuclear damage in the event that it occurs in the territory of the Russian Federation. The convention imposes strict liability on the nuclear operator for any nuclear damage caused, regardless of fault. This means 'the inability to provide compensation for such damages from the federal budget' [42]. The operator is liable even if an accident occurs without negligence. The convention also assigns liability exclusively to the nuclear operator, establishes compensation amounts as well as determines jurisdiction for nuclear incident inside the state territory and nuclear damages suffered in other countries. However, the convention does not grant any special privileges or exemptions to ratifying countries. The key benefits are the standardized legal framework for nuclear liability and compensation, which helps ensure victims can access prompt and adequate compensation. Russia's ratification simply binds it to these international legal obligations, rather than grants any unique privileges. The convention aims to create a harmonized global system, and not to provide advantages to individual states.

International legal frameworks provide for the resolution of disputes arising from nuclear contracts, often through arbitration mechanisms outlined in treaties or national laws. R. Gottemoeller and D. Zhukov note 'the flexibility with which both the United States and Russia have expanded the centers' role to facilitate exchanges with new partners'. The scholars also remark: 'Other states could adopt the model in order to implement their existing agreements and pave the way toward new diplomatic arrangements, whether focused on mitigating strategic risks or preventing regional crises' [35].

Additionally, the Russian Federation has taken into account the relevant provisions of other international agreements, such as the Brussels Convention on the Liability of Operators of Nuclear Ships of 1962 and the Brussels Convention relating to Civil Liability in the Field of Maritime Carriage of Nuclear Materials of 1971. Russian nuclear legislation aligns closely with these conventions to initiate 'the development and adoption of amendments to national legislation and international conventions regarding a lower minimum limit of operator liability for nuclear damage' [22].

Beyond the international conventions, national legislations and civil laws have also played a significant role in shaping the legal landscape for the nuclear industry. Examples include 'the US Price-Anderson Act (part of the US Atomic Energy Act of 1954), the Swiss Act on Nuclear Third-Party Liability of 18 March 1983, the Japanese Law on Compensation for Nuclear Damage (No. 147, 17 June 1961, as amended), and the Canadian Nuclear Liability Act of 1970' [42]. This collective experience has contributed to the development of a legally powerful and highly interconnected system of international nuclear law.

As can be seen, a legally powerful, highly ramified conventional system of international nuclear law has been created across the world. 'There are several hundred bilateral intergovernmental agreements in force. Overall, this system provides an adequate response to the main problems and trends in the development of global nuclear energy' [56]. Addressing these evolving needs and eliminating potential gaps in the current treaty system will be crucial for ensuring the continued safe and responsible use of nuclear technology.

[1] Convention on Third Party Liability in the Field of Nuclear Energy, 1960. No. 13706. United Nations, *Treaty Series*, vol. 956, p. 251.

'Initially, each nation had to decide whether public or private institutions would develop nonmilitary atomic energy. The resolution of this question determined the outcome of the two principal issues of atomic energy law – ownership and liability. Permissible limits to private ownership of nuclear materials, facilities, and technology had to be defined. Property law was affected because any individual rights in nuclear property were now subject to modification by special nuclear legislation' [50].

The emergence of a distinct legal framework for the peaceful applications of nuclear energy has attracted the attention of legal academia since the 1960s. During this period, some scholars have argued that nuclear law should be recognized as a new and distinctive branch of law, given the considerable economic, strategic, and political importance of the nuclear industry, as well as the unique principles and mechanisms established by the international conventions in this field.

Speaking of the principles, pioneering Russian and Western legal experts in international nuclear law emphasize their connections to the fundamental principles of contemporary international law.

V. P. Parkhitko analyzes how international nuclear law is intrinsically linked to principles such as state sovereignty, non-interference, and the right to peaceful use of resources. He argues that 'the legal frameworks governing nuclear energy must align with the greater objectives of contemporary international law, including nonproliferation and environmental sustainability' [77].

Z. V. Khanalieva addresses the challenges faced by international law in regulating nuclear energy and highlights the necessity of establishing a legal regime that would reflect the fundamental principles of international cooperation and mutual trust; at the same time, she underscores features of the regulatory and national regulation of the nuclear industry, namely that adopted in the Russian Federation [45].

On Western narrative side, K. Astner and M. Kutt approach the problem 'by differentiating between arguments based on the two main colliding narratives: humanitarian disarmament vs. security-based approaches' [6].

M. N. Schmitt examines the legal obligations of states under international humanitarian law in the context of nuclear weapons, asserting that these obligations require adherence to the principles of distinction and discrimination. His work reveals the inherent tensions between state security interests and international humanitarian principles, advocating for a cohesive approach that integrates nuclear law with humanitarian concerns [89].

D. Koplow provides an example of seismic monitoring of possible clandestine nuclear weapon tests, noting that 'the United States jealously maintains its own Atomic Energy Detection System'. He predicts that 'nuclear command and control messages, the most important national security functions imaginable, may be carried on future commercial networks' [48].

The scholars collectively underscore that international nuclear law is deeply rooted in the fundamental principles of contemporary international law, including state sovereignty, humanitarian law, and cooperative security. Each author contributes to a greater understanding of how these principles shape the legal frameworks governing nuclear energy and weapons, reflecting the ongoing evolution of international legal norms.

The relationship between nuclear contract law and the international legal framework is essential for ensuring that nuclear energy is used safely and responsibly. Both Russian and Western legal scholars provide valuable insights into how treaties influence national laws, how liability frameworks are aligned, and into the regulatory mechanisms that ensure oversight. Understanding these connections fosters international cooperation and helps mitigate the risks associated with nuclear energy use.

Nonetheless, international nuclear law has its own specific principles emerged from the unique nature of nuclear energy and technology and endorsed by contemporary international law. The key principles of nuclear law are as follows: the principle of safety that ensures nuclear safety on Earth; the principle of security that codifies rules for the nuclear peace and the development of non-proliferation of nuclear weapons; the principle of responsibility and compensation that addresses the liability for damage caused through the use of nuclear energy; the principle of sustainable development that ensures environmentally friendly use of nuclear energy. Let us take a closer look at each of the principles.

2.2. The Key Principles

- *Principle of safety that ensures nuclear safety on Earth*

O. G. Paramuzova emphasizes the importance of establishing a robust legal framework for nuclear safety that aligns with international standards. She argues that the principle of safety is not only a technical necessity but also a legal obligation that states must uphold to protect both human life and the environment [75].

M. N. Lysenko discusses the role of international treaties, such as the Convention on Nuclear Safety, in establishing safety standards for nuclear facilities. He underscores that nuclear safety is a fundamental principle that protects not only state interests but also the global community [55].

Western legal literature also demonstrates the significance of this principle. R. Ptasekaite analyzes the regulatory frameworks established by international organizations, highlighting the significance of the principle of safety in ensuring the secure operation of nuclear facilities. He argues that 'effective regulation is crucial for preventing accidents and safeguarding public health and safety' [100].

M. Schmitt advocates safety and security standards for humanitarian interests: 'Legitimate states are equally obligated to ensure the well-being of their citizenry, for the provision of 'public goods', such as physical safety, underpins the social contract between a state

and its people. In light of these often-contradictory interests, states must make policy choices, in the form of treaties or practice, as to their most efficient accommodation' [89].

R. Karim and E. Lee explore the evolving nature of nuclear safety laws and the challenges faced in their implementation: 'To craft a comprehensive legal and regulatory framework, it is essential to revisit the fundamental theories and objectives of nuclear energy law' [51].

- *Principle of security that codifies rules for the nuclear peace and the development of non-proliferation of nuclear weapons*

E. Karnaukhova argues that 'the principle of security is fundamental to the nuclear non-proliferation framework' [52], highlighting how international treaties like the NPT create a legal foundation for the peaceful use of nuclear energy while preventing the spread of nuclear weapons. She emphasizes that 'security guarantees are essential for fostering trust among states' [52].

D. Stepanovich analyzes how international legal instruments codify the security principle related to nuclear weapons non-proliferation. He discusses the balance between the right to security and the obligations to disarmament under the NPT, asserting that such frameworks are crucial for maintaining «peace throughout the world' [84].

The House of Lords of the UK Parliament examine the role of international treaties in reinforcing the security principle associated with nuclear non-proliferation. They argue that 'effective treaty mechanisms are essential for establishing a secure environment, deterring nuclear proliferation, and facilitating disarmament discussions'[1].

J. L. Black-Branch and D. Fleck discuss the interrelation between international security and non-proliferation legal frameworks, emphasizing the necessity of legal instruments like the NPT to maintain nuclear peace. They highlight that 'the legal frameworks both for the peaceful use of nuclear energy as well as for the prohibition of its use for military purposes are far from comprehensive or universally accepted' [16].

Although A. Graham primarily focuses on the threat of nuclear terrorism, he also emphasizes the importance of the non-proliferation regime in enhancing global security. He posits that 'cooperation among nations through legal agreements is crucial for preventing the spread of nuclear weapons and ensuring a safer world' [34].

This illustrates the vital role of the principle of security in codifying rules for nuclear peace and promoting the non-proliferation of nuclear weapons. Both Russian and Western authors emphasize the need for established legal frameworks and international cooperation to maintain peace and prevent the potential threats associated with nuclear proliferation.

- *Principle of responsibility and compensation that addresses the liability for damage caused through the use of nuclear energy*

This principle is enshrined in the Safety Standards of the International Atomic Energy Agency. The principle of state responsibility is a fundamental tenet of international nuclear law. It holds 'states accountable for breaches of their international obligations related to nuclear activities'[2]. This, accordingly, includes responsibilities regarding safety, security, and environmental protection. Of Russian legal researchers, Biryukov admits that 'this responsibility extends to both state-operated nuclear facilities and private entities under the state's jurisdiction' [8]. Referring to the Caribbean (Cuban) Crisis of 1961 and the concept of mutually assured destruction (MAD), A.V. Chaevich highlights the need for a robust international legal framework to govern state responsibility for 'limiting the nuclear arms race and strengthening the role of society in making political decisions' [96].

G. Handl provides an example of the Chernobyl accident remarking that 'states can be held responsible for nuclear incidents originating from private entities operating within their territory if the state failed to exercise adequate control or oversight. This has been a significant development in establishing the scope of state responsibility in international nuclear law' [37]. Another Western legal scholar notes that 'the principle of state responsibility requires states to take due diligence in preventing transboundary harm from their nuclear activities, even if the harm is not the result of an unlawful act. This places an onus on states to ensure robust safety and security measures at nuclear facilities under their jurisdiction or control' [15].

The 1963 Vienna Convention on Civil Liability for Nuclear Damage established the principle of strict liability for nuclear operators. This means they are 'liable for damages regardless of fault, providing victims with faster compensation'[3]. As M. Ampovska asserts: 'The development of principles of state liability and the duty to provide prompt notification and assistance have been critical in establishing clear obligations for states engaged in nuclear activities' [5].

The 1997 Convention on Supplementary Compensation for Nuclear Damage aims 'to ensure adequate compensation is available to victims by establishing an international fund to supplement national compensation schemes'[4]. M. Ampovska believes that this international regime helps deal with challenges of limited funds and jurisdictional barriers that can hinder timely and sufficient compensation 'by the creation of the nuclear insurance pools worldwide as a mechanism that has the leading role in insuring nuclear third-party liability. But,

[1] *Rising nuclear risk, disarmament and the Nuclear Non-Proliferation Treaty*. Published by the authority of the House of Lords. 2019. 121 p.
[2] Fundamental Safety Principles. Safety Fundamentals No. SF-1. IAEA, 2006.
[3] Vienna Convention on Civil Liability for Nuclear Damage. IAEA, 1963.
[4] Convention on Supplementary Compensation for Nuclear Damage. IAEA, 1997.

the revising process in the international third-party liability regime has brought new challenges for nuclear insurance pools for many reasons. A higher liability limits are being set and although they can generally be insured, other difficulties are still unsolved' [5].

The 1988 Joint Protocol Relating to the Application of the Vienna Convention and the Paris Convention requires 'contracting parties to treat damages as if the two conventions were a single instrument, facilitating compensation across borders'[1].

The Paris Convention on Third Party Liability in the Field of Nuclear Energy (1960) and the Vienna Convention on Civil Liability for Nuclear Damage (1963) are the two main international instruments establishing 'the nuclear operator's strict liability for nuclear incidents'[2]. When examining the complexities of civil liability in the context of nuclear damage, it is important to consider the following points: 'Moving on to the issue of civil liability for nuclear damage, it is worth noting that these include the 'concentration' of liability on the operator of the nuclear installation, liability in the absence of fault on the part of the injurer, limitation of liability in terms of amount and time, as well as the jurisdiction of the court that hears disputes over compensation for damage caused by a nuclear disaster. The Vienna Convention places liability for nuclear damage on the operator of the nuclear installation. It introduces strict liability for the operator of the nuclear installation as the owner of a source of increased danger' [53].

The Protocol to Amend the 1963 Vienna Convention on Civil Liability for Nuclear Damage (1997) increased the minimum liability for nuclear operators and expanded the definition of nuclear damage to include environmental restoration[3].

- *Principle of sustainable development that ensures environmentally friendly use of nuclear energy*

The principle of sustainable development is an important consideration in the use of nuclear energy under international nuclear law. It can be found in both Russian and Western legal literature.

'The principle of sustainable development implies that countries using nuclear energy must implement the best available technologies and practices to prevent accidents and protect the environment from radioactive contamination' [44]. In this regard, some legal researchers suggest that 'only a combination of green and nuclear energy can ensure both the sustainable development of the economy and energy for a long time in the future, as well as a truly effective solution to the environmental problems facing civilization' [85].

Emphasizing the need to use nuclear power in an environmentally responsible manner, Westerns legal authors explain how the principle of sustainable development has become an important guiding principle in the regulation of nuclear energy under international law. 'The principle of sustainable development requires that the use of nuclear energy be environmentally responsible and protective of natural resources for present and future generations. This includes mitigating radioactive waste, ensuring nuclear safety, and preventing transboundary environmental damage' [69]. In the realm of international nuclear law, the imperative for sustainable development in the utilization of nuclear power is increasingly emphasized. It is noted that: 'The sustainable development of nuclear power has been a key concern in international nuclear law. Treaties like the Convention on Nuclear Safety and the Joint Convention on the Safety of Spent Fuel Management have sought to enshrine environmental protection and responsible resource use as integral to the peaceful use of nuclear energy' [88]. As the discourse on nuclear energy continues to evolve, the significance of sustainable development emerges as a critical focal point. It is observed that: 'The principle of sustainable development requires states to strike a balance between the economic and energy benefits of nuclear power, and the environmental risks and long-term stewardship obligations. This has led to increased emphasis on nuclear safety, waste management, and environmental impact assessment in international nuclear law and policy' [49].

Russian legal authors also underscore the necessity of robust legal frameworks and international cooperation to ensure the safe use of nuclear technology and to protect human health and the environment from potential nuclear hazards.

Some Russian authors draw 'attention of authorities and influential categories of the population to the need of solving the main problems of sustainable development of Russia. It is noted that one of the main factors in achieving the Sustainable Development Goals is the provision of energy. Only nuclear energy with fast neutron reactors and a closed nuclear fuel cycle, which are expected to become more widespread in the world in the near future, can be such a source' [31]. N. A. Besetskaya also notes that 'within the framework of Eurasian integration… the formation of unified norms for the peaceful use of nuclear energy… has been suspended at the stage of developing draft international agreements. Consequently, it is necessary to review existing approaches and move from the implementation of a 'coordinated' policy to the implementation of a 'harmonized' or 'unified' policy' [12].

[1] Joint Protocol Relating to the Application of the Vienna Convention and the Paris Convention. IAEA, 1988.
[2] Paris Convention on Third Party Liability in the Field of Nuclear Energy. OECD, 1960.
[3] Protocol to Amend the 1963 Vienna Convention on Civil Liability for Nuclear Damage. IAEA, 1997.

2.3. Extensive Intersections and Codification

International nuclear law governs the relations between states and international organizations in various domains related to the use of nuclear energy. Its norms have far-reaching implications, encompassing environmental protection, the use of outer space and the world's oceans, the operation of marine and river vessels, and the regulation of international and national territories and sovereignty. Consequently, the norms of international nuclear law are inherently complex, intersecting with multiple branches of international law, including maritime law, space law, international security law, and environmental law.

In the late 20th century, a significant number of international legal norms were developed and codified within the framework of international nuclear law. This ongoing process of codification and legalization is driven by the rapid advancements in nuclear technologies and materials, which have created a pressing need for comprehensive and well-defined regulation.

This process can be exemplified by a substantial number of resolutions drafted and adopted by the United Nations General Assembly that are directly and indirectly connected to the development and reinforcement of the international legal framework governing nuclear activities, including nonproliferation, safety, and security. 'Regardless whether one supports progress 'towards' or 'in' disarmament, both stances would benefit from the development of a 'strategic plan' to achieve their concrete objectives. There is no sign that any such plan exists in either camp, as the possessors proceed with their own plans for indefinite retention and modernization, and the non-nuclear-weapon states proceed to itemize actions that must be taken without addressing the political circumstances necessary to achieve them' [79].

One of the latest initiatives is a package of resolutions before the Assembly concerning nuclear and other mass destruction weapons, the disarmament aspects of outer space, conventional weapons, other disarmament measures and international security, regional disarmament and security, and the United Nations disarmament machinery which are directly and indirectly linked to international nuclear law. 'The UN General Assembly has adopted a package of annual resolutions on nuclear disarmament and other weapons of mass destruction. These resolutions directly address issues such as the Comprehensive Nuclear-Test-Ban Treaty, fissile material, and nuclear-weapon-free zones, which are core components of the international nuclear legal framework' [82].

Among those, General Assembly included a new resolution titled 'Prohibiting the use of radiological weapons'[1], urging the Conference on Disarmament to adopt, in 2024, a comprehensive and balanced program of work that comprises negotiations to conclude, as an initial step on this issue, a legally binding multilateral ban on radiological weapons use by states.

The nuclear technology continues to escalate in both civilian and military applications. This has led to a paradoxical perception, where 'peaceful applications of nuclear energy — and all the promise they entail for humanity — are paradoxically often perceived in juxtaposition with the prospects of nuclear weapons' proliferation and nuclear war. The mixed perception is understandable: the materials, knowledge, and expertise required to produce nuclear weapons are often indistinguishable from those needed to generate nuclear power and conduct nuclear research' [26]. This requires a well-defined and strict compliance with existing norms and frameworks in the sphere of international nuclear law. 'As a result, the focus of the international community has always been to ensure that nuclear energy is used peacefully and safely. The approach is defined by a complex network of national and international measures' [26].

The corpus of international nuclear law is a multifaceted 'tapestry' made up by an intricate array of treaties, conventions, and agreements. When examining the normative foundations and frameworks that underpin this specialized field of international law, it is possible to thematically group them into categories, these including safety and security, environment protection against contamination, and liability and compensation for nuclear incident.

The first domain encompasses the safety and security considerations surrounding the development, testing, and deployment of nuclear weapons. It includes landmark agreements such as:

- Treaty Banning Tests of Nuclear Weapons in the Atmosphere, Outer Space and Underwater of August 5, 1963;
- Comprehensive Nuclear Test Ban Treaty of September 24, 1996;
- Treaty on the Non-Proliferation of Nuclear Weapons of July 1, 1968;
- Treaty on the Prohibition of the Placement of Nuclear Weapons and Other Weapons of Mass Destruction on the Bottom of the Seas and Oceans and in Their Subsoil of February 11, 1971;
- Treaty for the Prohibition of Nuclear Weapons in Latin America of January 14, 1967 (Treaty of Tlatelolco);
- International Convention for the Suppression of Acts of Nuclear Terrorism, developed within the UN (was opened for signature in 2005; entered into force in July 2007);
- Treaty on a nuclear-free zone in the South Pacific of August 6, 1985 (Treaty of Rarotonga) and other agreements on areas free of nuclear weapons (Pelindaba, Bangkok treaties, Semipalatinsk Treaty of Central Asian countries of September 8, 2006).

[1] Prohibiting the use of radiological weapons, A/C.1/78/L.51. UN General Assembly, 2023.

There are nuclear weapons agreements under development, including the Convention on the Prohibition of Radiological Weapons and the Convention on the Prohibition of the Use of Nuclear Weapons. In addition to multilateral ones, there are many bilateral treaties between states regarding nuclear weapons.

The second thematic area focuses on the protection of the environment and the planet from the hazards associated with nuclear technology. Key agreements in this domain include:

- International Convention for the Prevention of Marine Pollution by Dumping of Wastes and Other Materials, 1972 (as amended in 1994);
- Convention on the Physical Protection of Nuclear Material, 1980;
- Convention on Early Notification of a Nuclear Accident and on Assistance in the Case of a Nuclear Accident or Radioactive Emergency, 1986;
- Convention on Nuclear Safety, 1994;
- Convention on Assistance in the Case of a Nuclear Accident or Emergency, 1986;
- Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management, 1997.

The third category encompasses standards and conventions governing liability and compensation for nuclear-related incidents and accidents. Noteworthy examples include:

- Convention for the Protection of Workers from Ionizing Radiation, 1960;
- Convention on Third Party Liability in the Field of Nuclear Energy, 1960 (as amended in 1964, 1982);
- International Convention on Civil Liability for Nuclear Damage, 1963 (as amended in 1997);
- Convention on the Liability of Operators of Nuclear Ships, 1962 (not in force);
- Convention on Civil Liability in the Field of Maritime Transport of Nuclear Materials, 1971.

These agreements aim to create a harmonized system of legal accountability and financial compensation in the event of a nuclear disaster.

Importantly, the sources of international nuclear law do not exist in isolation but rather intersect with other branches of public international law, such as the law of the sea, outer space law, and international environmental law. This interconnectedness reflects the complexity and multidimensional nature of the legal frameworks governing the peaceful and responsible use of nuclear technology on a global scale. As an example, Treaty on the principles governing the activities of states in the exploration and use of outer space, including the Moon and other celestial bodies, dated January 20, 1967, prohibits the launching into Earth orbit of any objects with nuclear weapons, etc.

3. The Potentials and Complexities of International Nuclear Law

The field of international nuclear law encompasses a broad range of legal frameworks and principles governing the various aspects of nuclear energy, with a particular focus on four key areas: safety, security, safeguards, and liability. Legal doctrines recognize the inherent tension within the nature of international nuclear law. On the one hand, the regulation of nuclear activities is firmly established as the exclusive responsibility of sovereign states. On the other hand, the unique risks and global implications of nuclear energy make it challenging to precisely define a comprehensive set of legally binding rules and obligations. As noted in the judgement *SS 'Wimbledon', United Kingdom and ors v Germany* (1923), by undertaking the obligations of a treaty, a state 'places an important limitation on the exercise by [itself] of sovereign rights'[1].

These restrictions on state sovereignty are fundamental to the development of international nuclear law. A state's participation in a treaty is not considered an abandonment of its sovereignty; rather, 'the right of entering into international engagements is an attribute of State sovereignty'[2], as affirmed in the *SS 'Wimbledon'* case.

International nuclear law is based on such voluntary limitations of sovereignty. By voluntarily participating in these cooperative frameworks, states essentially surrender the degree of their independence in exchange for the collective benefits and risk-mitigation mechanisms provided by the international legal regime.

However, it would be an oversimplification to assert that international nuclear law simply imposes constraints on state sovereignty. Its instrument is not capable of compelling exclusive responsibility on the state in various aspects of nuclear energy, whereas it 'rather reinforces the state sovereignty' [88]. In reality, the legal instruments in this domain also serve to reinforce and reaffirm the fundamental role of the nation-state as the primary actor responsible for the governance of nuclear activities within its own jurisdiction. This tension between limiting and reinforcing state sovereignty is a defining characteristic of the international nuclear legal framework.

It is important to recognize that the evolution of international nuclear law did not occur in a vacuum. Prior to the establishment of this specialized legal regime, nuclear technology had already been developed and utilized by states as a means of demonstrating territorial defense capabilities, extraterritorial power, and authority, as well as mechanisms for peaceful containment. The contemporary international nuclear legal framework encompasses a diverse array of obligations, ranging from well-defined 'hard law' provisions to more ambiguous 'soft law' principles that lack precise legal

[1] The SS 'Wimbledon', United Kingdom and ors v Germany, Judgment, (1923) PCIJ Series A no 1, ICGJ 235 (PCIJ 1923).
[2] Ibid.

enforceability. This inherent duality, with both legally binding and non-binding elements, contributes to the flaws and shortcomings that permeate various aspects of international nuclear law.

3.1. Nuclear Weapon Proliferation and Nuclear Security

The issue of nuclear security and non-proliferation of nuclear weapons is widely regarded as the primary concern underpinning the development of international nuclear law. Nuclear weapons have been a central consideration in the foundational principles of international law governing the use of force and the conduct of hostilities.

The United Nations Charter, in its preamble, expresses the primary aim of the organization as 'to save succeeding generations from the scourge of war' [1]. Accordingly, the UN Charter restricts the use of armed force by states, limiting it to instances of 'self-defense'[2] or actions authorized by the Security Council[3]. This prohibition on the use of force applies to all forms of weaponry, including nuclear armaments.

In its Advisory Opinion 'Legality of the Threat or Use of Nuclear Weapons'[4], the International Court of Justice (ICJ) grappled with the unique challenges posed by nuclear weapons in the context of international humanitarian law. While the Court acknowledged the difficulty in reconciling the use of nuclear weapons with the principles of the law of armed conflict, it ultimately refrained from making a definitive ruling on the legality or illegality of nuclear weapons, particularly in extreme circumstances of self-defense where a state's survival may be at stake. The Court noted that 'in view of the current state of international law and of the elements of fact at its disposal, [it] cannot conclude definitively whether the threat or use of nuclear weapons would be lawful or unlawful in an extreme circumstance of self-defense, in which the very survival of a State would be at stake'[5].

In other words, the ICJ's reluctance to provide a clear-cut determination on the legality of nuclear weapons has been interpreted by some as potentially undermining the established principle of jus ad bellum, which governs the justification for the use of force, and jus in bello, which regulates the actual conduct of hostilities. As every armed conflict can potentially be perceived by states as an 'extreme circumstance of self-defense'[6], it is not crystal clear whether the Court inferred that the principle of *jus ad bellum,* justifying the use of armed force, might set aside the principle of *jus in bello,* governing the actual conduct of hostilities. The consequences of the ambiguity between the principles of jus ad bellum and jus in bello, including the erosion of humanitarian law, selective application of norms, escalation of conflicts, undermining of international stability, and weakening of accountability, have raised concerns that the exceptional nature of nuclear weapons may lead states to prioritize the principles of self-defense over the established laws of war.

N. Ronzitti states that the risk of a conflict between jus ad bellum and jus in bello is that states may be tempted to disregard the rules of jus in bello if they believe that their cause is just. He concludes that 'State practice is insufficient to establish the legality of such interventions', but that 'the number of precedents and the relatively limited protests they have raised, on the other hand, allow us to expect their legitimacy de lege ferenda. In other words, these actions constitute neither a violation of peremptory norms nor, strictly speaking, aggression' [81].

Similarly, M. G. Smirnov argues that the ambiguity between jus ad bellum and jus in bello creates a dangerous precedent where states might selectively apply the laws of war based on their perceived justification for the use of force. This could result in the erosion of fundamental humanitarian principles. 'If the justness of a war's cause is allowed to override the laws of war, it could lead to a more permissive environment for the use of force and the disregard of crucial humanitarian norms. This would undermine the overall stability and predictability of the international legal order' [29].

In a similar vein, J. G. Stewart, a Canadian legal scholar, writes in his article that 'the blurring of the lines between jus ad bellum and jus in bello can make it more difficult to hold parties accountable for violations of the laws of war, as they might claim their actions were justified by the legitimacy of their cause' [90].

Nonetheless, the ICJ did emphasize the obligation of states to pursue good-faith negotiations leading to the comprehensive disarmament of nuclear weapons under strict and effective international control. This reflects the broader recognition that the proliferation and potential use of nuclear weapons pose an existential threat to humanity and the global environment, necessitating a concerted international effort to eliminate these weapons of mass destruction.

Beyond the principles of the UN Charter and the Advisory Opinion of the ICJ, the regulation of the conduct

[1] Charter of the United Nations, 24 October 1945.

[2] Ibid. Article 51.

[3] Article 42 of the United Nations Charter gives the Security Council the authority to act by air, sea or land forces as may be necessary to maintain or restore international peace and security. The Security Council has authorized military force to reverse or repel aggression by one State against another. Since 1990, the Security Council has increasingly authorized the use of force under Chapter VII of the Charter — in different circumstances and to varying degrees.

[4] Legality of the Threat or Use of Nuclear Weapons, Advisory Opinion of 8 July 1996. *I.C.J. Reports 1996*. P. 226. International Court of Justice (ICJ).

[5] Ibid.

[6] Ibid.

of hostilities in armed conflicts is also governed by international humanitarian law, both treaty and customary law, particularly the 1977 Additional Protocol I to the Geneva Conventions. This protocol establishes the principle of distinction, which prohibits the use of weapons that cannot distinguish between civilian and military targets. According to Article 51(4)(c) of this Additional Protocol, states involved in a conflict 'employ a method or means of combat the effects of which cannot be limited as required by this Protocol; and consequently, in each such case, are of a nature to strike military objectives and civilians or civilian objects without distinction'[1].

The indiscriminate nature of nuclear weapons, with their devastating and long-lasting impacts on both human populations and the environment, has been widely regarded as inherently incompatible with this fundamental principle of international humanitarian law.

In addition to the principles of distinction and necessity, the law of armed conflict also emphasizes the crucial role of proportionality in regulating the conduct of hostilities. This principle, enshrined in articles 51(5)(b) and 57(2)(a)(iii) and (b) of the Additional Protocol I to the Geneva Conventions, as well as in numerous other provisions of the 1949 Geneva Conventions and their 1977 Additional Protocols, requires that any military action must not cause excessive civilian harm in relation to the anticipated military advantage.

In this regard, United Nations General Assembly Resolution 1653 (XVI) (1961) declares that the use of nuclear and thermonuclear weapons is contrary to the spirit, letter, and aims of the United Nations and, as such, is a direct violation of the Charter of the United Nations. The Advisory Opinion of the International Court of Justice (ICJ) on the Legality of the Threat or Use of Nuclear Weapons (1996) states that 'the destructive power of nuclear weapons cannot be contained in either space or time. They have the potential to destroy all civilization and the entire ecosystem of the planet'[2]. Articles 51 and 55 of the Additional Protocol I to the Geneva Conventions (1977) prohibit 'the indiscriminate attack of civilian populations, which is a characteristic of the use of nuclear weapons'[3] and 'the use of methods or means of warfare that are intended, or may be expected, to cause widespread, long-term, and severe damage to the natural environment'[4]. The ICJ concludes that the use of nuclear weapons would generally be contrary to the principles and rules of international humanitarian law. Ultimately, the Customary International Humanitarian Law (ICRC study, 2005) infers that 'the use of weapons that are by nature indiscriminate is prohibited, and that the use of weapons that cause excessive or unjustified suffering is also prohibited'[5].

Applying the principle of proportionality to the use of nuclear weapons presents significant challenges. The indiscriminate nature of these weapons, with their potential for widespread and long-lasting impacts on civilian populations, environments, and infrastructure, makes it inherently difficult to ensure that their use would not result in disproportionate collateral damage. The sheer destructive power of nuclear weapons, even when employed against military targets, raises serious doubts about the feasibility of maintaining proportionality.

However, the International Court of Justice acknowledged in its 1996 Advisory Opinion that there may be exceptional circumstances where the use of nuclear weapons could potentially be considered proportionate. The court noted that 'the reality ... is that nuclear weapons might be used in a wide variety of circumstances with very different results in terms of likely civilian casualties'[6]. It suggested that in certain limited scenarios, such as the use of a low-yield nuclear weapon against military targets in sparsely populated areas, it might be possible to envisage a nuclear attack that would not inevitably cause catastrophic civilian harm.

While the ICJ's opinion leaves open the possibility of a proportionate use of nuclear weapons in some hypothetical scenarios, it is essential to recognize the inherent challenges in applying this principle in practice. The devastation caused by nuclear weapons, even at relatively low yields, and the unpredictable long-term consequences make it exceedingly difficult to ensure that any use of such weapons would be truly proportionate. Moreover, the court's acknowledgment of potential exceptions has been criticized by many as undermining the long-standing humanitarian principles that prohibit the indiscriminate use of weapons and the disproportionate infliction of civilian suffering.

Ultimately, the legal and ethical complexities surrounding the use of nuclear weapons continue to be a subject of intense debate and controversy within the international community. While the principle of proportionality provides a framework for assessing the legality of military actions, the unique characteristics of nuclear weapons raise profound questions about the ability to reconcile their use with the established laws of armed conflict.

The pivotal concern of both the 2030 Agenda for Sustainable Development and the Paris Agreement on

[1] Protocol Additional to the Geneva Conventions of 12 August 1949, and Relating to the Protection of Victims of International Armed Conflicts (Protocol I). Available at: https://treaties.un.org/doc/Publication/UNTS/Volume%201125/v1125.pdf .

[2] Legality of the Threat or Use of Nuclear Weapons, Advisory Opinion of 8 July 1996. *I.C.J. Reports 1996*. P. 226. International Court of Justice (ICJ).

[3] Article 51 of the Additional Protocol I to the Geneva Conventions (1977).

[4] Article 55 of the Additional Protocol I to the Geneva Conventions (1977).

[5] Customary International Humanitarian Law (ICRC study, 2005).

[6] Legality of the Threat or Use of Nuclear Weapons, Advisory Opinion of 8 July 1996. *I.C.J. Reports 1996*. P. 226. International Court of Justice (ICJ).

Climate Change is energy, particularly the ensuring of access to cost-effective, environmentally friendly, and safe energy.

Nuclear energy is the most available option as the demand for energy has brought into focus the technology for low carbon electricity generation. Accordingly, the issue of safety in the use of nuclear energy has come forward. The most overwhelming portion of responsibility has fallen upon states. States also try to fulfill such a responsibility through international cooperation for the peaceful use of nuclear energy. To this end, the IAEA has been established.

Article II of the IAEA Statute provides the mandate for the IAEA in the peaceful application of nuclear energy. It states: 'the Agency shall seek to accelerate and enlarge the contribution of atomic energy to peace, health and prosperity'[1]. However, under the terms of Article III of its Statute, the IAEA does not explicitly provide for environmental protection from radioactive contamination. The IAEA only mentions 'standards of safety for protection of health and minimization of danger to life and property'[2]. As the environment was not the center of negotiation of the IAEA founders, the Statute focused on potential risks of nuclear energy in weapon proliferations, rather than on environmental protection.

In accordance with Article III of the IAEA Statute, the Agency has the authority to apply health and safety standards to nuclear activities of any state by means of a special agreement with the IAEA with respect to radiation protection and nuclear safety. The observance of health and safety standards are automatically binding on the Agency's own activities. Nonetheless, in all other cases, these standards become binding when they are included in instruments that have a binding character, e.g., international treaties or agreements. This means that the IAEA safeguards are not self-executing and depend for implementation on an agreement between the Agency and the nation concerned.

3.2. State Responsibility and Nuclear Liability

The international legal framework governing nuclear liability was developed to serve two primary objectives: ensuring adequate compensation to individuals and communities affected by nuclear accidents and incentivizing the nuclear industry to assume responsibility for the risks inherent in its operations without facing the threat of ruinous liability.

This dual purpose is reflected in the structure of international nuclear liability regimes, which typically impose strict liability on the operators of nuclear facilities for any resulting damages, while also limiting the total amount of compensation that can be demanded. As B. Julio has observed: 'In international law, a number of specific (hazardous) activities are regulated by multilateral conventions where the liability for transboundary damages falls mainly on private persons or entities, and in some cases there may be a residual State liability. In one convention, there is exclusive State accountability' [43].

The Paris Convention on Third Party Liability in the Field of Nuclear Energy is a seminal example of this approach. By establishing that the operator of a nuclear installation is strictly liable for any harm caused by a nuclear incident, the convention aims to provide swift and certain compensation to affected parties. At the same time, it limits the operator's liability to a finite, pre-determined amount, thereby preserving the industry's capacity to develop and operate nuclear technology.

Specifically, the Paris Convention stipulates that the nuclear operator shall be liable for damage if it can be demonstrated that such harm was directly caused by a nuclear incident related to the installation, its fuel, or radioactive substances released from the facility. Furthermore, 'the operator shall be liable for damage caused by a nuclear incident directly due to an act of armed conflict, hostilities, civil war, insurrection or a grave natural disaster of an exceptional character'[3].

However, the prerequisite for the operator's liability depends upon 'proof that such damage was caused by a nuclear incident'[4]. In fact, the requirement to prove a direct causal link between the nuclear incident and the resulting harm can present significant evidentiary challenges, often necessitating extensive scientific investigation and field research. The exemplar evidence is the NATO bombing of Serbia in 1999: the NATO member states had differing views on whether the impact of the campaign was compatible with the principles of international humanitarian law. While in NATO's own statements, the organization acknowledges that some of the attacks resulted in unintended 'civilian casualties'[5,6] and damage to the environment, it maintains that it took 'extensive measures to avoid and minimize civilian harm'[7] and that the campaign was conducted 'in accordance with international law'[8].

[1] 1956 Statute of the International Atomic Energy Agency, 23 Oct. 1956, 276 UNTS 3, 8 UST 1093, TIAS 3873. Article III (A)(6). Available at : https://www.iaea.org/sites/default/files/statute.pdf.

[2] Ibid.

[3] OECD, Convention on Third Party Liability in the Field of Nuclear Energy (Paris Convention), OECD/LEGAL/0038Annex Art. 9.

[4] Ibid. Art. 3.

[5] Press Conference by Commander of the 315th Air Expeditionary Wing at Aviano Air Base. 1999. Available at: https://www.nato.int/docu/speech/1999/index.html.

[6] Press Conference by NATO Secretary General Javier Solana. 1999. Available at: www.nato.int/cps/en/natolive/opinions_27448.htm.

[7] NATO's Final Report to the Prosecutor of the International Criminal Tribunal for the former Yugoslavia (ICTY), 2000.

[8] Ibid.

Contrary to NATO's statements, legal scholars are of the opinion that the NATO bombing campaign in Serbia was incompatible with the principles of international humanitarian law. E. G. Ponomareva and A. V. Frolov argue that 'the widespread and indiscriminate nature of the NATO air strikes, including the targeting of dual-use civilian infrastructure, such as bridges, power plants, and media outlets, raises serious questions about the compliance with the principles of distinction and proportionality under international humanitarian law. The long-term environmental and public health consequences of the use of depleted uranium munitions also seem to contradict the requirement to minimize unnecessary suffering' [78].

A. O. Burukina also notes that the NATO intervenetion in Yugoslavia, while potentially justified by humanitarian considerations, appears to have been conducted in a manner that disregarded key principles of international humanitarian law. The extensive damage to civilian objects and the environment as well as the use of controversial weapons suggest that the alliance failed to take all feasible precautions to avoid or minimize collateral damage [7].

Of Western legal scholars, M. Bothe comments that 'the bombing, …, was likely disproportionate and therefore a violation of international humanitarian law. The attack did not meet the requirement of distinguishing between military and civilian objects, nor did it seem to offer a concrete and direct military advantage that would justify the incidental civilian loss' [13].

M. Milanović notes that 'it is immediately apparent from even a cursory examination of the case law on the application of human rights treaties extraterritorially or in times of armed conflict that courts greatly fear overcomplexity and their own institutional incompetence, whether perceived or real' [64].

This can complicate the process of obtaining compensation, particularly in cases where the full extent of environmental or public health impacts may not be immediately apparent.

The development of this nuclear liability regime has been influenced by the broader evolution of international law governing state responsibility for environmental harm. Over the past half-century, the International Law Commission (ILC) has worked to codify the general principles of state responsibility, including the duty to prevent 'transboundary damage from hazardous activities' [1] and respond to 'loss from transboundary harm arising out of hazardous activities'[2].

According to the Responsibility of States for Internationally Wrongful Acts, adopted in 2001, the law of state responsibility is based on two elements. One is that an act or omission is 'attributable to the State under international law'[3], and the other is that an act or omission 'constitutes a breach of an international obligation of the State'[4]. However, the concept of state responsibility has played a relatively limited role in the context of nuclear environmental protection, as the latter primarily addresses the actions of states themselves, rather than the liability of private actors who dominate the nuclear industry.

Thus, while the international legal system has sought to balance the needs of nuclear technology development with the imperative of environmental protection and victim compensation, there remain significant challenges in effectively addressing the transboundary risks posed by nuclear activities. The complexity of establishing causation and the limitations of state responsibility in this domain underscore the ongoing efforts to refine and strengthen the nuclear liability regime.

The concept of state responsibility in international law has its historical roots in instances where states have violated established norms of treaty and customary international law. These include cases of repeated violent or discriminatory acts against foreign nationals, as well as the transboundary transmission of hazards that have infringed upon the sovereignty and territory of other states. In such circumstances, the injured state was recognized as having a right to exercise 'its power of diplomatic protection to demand compensation or reparation' [91].

This general principle of state accountability for transboundary harms is also reflected in the objectives of international agreements like the Basel Protocol[5], which seeks to address 'the risk of damage to human health, property and the environment caused by the transboundary effects of industrial accidents'[6]. However, the practical implementation of state liability frameworks remains challenging, as international treaties and rules often lack clarity on the specific terms, conditions, and thresholds that govern the attribution of responsibility.

Yet, international agreements and rules on liability require clarification with regard to the terms and conditions as well as the limits, intervals, and thresholds for the states. They, in turn, necessitate the consensus of states concerning these hotspots. In practice, determining liability for damage is complicated, as it depends on

[1] UN General Assembly, Resolution 52/156 of 15 December 1997, A/RES/53/102, 26 January 1999. Available at: http://www.worldlii.org/int/other/UNGA/1998/189.pdf.

[2] Ibid.

[3] Responsibility of States for Internationally Wrongful Acts 2001. *International Law Commission*, 2001, vol. II (Part Two).

[4] Ibid.

[5] Protocol on Liability and Compensation for Damage Resulting from Transboundary Movements of Hazardous Wastes and Their Disposal, International Union for Conservation of Nature, Dec 10, 1999. IUCN (ID: TRE-001341). Available at: https://www.basel.int/Portals/4/Basel%20Convention/docs/meetings/cop/cop5/docs/prot-e.pdf.

[6] Protocol on Civil Liability and Compensation for Damage Caused by the Transboundary Effects of Industrial Accidents on Transboundary Waters to the 1992 Convention on the Protection and Use of Transboundary Watercourses and International Lakes and to the 1992 Convention on the Transboundary Effects of Industrial Accidents, IUCN (ID: TRE-001372).

the extent to which a state has contributed to the occurrence of that damage. Occasionally, not the whole state but only its part contributes to the event that causes harm. As the International Law Commission articulates, 'a State which aids or assists another State in the commission of an internationally wrongful act by the latter is internationally responsible for doing so if: (a) that State does so with knowledge of the circumstances of the internationally wrongful act; and (b) the act would be internationally wrongful if committed by that State'[1]. This speaks to the complex web of state involvement and culpability that can underlie transboundary harms.

This is particularly salient in the context of nuclear energy, where the determination of liability is often highly contentious. The operator of a nuclear facility is typically held strictly liable for any damages resulting from a nuclear incident, regardless of the specific cause. Hence, challenges can arise when the harm occurs during the ostensibly lawful operation of the plant, making it difficult to establish a clear causal link between the state's conduct and the resulting damage. As the International Court of Justice has affirmed, 'no State has the right to use or permit the use of its territory in such a manner as to cause injury by fumes in or to the territory of another or the properties or persons therein, when the case is of serious consequence and the injury is established by clear and convincing evidence'[2]. Moreover, a problematic situation may arise if the damage emerges through the state's lawful conduct and the injured state faces difficulty enforcing liability claims due to lack of causal connection between the state's conduct that has led to the violation of the safeguards and the damage.

State liability should, therefore, be based upon the precautionary principle in case the state fails to take measures to prevent risks to safety as the United Nations stresses that 'the importance of the precautionary approach according to which lack of full scientific certainty should not be used for postponing cost-effective measures to prevent environmental degradation, where there are threats of serious or irreversible damage'[3]. This suggests that states may be obligated to take proactive steps to mitigate risks, even in the absence of a clear causal link between their actions and potential harms.

Ultimately, the challenges of establishing state responsibility for transboundary environmental and public health impacts, particularly in the nuclear sector, underscore the need for ongoing refinement and strengthening of the international legal frameworks governing liability. As the global community grapples with the complex risks posed by hazardous activities, the development of more robust and transparent accountability mechanisms will be crucial.

Conclusion

International nuclear law has emerged as a distinct specialized branch of contemporary public international law, addressing a wide range of legal issues associated with nuclear technology, materials, and activities. From nuclear enrichment and arms control to the broader environmental and public safety implications, this evolving legal domain occupies a critical position within the global governance framework for managing the complexities and risks of the nuclear age.

While both Western and Russian legal scholars have grappled with the nature and categorization of international nuclear law, a shared definitional consensus remains elusive. The absence of a universally accepted taxonomy has prompted Western academics to develop a rich array of conceptual approaches, even as Russian doctrines have brought their own unique perspectives to the table. This terminological diversity has added a layer of complexity to the fundamental question of whether international nuclear law should be classified as part of the private or public international law domain.

Delving deeper into the substantive scope of international nuclear law, one finds a multifaceted landscape encompassing the issues of safety, security, safeguards, and liability. These various components, each with their own distinct capacities and limitations, have presented significant challenges for international law. From environmental protection to the specter of nuclear terrorism, the limitations inherent in this emergent field have forced the global legal order to confront a range of interconnected complex issues. Underlying these challenges are the divergent legal philosophies espoused by Western and Russian doctrines.

While the Western approach has tended to emphasize the peaceful use of nuclear energy and the imperative of environmental safeguards, a different perspective has often placed a greater emphasis on concepts of state sovereignty, the inherent right to nuclear development, and other concepts such as 'general property and tort' [50]. This tension has manifested itself in ongoing debates over the appropriate balance between nuclear security, national interests, and global governance.

In this vein, there is assured growth in the number of international nuclear law doctrines placing consistently developing regional regimes in line with the universal framework of international nuclear law. As discussed before, every aspect of international nuclear law has certain limitations which require to be improved to facilitate the deployment and development of legal standards in safety, security, safeguards, and liability of nuclear energy. Nevertheless, Western legal doctrine highlights the importance of peaceful use of nuclear

[1] Responsibility of States for Internationally Wrongful Acts 2001. *International Law Commission*, 2001, vol. II (Part Two).

[2] Trail Smelter Arbitration (United States v. Canada) 16 April 1938 and 11 March 1941. *Reports of International Arbitral Awards*. Vol. III. Pp. 1905-1982.

[3] Resolution 1/6: Marine plastic debris and microplastics. Resolutions and decisions adopted by the United Nations Environment Assembly of the United Nations Environment Programme at its first session on 27 June 2014.

energy and environment protection against radioactive hazards. In line with this doctrine, many states around the world have been working to align their nuclear policies with Western standards. Yet, Russian legal doctrine proclaims that the issue of nuclear possession and development must be regarded as a part of the concept of sovereignty. In this regard, the state interests, local necessities, and sovereign rights directly addressing safeguarding sources of nuclear energy are the center of attention and debates.

While Russian legal doctrine on the nature and categorization of nuclear law puts more weight on nuclear law as private international law, there are other, less visible perspectives in this doctrine that more closely align with its Western counterpart, such as the approaches that treat international nuclear law as an area of public international law.

Despite these ideological differences, there are signs of an evolving convergence, as various regional regimes develop in alignment with the overarching framework of international nuclear law. Nonetheless, the persistent limitations and shortcomings of this field suggest the need for continued refinement and improvement of the legal standards governing nuclear safety, security, safeguards, and liability.

'Consequently, the regulation of nuclear energy necessitates the endowment of the international community with residual responsibility, or in certain instances co-responsibility, to ensure, among other things uniformity of standards, co-ordination, pooling of resources and services, as well as compliance' [26]. As the global nuclear landscape continues to evolve, it appears that the international community must be entrusted with residual responsibility, or in some cases – co-responsibility, to ensure the consistent application of standards, coordinate resources and services, and promote compliance – all in the service of a more secure and sustainable nuclear future.

References

1. Anikina T. A. et al. *Predotvrashchenie terroristicheskikh ugroz sredi naseleniya* [Prevention of Terrorist Threats among the Population]. Kazan, 2016. 101 p. Available at: https://kpfu.ru/staff_files/F870436660/Posobie_antiterror_1_pdf. (In Russ.).

2. Aramyan A. *Mezhdunarodno-pravovye aspekty ispol'zovaniya yadernogo materiala v mirnykh tselyakh* [International Legal Aspects of the Use of Nuclear Material for Peaceful Purposes]. *21-y VEK* – 21st CENTURY. 2013. Issue 2 (27). Pp. 77–90. (In Russ.).

3. Boyko A. A. *Miropoliticheskie aspekty razvitiya atomnoy energetiki* [Global Political Aspects of Nuclear Energy Development]. *Teorii i problemy politicheskikh issledovaniy* – Theories and Problems of Political Studies. 2016. Vol. 5. Issue 6A. Pp. 28–46. Available at: http://www.publishing-vak.ru/file/archive-politology-2016-6/3-boiko.pdf. (In Russ.).

4. Arbatov A. G. *Ogranichenie i nerasprostranenie yadernogo oruzhiya: pauza ili konets poluvekovoy istorii?* [Limitation and Non-Proliferation of Nuclear Weapons: A Pause or the End of a Half-Century History?]: a report at the IMEMO RAS Academic Council meeting. 2014. 6 p. Available at: https://www.imemo.ru/files/File/ru/sc/2014/17122014_tez.pdf. (In Russ.).

5. Ampovska M. Nuclear Insurance Pools Worldwide: The Role in the Nuclear Law. *Balkan Social Science Review*. 2017. Vol. 9. Pp. 7–21. Available at: https://eprints.ugd.edu.mk/18491/1/1899-25-3376-1-10-20170630.pdf. (In Eng.).

6. Astner K., Kütt M. The Treaty on the Prohibition of Nuclear Weapons: Changing Disarmament Discourses in Germany? In: Kühn U. (ed.). *Germany and Nuclear Weapons in the 21st Century*. Taylor&Francis, 2024. Pp. 203–229. DOI: 10.4324/9781003341161-13. (In Eng.).

7. Burukina A. O. *Razvitie mezhdunarodnogo gumanitarnogo prava v XXI v.: politicheskie i ekonomicheskie aspekty* [Development of International Humanitarian Law in the 21st Century: Political and Economic Aspects]. *Ekonomika: vchera, segodnya, zavtra* – Economics: Yesterday, Today and Tomorrow. 2020. Vol. 10. Issue 7A. Pp. 17–32. DOI: 10.34670/AR.2020.99.57.002. Available at: http://publishing-vak.ru/file/archive-economy-2020-7/2-burukina.pdf. (In Russ.).

8. Biryukov P. N. *Mezhdunarodnoe pravo* [International Law]: a handbook. 2nd ed. Moscow, 2000. 416 p. (In Russ.).

9. Bol'shov L. A., Laverov N. P., Linge I. I. (eds.). *Problemy yadernogo naslediya i puti ikh resheniya* [Problems of Nuclear Legacy and Ways to Solve Them]. Vol. 3. Moscow, 2015. 316 p. Available at: https://ibrae.ac.ru/docs/109/monografiyaiproblemiiyadernogoinasledіyaitomi3irevised.pdf. (In Russ.).

10. Belozertsev S. M. *Yadernoe razoruzhenie: nekotorye aspekty mezhdunarodno-pravovogo regulirovaniya* [Nuclear Disarmament: Some Aspects of International Legal Regulation]. *Mezhdunarodnoe pravo* – International Law. 2023. Issue 1. Pp. 61–69. DOI: 10.25136/2644-5514.2023.1.39177. Available at: https://nbpublish.com/library_read_article.php?id=39177. (In Russ.).

11. Berdennikov G. *Perspektivy i vyzovy novogo obzornogo tsikla dogovora o nerasprostranenii yadernogo oruzhiya (2016-2020 gg.)* [Prospects and Challenges of the New Review Cycle of the Treaty on the Non-Proliferation of Nuclear Weapons (2016-2020)]. Center for Energy and Security Studies, 2017. 12 p. Available at: https://ceness-russia.org/conf2017/Discussion_Paper_by_Amb._Berdennikov_RUS.pdf. (In Russ.).

12. Besetskaya N. A., Sharikova V. P. *Pravovye standarty bezopasnogo ispol'zovaniya atomnoy energii v ramkakh EAES* [Legal Standards for the Safe Use of Atomic Energy Within the EAEU]. *Vestnik Polotskogo gosudarstvennogo universiteta. Seriya D. Ekonomicheskie i yuridicheskie nauki* – Vestnik of Polotsk State University. Part D. Economic and Legal Sciences. 2023. Issue 2 (64). Pp. 68–73. DOI: 10.52928/2070-1632-2023-64-2-68-73. Available at: https://elib.psu.by/bitstream/123456789/41358/1/68-73.pdf. (In Russ.).

13. Bothe M. The Protection of the Civilian Population and NATO Bombing on Yugoslavia: Comments on a Report to the Prosecutor of the ICTY. *European Journal of International Law*. 2001. Vol. 12. Issue 3. Pp. 531–535. Available at: http://www.ejil.org/pdfs/12/3/1531.pdf. (In Eng.).

14. Boulanger W. Developing Nuclear Law. *IAEA Bulletin*. 1968. Vol. 10. Issue 3. Available at: https://www.iaea.org/sites/default/files/publications/magazines/bulletin/bull10-3/10305080308.pdf. (In Eng.).

15. Boyle A. State Responsibility and International Liability for Injurious Consequences of Acts Not Prohibited by International Law: A Necessary Distinction? *International and Comparative Law Quarterly*. 1990. Vol. 39. Issue 1. Pp. 1–26. (In Eng.).

16. Black-Branch J. L., Fleck D. (eds.). *Nuclear Non-Proliferation in International Law*. Vol. 1. 2014. 260 p. DOI: 10.1007/978-94-6265-020-6. Available at: https://www.sci-hub.ru/10.1007/978-94-6265-020-6. (In Eng.).

17. Chernyad'eva N. A. *Tendentsii razvitiya mezhdunarodno-pravovoy bor'by s terrorizmom* [Trends of Development of International Legal Fight Against Terrorism]. *Moskovskiy zhurnal mezhdunarodnogo prava* – Moscow Journal of International Law. 2019. Issue 4. Pp. 61–78. DOI: 10.24833/0869-0049-2019-4-61-78. (In Russ.).

18. Stoiber C. et al. *Handbook on Nuclear Law*. Vienna: IAEA, 2003. Available at: https://www-pub.iaea.org/mtcd/publications/PDF/Pub1160_web.pdf. (In Eng.).

19. Chemmalar S. Use of Nuclear Weapons and the Doctrine of Self-Defense in International Law. *International Journal of South Asian Studies*. 2017. Vol. 10 (2). Pp. 127–132. (In Eng.).

20. Moxley C. J. Jr. *Nuclear Weapons and International Law: Existential Risks of Nuclear War and Deterrence Through a Legal Lens*. 2nd ed. Hamilton Books, 2024. 800 p. (In Eng.).

21. Chekov A. D. Five Years Without the INF Treaty: Lessons and Prospects. *Russia in Global Affairs*. 2024. Vol. 22. Issue 4. Pp. 24–47. DOI: 10.31278/1810-6374-2024-22-4-24-47. Available at: https://eng.globalaffairs.ru/wp-content/uploads/2024/09/024-047.pdf. (In Eng.).

22. Demin V. F. et. al. *Aspekty obespecheniya bezopasnosti i strakhovaniya grazhdanskoy otvetstvennosti za yadernye riski ot AES maloy moshchnosti* [Aspects of Ensuring Safety and Insurance of Civil Liability for Nuclear Risks from Small Nuclear Power Plants]. *Meditsinskaya radiologiya i radiatsionnaya bezopasnost'* – Medical Radiology and Radiation Safety. 2019. Vol. 64. Issue 6. Pp. 31–36. Available at: https://medradiol.fmbafmbc.ru/journal_medradiol/abstracts/2019/6/31-36_Demin_et_al_rus.pdf?ysclid=m8pxzp02id78518593. (In Russ.).

23. Duffy H. A. *The 'War on Terror' and the Framework of International Law*. Cambridge University Press, 2005. 488 p. Available at: https://www.defence.lk/upload/ebooks/Helen%20Duffy-The%20'War%20on%20Terror'%20and%20the%20Framework%20of%20International%20Law-Cambridge%20University%20Press%20(2005).pdf. (In Eng.).

24. Drace Z., Ojovan M. I., Samanta S. K. Challenges in Planning of Integrated Nuclear Waste Management. *Sustainability.* 2022. Vol. 14. Issue 21. Article 14204. DOI: 10.3390/su142114204. (In Eng.).

25. Ermolina M. A. *Mezhdunarodnoe ekologicheskoe pravo i prirodookhrannye rezhimy* [International Environmental Law and Environmental Protection Regimes]: a textbook for higher institutions. Moscow, 2020. 149 p. Available at: https://pureportal.spbu.ru/files/71465382/38362_1_1_.pdf. (In Russ.).

26. ElBaradei M., Nwogugu E., Rames J. International Law and Nuclear Energy: Overview of the Legal Framework. *IAEA BULLETIN*. 1995. Vol. 3. Pp. 16-23. Available at: https://www.iaea.org/sites/default/files/37302081625.pdf. (In Eng.).

27. Fischer D. *History of the International Atomic Energy Agency: The First Forty Years*. Vienna: International Atomic Energy Agency, 1997. 564 p. Available at: https://www-pub.iaea.org/MTCD/Publications/PDF/Pub1032_web.pdf. (In Eng.).

28. Fyhr K. Kelsen in the Reactor Hall? The Complex Interrelationship of National Law, European Union Law and International Law in the Regulation of Nuclear Safety. *Studia Prawa Publicznego*. 2023. Issue 3 (43). Pp. 58–88. DOI: 10.14746/spp.2023.3.43.3. (In Eng.).

29. Smirnov M. G. *Evolyutsiya pravila Jus ad bellum v mezhdunarodnom gumanitarnom prave: k voprosu razgranicheniya terminov jus in bello i jus ad bellum* [The Evolution of the jus ad bellum Rule in International Humanitarian Law: Towards the Distinction Between the Terms jus in bello and jus ad bellum]. *Voprosy rossiyskogo i mezhdunarodnogo prava* – Matters of Russian and International Law. 2021. Vol. 11. Issue 12A. Pp. 251–257. DOI: 10.34670/AR.2022.82.26.027. Available at: http://publishing-vak.ru/file/archive-law-2021-12/e3-smirnov.pdf. (In Russ.).

30. Gordon B. G. *Bezopasnost' i razvitie atomnoy energetiki* [Safety and Development of Nuclear Energy]. *Yadernaya i radiatsionnaya bezopasnost'* – Nuclear and Radiation Safety. 2005. Issue 2. Pp. 3–6. Available at: https://nrs-journal.ru/upload/iblock/68c/34_01.pdf. (In Russ.).

31. Gorin N. V., Vodolaga B. K., Kuchinov V. P., Shidlovskiy V. V. *Atomnaya energetika kak osnova ustoychivogo razvitiya* [Nuclear Energy as a Basis for Sustainable Development]. *Gosudarstvennoe upravlenie. Elektronnyy vestnik* – Public Administration. E-Journal. 2022. Issue 95. Pp. 7–19. Available at: https://spajournal.ru/index.php/spa/article/view/68/62. (In Russ.).

32. Grossi R. M. Nuclear Law: The Global Debate. In: International Atomic Energy Agency (ed.). *Nuclear Law: The Global Debate*. Vienna, 2022. Pp. 1–27. DOI: 10.1007/978-94-6265-495-2_1. Available at: https://link.springer.com/book/10.1007/978-94-6265-495-2. (In Eng.).

33. Glennon M. J. Pre-Empting Proliferation: International Law, Morality, and Nuclear Weapons.

European Journal of International Law. 2013. Vol. 24. Issue 1. Pp. 109–127. Available at: http://www.ejil.org/pdfs/24/1/2373.pdf. (In Eng.).

34. Graham A. *Nuclear Terrorism: The Ultimate Preventable Catastrophe*. New York: Times Books, 2004. 272 p. (In Eng.).

35. Gottemoeller R., Zhukov D. *Nuclear Risk Reduction Centers: A Stable Channel in Unstable Times*. Stanley Center for Peace and Security, 2023. 12 p. Available at: https://stanleycenter.org/wp-content/uploads/2023/10/Nuclear-Risk-Reduction-Centers-Gottemoeller-Zhukov.pdf. (In Eng.).

36. Handrlica J. 'Atomic Law' or 'Nuclear Law'? An Academic Discussion Revisited. *BRICS Law Journal.* 2018. Vol. V. Issue 3. Pp. 135–151. (In Eng.).

37. Handl G. State Liability for Accidental Transnational Environmental Damage by Private Persons. *American Journal of International Law*. 1980. Vol. 74 (3). Pp. 525–565. DOI: 10.2307/2201649. (In Eng.).

38. Hood A., Cormier M. Nuclear Threats under International Law Part I: The Legal Framework*. Journal for Peace and Nuclear Disarmament*. 2024. Vol. 7(1). Pp. 157–177. DOI: 10.1080/25751654.2024.2317489. (In Eng.).

39. Hunter D., Salzman J., Zaelke D. *International Environmental Law and Policy*. 2nd ed. Foundation Press, 2015. 1547 p. (In Eng.).

40. Ioyrysh A. I. *Kontseptsiya atomnogo prava* [The Concept of Atomic Law]: a scientific publication. Moscow, 2008. 719 p. (In Rus.).

41. Joyner D. H. *Interpreting the Nuclear Non-Proliferation Treaty*. Oxford University Press, 2011. 184 p. (In Eng.).

42. Johnson M. Defining Interim Storage of Nuclear Waste. *Northwestern University Law Review*. 2023. Vol. 117. Issue 4. Pp. 1177–1212. Available at: https://scholarlycommons.law.northwestern.edu/nulr/vol117/iss4/5. (In Eng.).

43. Barboza J. *The Environment, Risk and Liability in International Law*. Martinus Nijhoff Publishers, 2010. 204 p. (In Eng.).

44. Kukushkina A. V. *Yadernoe razoruzhenie i mezhdunarodno-pravovoe regulirovanie ekologicheskoy bezopasnosti* [Nuclear Disarmament and International Legal Regulation of Environmental Safety]. *Moskovskiy zhurnal mezhdunarodnogo prava* – Moscow Journal of International Law. 2015. Issue 1. Pp. 135-148. DOI: 10.24833/0869-0049-2015-1-135-148. (In Russ.).

45. Khanalieva Z. V. *Osobennosti normativno-pravovogo regulirovaniya atomnoy otrasli Rossii* [The Regulatory and Legal Features of the Russian Nuclear Industry]. *Moskovskiy ekonomicheskiy zhurnal* – Moscow Economic Journal. 2018. Vol. 3. Issue 4. Pp. 563–568. DOI: 10.24411/2413-046X-2018-14052. (In Russ.).

46. Kurashvili A. Yu. *Mezhdunarodno-pravovoe sotrudnichestvo Rossiyskoy Federatsii v sfere yadernoy bezopasnosti* [International Legal Cooperation of the Russian Federation in the Field of Nuclear Safety]. *Leningradskiy yuridicheskiy zhurnal* – Leningrad Legal Journal. 2019. Issue 1 (55). Pp. 177–186. (In Russ.).

47. Khripunov I. *International Legal Framework for Strengthening Nuclear Security*. IAEA International Nuclear Forensics Conference, Vienna, 2014, July 7-10. 2014. 8 p. Available at: https://www.academia.edu/8012181/International_Legal_Framework_for_Strengthening_Nuclear_Security?auto=download. (In Eng.).

48. Koplow D. A. Reverse Distinction: A U.S. Violation of the Law of Armed Conflict in Space. *Harvard National Security Journal*. 2022. Vol. 13. Pp. 25–120. (In Eng.).

49. Kiss A., Shelton D. *Guide to International Environmental Law*. Martinus Nijhoff Publishers, 2007. 44 p. DOI: 10.1163/ej.9781571053442.1-329. (In Eng.).

50. Kazimierz G., Dobishinski W. Property and Tort in Nuclear Law Today. *Vanderbilt Journal of Transitional Law*. 1977. Vol. 10 (3). Pp. 433–455. (In Eng.).

51. Karim R., Lee E. *Navigating Nuclear Energy Lawmaking for Newcomers: An Asian Perspective*. Springer, 2023. DOI: 10.1007/978-981-99-5708-8_3. (In Eng.).

52. Karnaukhova E. *Eroziya rezhima yadernogo nerasprostraneniya v usloviyakh transformatsii mirovogo poryadka (na primere X obzornoy konferentsii Dogovora o nerasprostranenii yadernogo oruzhiya)* [Erosion of the Nuclear Nonproliferation Regime in the Context of Transformation of the World Order (the case of Tenth Non-Proliferation Treaty Review Conference)]. *Puti k miru i bezopasnosti* – Pathways to Peace and Security. 2022. Issue 2 (63). Pp. 217–233. DOI: 10.20542/2307-1494-2022-2-217-233. (In Russ.).

53. Logvinov A. I. *Mezhdunarodno-pravovye aspekty regulirovaniya grazhdansko-pravovoy otvetstvennosti za yadernyy ushcherb: osnovnye ponyatiya i osobennosti* [International Legal Aspects of Regulating Civil Liability for Nuclear Damage: Key Concepts and Peculiarities]. *Alleya Nauki* – Alley of Science. 2023. Issue 1 (76). Pp. 763–767. Available at: https://alley-science.ru/domains_data/files/Collection_of_journals/Yanvar_2023.pdf?x25967. (In Russ.).

54. Lyakh N. N. *Puti sovershenstvovaniya mezhdunarodno-pravovykh usiliy dlya obespecheniya yadernoy bezopasnosti v ramkakh MAGATE* [Ways to Improve International Legal Efforts to Ensure Nuclear Safety Within the Framework of the IAEA]. *Voprosy rossiyskogo i mezhdunarodnogo prava* – Matters of Russian and International Law. 2021. Vol. 11. Issue 3A. Pp. 274–282. DOI: 10.34670/AR.2021.60.93.039. (In Russ.).

55. Lysenko M. N. *Yadernye tekhnologii i mezhdunarodnoe pravo (k 60-letiyu Mezhdunarodnogo Agentstva po Atomnoy Energii)* [Nuclear Technologies and International Law (to the 60th Anniversary of the International Atomic Energy Agency)]. *Zakon i pravo* – Law & Legislation. 2017. Issue 12. Pp. 15–18. (In Russ.).

56. Lysenko M. N. *Mezhdunarodnoe yadernoe pravo – eto otrasl' mezhdunarodnogo prava?* [Is the International Nuclear Law a Separate Branch of International Law?]. *Moskovskiy zhurnal mezhdunarodnogo prava* – Moscow Journal of International Law. 2016. Issue 4. Pp. 11–20. DOI: 10.24833/0869-0049-2016-4-11-20. (In Russ.).

57. Lysenko M. N. *Dogovor, ispytannyy vremenem (k 50-letiyu Dogovora o nerasprostranenii yadernogo oruzhiya)* [Time-Tested Treaty (on the occasion of the 50th Anniversary of the Treaty on the Non-Proliferation of Nuclear Weapons)]. *Zakon i pravo* – Law & Legislation. 2018. Issue 8. Pp. 15–19. DOI: 10.24411/2073-3313-2018-10088. (In Russ.).

58. Feldman D. I. *Sistema mezhdunarodnogo prava* [System of International Law]. Kazan, 1983. 119 p. (In Russ.).

59. Lebedeva Yu. V. *Osobennosti obrashcheniya radioaktivnykh otkhodov i otrabotavshego yadernogo topliva po pravu ES: diss. … kand. yurid. nauk* [Features of Handling Radioactive Waste and Spent Nuclear Fuel under EU Law: Cand. jurid. sci. diss.]. Moscow, 2022. 267 p. Available at: https://mgimo.ru/upload/diss/2022/Lebedeva_diss.pdf?utm_source=yandex.ru&utm_medium=organic&utm_campaign=yandex.ru&utm_referrer=yandex.ru. (In Russ.).

60. Lebedeva Yu. Draft Federal Act of the Russian Federation 'The Civil Liability for Nuclear Damage and Its Financial Security'. *Nuclear Law Bulletin*. 2014. Issue 94. Vol. 2014/2. Pp. 105–111. (In Eng.).

61. Likhachev M. A. *Ponimanie mezhdunarodnoy pravosub"ektnosti v rakurse inykh, smezhnykh kategoriy* [Understanding International Legal Personality in the Context of Other Related Categories]. *Vestnik Chelyabinskogo gosudarstvennogo universiteta* – Bulletin of Chelyabinsk State University. 2010. Issue 33 (214). Pp. 74–81. (In Russ.).

62. Marukhovska-Kartunova O., Bozhkov A., Romanchuk V., Bazov O., Grytsyshen D., Opanasiuk V. International Law (SDG'S): Regulation of Conflicts and International Relations. *Journal of Lifestyle and SDGs Review.* 2024. Vol. 4. Issue 1. Pp. 01–22. DOI: 10.47172/2965-730X.SDGsReview.v4.n00.pe01667. (In Eng.).

63. Moniz E. *Written Remarks for the Record*. IAEA General Conference, September 14, 2015. 2015. 12 p. Available at: https://www.iaea.org/sites/default/files/usa2015.pdf. (In Eng.).

64. Milanović M. Norm Conflicts, International Humanitarian Law and Human Rights Law. In: Ben-Naftali O. (ed.). *International Humanitarian Law and International Human Rights Law*. Oxford University Press, 2011. Pp. 95–126. (In Eng.).

65. Mikhaylenko E. B. (ed.). *Yadernyy mir: novye vyzovy rezhimu yadernogo nerasprostraneniya* [The Nuclear World: New Challenges to the Nuclear Non-Proliferation Regime]. Yekaterinburg, 2017. 432 p. Available at: https://elar.urfu.ru/bitstream/10995/52556/1/978-5-7996-2225-1_2017.pdf. (In Russ.).

66. Malyshev A., Gordon B. *«Otstuplenie» otvetstvennosti v oblasti ispol'zovaniya atomnoy energii* ['Departure' of Responsibility in the Field of Nuclear Energy Use]. *Byulleten' po atomnoy energii* – Bulletin on Atomic Energy. 2005. Issue 7. Pp. 21–26. Available at: https://elib.biblioatom.ru/text/byulleten-atomnoy-energii_2005_v7/p21/. (In Russ.).

67. Malinin S. A. *Chelovecheskoe izmerenie kak. obyazatel'nyy komponent vseob"emlyushchego podkhoda k mezhdunarodnoy bezopasnosti* [The Human Dimension as a Mandatory Component of the Comprehensive Approach to International Security]. *Izvestiya vysshikh uchebnykh zavedeniy. Pravovedenie* – Proceedings of Higher Educational Institutions. Pravovedenie. 1994. Issue 3. Pp. 40–47. (In Russ.).

68. Nepoklonov V. B., Khabarova I. A., Vorobey T. N. *Pravovoe regulirovanie vozmeshcheniya vreda, prichinennogo okruzhayushchey srede* [Legal Regulation of Compensation for Harm Caused to the Environment]. *Pravovye problemy vozmeshcheniya vreda, prichinennogo okruzhayushchey srede* [Legal Issues of Compensation for Harm Caused to the Environment]: Proceedings of the International Scientific and Practical Conference. Moscow, 2017. Pp. 31–33. Available at: https://publications.hse.ru/pubs/share/folder/jlroxqyem0/204585247.pdf. (In Russ.).

69. Nanda V., Pring G. *International Environmental Law and Policy for the 21st Century*. 2nd ed. Martinus Nijhoff Publishers, 2013. 684 p. (In Eng.).

70. Nye J. S. *Nuclear Ethics*. New York: Free Press, 1986. 162 p. (In Eng.).

71. Nick K. S., Burns S. G. (eds.). *Principles and Practice of International Nuclear Law*. NEA, 2022. Issue 7599. 520 p. (In Eng.).

72. Usanov V. I., Pupko L. P. *Rol' i osnovnye dostizheniya proekta INPRO v mezhdunarodnoy deyatel'nosti* [The Role and Main Achievements of the INPRO Project in International Activities]. Obninsk, 2019. 24 p. Available at: https://www.ippe.ru/images/publications/preprints/2019/0309_OB.pdf. (In Russ.).

73. O'Connell M. E. American Exceptionalism and the International Law of Self-Defense. *Denver Journal of International Law & Policy.* 2002. Vol. 31. Issue 1. Article 6. Pp. 43–57. Available at: https://digitalcommons.du.edu/cgi/viewcontent.cgi?article=1351&context=djilp. (In Eng.).

74. Ojovan M., Petrov V., Yudinstev S. (eds.). *Nuclear Waste Management and Sustainability*. 2023. 295 p. DOI: 10.3390/books978-3-0365-8607-6. (In Eng.).

75. Paramuzova O. G. *Sovremennye mezhdunarodno-pravovye problemy yadernoy bezopasnosti i radiatsionnoy zashchity* [Modern International Legal Problems of Nuclear Safety and Radiation Protection]. *Evraziyskaya integratsiya: ekonomika, pravo, politika* – Eurasian Integration: Economics, Law, Politics. 2020. Vol. 14. Issue 2. Pp. 56–64. DOI: 10.22394/2073-2929-2020-2-56-64. (In Russ.).

76. Parkhitko V. P. *Sovremennoe sostoyanie i budushchee mezhdunarodnogo yadernogo prava (nekotorye shtrikhi)* [The Current State and Future of International Nuclear Law (Some Highlights)]. *Moskovskiy zhurnal mezhdunarodnogo prava* – Moscow Journal of International Law. 2000. Vol. 3. Pp. 239–243. (In Russ.).

77. Parkhitko V. P. *Mezhdunarodnoe agentstvo po atomnoy energii: mezhdunarodno-pravovye voprosy struktury i deyatel'nosti: diss. … kand. yurid. nauk* [International Atomic Energy Agency: International Legal Issues of Structure and Activities: Cand. jurid. sci. diss.]. Moscow, 1967. 370 p. (In Russ.).

78. Ponomareva E. G., Frolov A. V. *Agressiya NATO protiv Yugoslavii: mezhdunarodno-pravovye, voenno-strategicheskie i geopoliticheskie posledstviya* [NATO Aggression Against Yugoslavia: International-Legal, Military Strategic and Geopolitical Consequences]. *Vestnik MGIMO-Universiteta* – MGIMO Review of International Relations. 2019. Issue 2(65). Pp. 32-56. DOI: 10.24833/2071-8160-2019-2-65-32-56. (In Russ.).

79. Rydell R. A Strategic Plan for Nuclear Disarmament: Engineering a Perfect Political Storm. *Journal for Peace and Nuclear Disarmament*. 2018. Vol. 1. Issue 1. Pp. 49–65. DOI: 10.1080/25751654.2017.1410386. (In Eng.).

80. Robinson M. Big Science Collaborations; Lessons for Global Governance and Leadership. *Global Policy.* 2021. Vol. 12. Issue 1. Pp. 66–80. DOI: 10.1111/1758-5899.12861. (In Eng.).

81. Ronzitti N. *Rescuing Nationals Abroad Through Military Coercion and Intervention on Grounds of Humanity*. Dordrecht: Martinus Nijhoff Publishers, 1985. xix+236 p. (In Eng.).

82. Rauf T. Initiatives and Multilateral Treaties on Nuclear Disarmament, Non-Proliferation and Arms Control. *SIPRI Yearbook 2017: Armaments, Disarmament and International Security*. 2017. Pp. 491–504. Available at: https://www.sipri.org/sites/default/files/SIPRIYB17c12sIII.pdf. (In Eng.).

83. Raetzke C. Nuclear Law and Environmental Law in the Licensing of Nuclear Installations. *Nuclear Law Bulletin*. 2013. Issue 92. Vol. 2013/2. Pp. 67–105; 309–342. (In Fr.; Eng.).

84. Stefanovich D. *O neprekhodyashchey tsennosti nerasprostraneniya yadernogo oruzhiya* [On the Enduring Value of Non-Proliferation of Nuclear Weapons]. *Vedomosti*. 2024, November 24. Available at: https://www.vedomosti.ru/opinion/columns/2024/11/24/1076926-o-neprehodyaschei-tsennosti. (In Russ.).

85. Starykh A. A., Likhachev V. V., Zolotukhina V. D. *Atomnaya energetika v obespechenii ustoychivogo razvitiya toplivno-energeticheskogo kompleksa rossii* [Nuclear Energy in Ensuring Sustainable Development of the Fuel and Energy Complex of Russia]. *REGION: sistemy, ekonomika, upravlenie* – REGION: Systems, Economics, Management. 2023. Issue 1 (60). Pp. 62–66. Available at: https://rseu.vrn.ranepa.ru/jfiles/25072023/22.pdf. (In Russ.).

86. Scheinman L. The Relevance of Nuclear Proliferation to Future European Security. *Cornell International Law Journal*. 1991. Vol. 24. Issue 3. Article 5. Pp. 469–478. Available at: https://scholarship.law.cornell.edu/cgi/viewcontent.cgi?article=1275&context=cilj. (In Eng.).

87. Schmid A. *Defining Terrorism*. International Centre for Counter-Terrorism (ICCT), 2023. 45 p. DOI: 10.19165/2023.3.01. Available at: https://icct.nl/sites/default/files/2023-03/Schmidt%20-%20Defining%20Terrorism_0.pdf. (In Eng.).

88. Sands P., Peel J. *Principles of International Environmental Law*. 4th ed. Cambridge University Press, 2018. 1032 p. (In Eng.).

89. Schmitt M. N. Military Necessity and Humanity in International Humanitarian Law: Preserving the Delicate Balance. *Virginia Journal of International Law*. 2010. Vol. 50. Issue 4. Pp. 795–839. Available at: https://www.onlinelibrary.iihl.org/wp-content/uploads/2021/07/Military-Necessity-Humanity-Balance.pdf. (In Eng.).

90. Stewart J. G. Towards a Single Definition of Armed Conflict in International Humanitarian Law: A Critique of Internationalized Armed Conflict. *IRRC*. 2003. Vol. 85. Issue 850. Pp. 313–350. Available at: https://international-review.icrc.org/sites/default/files/S00353 36100115199a.pdf. (In Eng.).

91. Sucharitkul S. State Responsibility and International Liability under International Law. *Loyola of Los Angeles International and Comparative Law Journal*. 1996. Vol. 18. Pp. 821–839. Available at: https://digitalcommons.law.ggu.edu/cgi/viewcontent.cgi?referer=&httpsredir=1&article=1225&context=pubs. (In Eng.).

92. Tunkin G. I. *Teoriya mezhdunarodnogo prava* [Theory of International Law]. Moscow, 2000. 397 p. Available at: https://rusneb.ru/catalog/000199_000009_000672600/. (In Russ.).

93. Tunkin G. I. *Mezhdunarodnoe pravo* [International Law]: a textbook. Moscow: Progress Publishers, 1986. 546 p. (In Eng.) Available at: https://lawcat.berkeley.edu/record/238671.

94. Thakur R. Nuclear Nonproliferation and Disarmament: Can the Power of Ideas Tame the Power of the State? *International Studies Review*. 2011. Vol. 13. Issue 1. Pp. 34–45. DOI: 10.1111/j.1468-2486.2010.00996.x. (In Eng.).

95. Fuong H.-V. *Zakonodatel'stvo i reglamentiruyushchie trebovaniya otnositel'no deyatel'nosti v yadernoy oblasti* [Legislation and Regulations Regarding Nuclear Activities]. *Byulleten' MAGATE* – IAEA Bulletin. 1984. Vol. 26. Issue 1. Pp. 53–56. Available at: https://www.iaea.org/sites/default/files/26105185154_ru.pdf. (In Russ.).

96. Chaevich A. V. *Rol' yadernogo oruzhiya v mirovoy politike: istoriya i sovremennost'* [The Role of Nuclear Weapons in World Politics: History and Modernity]. *Vlast'* – Power. 2021. Issue 6. Pp. 60–65. Available at: https://cyberleninka.ru/article/n/rol-yadernogo-oruzhiya-v-mirovoy-politike-istoriya-i-sovremennost. (In Russ.).

97. Wan W. *Nuclear Risk Reduction: A Framework for Analysis*. United Nations Institute for Disarmament Research, 2019. 40 p. Available at: https://unidir.org/files/2019-11/nuclear-risk-reduction-a-framework-for-analysis-en-.pdf. (In Eng.).

98. Witherspoon P. A., Bodvarsson G. S. (eds.). *Geological Challenges in Radioactive Waste Isolation: Third Worldwide Review*. University of California, 2001. 335 p. Available at: https://escholarship.org/content/qt8k17r675/qt8k17r675.pdf. (In Eng.).

99. Montjoie M. Treaty Implementation Applied to Conventions on Nuclear Safety. *Nuclear Law Bulletin*. 2015. Issue 96. Vol. 2015/2. Pp. 9–34. (In Eng.).

100. Ptasekaite R. The Role of the Regulator: Nuclear Safety and Nuclear Safety Culture. Dissertation for the International School of Nuclear Law, Montpellier 2011.

Информация об авторе:

Л. Каземи Шариат Панахи
Аспирант
Российский университет дружбы народов
имени Патриса Лумумбы
117198, Россия, г. Москва, ул. Миклухо-Маклая, 6

ORCID: 0000-0001-9318-167X
ResearcherID: AAE-1978-2022

Статьи в БД «Scopus» / «Web of Science»:
DOI: 10.17589/2309-8678-2021-9-4-128-157
DOI: 10.17072/1995-4190-2023-59-159-181

About the author:

L. Kazemi Shariat Panahi
RUDN University
6, Miklukho-Maklaya st., Moscow, 117198, Russia

ORCID: 0000-0001-9318-167X
ResearcherID: AAE-1978-2022

Articles in Scopus / Web of Science:
DOI: 10.17589/2309-8678-2021-9-4-128-157
DOI: 10.17072/1995-4190-2023-59-159-181