THE FOUR-PILLAR STRUCTURE OF INTERNATIONAL NUCLEAR LAW: NUCLEAR SAFETY, NUCLEAR SECURITY, NUCLEAR SAFEGUARDS AND LIABILITY(*)

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ABSTRACT

With the discovery and global expansion of nuclear energy, the need for an international nuclear law framework has emerged. Thus, realizing the advantages of the safe, secure, and peaceful use of nuclear technology and its applications in our daily lives depends on an international nuclear law framework. According to International Atomic Energy Agency (IAEA) nuclear law stands on four main 'pillars': nuclear safety, nuclear security, nuclear safeguards and liability. This study aims to trace the development of international nuclear law focusing particularly on its four-pillar structure. To this end, the study first examines the concept of international nuclear law, and then respectively focuses on nuclear safety, nuclear security, nuclear safeguards and civil liability for nuclear damage within the framework of international nuclear law. In this regard, the work of the IAEA, the world's international nuclear watchdog, towards ensuring that nuclear science and technology are used in a safe, secure, and peaceful manner has been assessed. The study also puts that all four pillars of international nuclear law has been expanded and improved due to the need in process and the particular challenges they have faced.

Keywords

Nuclear Energy, International Atomic Energy Agency (IAEA), Nuclear Safety, Nuclear Security, Nuclear Safeguards, Civil Liability for Nuclear Damage.

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ULUSLARARASI NÜKLEER HUKUKUN DÖRT SÜTUNLU YAPISI: NÜKLEER GÜVENLİK, NÜKLEER EMNİYET, NÜKLEER GÜVENCELER VE SORUMLULUK

ÖZET

Nükleer enerjinin keşfedilmesi ve küresel ölçekte yayılmasıyla birlikte, uluslararası bir nükleer hukuk çerçevesine duyulan ihtiyaç ortaya çıkmıştır. Bu nedenle, nükleer teknolojinin güvenli, emniyetli ve barışçıl kullanımının avantajlarının ve günlük hayatımızdaki uygulamalarının gerçekleştirilmesi, uluslararası bir nükleer hukuk çerçevesine bağlıdır. Uluslararası Atom Enerjisi Ajansı'na (IAEA) göre, nükleer hukuk dört ana "sütun" üzerinde yükselmektedir: nükleer güvenlik, nükleer emniyet, nükleer güvenceler ve sorumluluk. Bu çalışma, özellikle dört sütunlu yapısına odaklanarak uluslararası nükleer hukukun gelişiminin izini sürmeyi amaçlamaktadır. Bu amaçla, çalışmada öncelikle uluslararası nükleer hukuk kavramı incelenmekte, ardından uluslararası nükleer hukuk çerçevesinde sırasıyla nükleer güvenlik, nükleer güvenlik, nükleer güvenceler ve nükleer zararlara ilişkin hukuki sorumluluk konuları üzerinde durulmaktadır. Bu bağlamda, dünyanın uluslararası nükleer gözlemcisi olan IAEA'nın nükleer bilim ve teknolojinin güvenli, emniyetli ve barışçıl bir şekilde kullanılmasını sağlamaya yönelik çalışmaları değerlendirilmektedir. Çalışma ayrıca, uluslararası nükleer hukukun dört sütununun da süreçteki ihtiyaç ve karşılaştığı belirli zorluklar nedeniyle genişletildiğini ve iyileştirildiğini ortaya koymaktadır.

Anahtar Kelimeler

Nükleer Enerji, Uluslararası Atom Enerjisi Ajansı (IAEA), Nükleer Güvenlik, Nükleer Emniyet, Nükleer Güvenceler, Nükleer Zararlara İlişkin Hukuki Sorumluluk.

INTRODUCTION

President Eisenhower's so-called "Atoms for Peace" speech in 1953 laid the groundwork for the International Atomic Energy Agency (IAEA) and the Treaty on the Non-Proliferation of Nuclear Weapons (NPT)[1], two pillars that continue to guide the global strategy for guaranteeing that the world's most potent energy source is used solely for peaceful purposes. IAEA's "vision" and objectives of "preventing nuclear proliferation" and "promoting the peaceful use of atomic energy" is clearly emphasized in the Atom for Peace speech. Thus, in many ways, the "Atoms for Peace" plan formed the principles underpinnings of both the IAEA and the NPT.[2] In 1957 the Statue of IAEA came into force with a major mission to "seek to accelerate and enlarge the contribution of atomic energy to peace, health and prosperity throughout the world", and to "ensure that assistance provided by it or at its request or under its supervision or control is not used in such a way as to further any military purpose."[3] The Agency's main mission clearly indicates the dual-use nature of nuclear technology namely peaceful and military uses.

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1 **United Nations (UN)** (1968) Treaty on the Non-Proliferation of Nuclear Weapons (NPT) <https://www.un.org/en/conf/npt/2005/npttreaty.html> l.a.d. 11.03.2023.

Treaty on the Non-Proliferation of Nuclear Weapons (NPT) opened for signature 1 July 1968, entered into force 5 March 1970. NPT is a landmark international treaty standing on a three-pillar structure namely: nuclear nonproliferation, disarmament and the peaceful uses of nuclear energy. Its mission is to prevent the spread of nuclear weapons and weapons technology, to promote cooperation in the peaceful uses of nuclear energy, and to advance the goal of nuclear disarmament and general and full disarmament. NPT is regarded as the cornerstone of the global nuclear non-proliferation regime and nuclear disarmament with 191 state parties. Its 191 signatories are divided into two groups: nuclear-weapon states (NWS), which include the US, Russia, China, France, and the United Kingdom, and non-nuclear-weapon states (NNWS). The treaty commits the five NWS to achieving general and complete disarmament, while the NNWS agrees to refrain from developing or acquiring nuclear weapons. In every five years state parties gather together in order to review the implementation of the Treaty and make projections for the future of it in Review Conferences (RevCons).

2 **Pilat, Joseph F.** (2007) (Editor), Atoms for Peace: A Future after FiftyYears? Baltimore, Johns Hopkins University Press/Woodrow Wilson Center Press, p. 3-4.

3 **International Atomic Energy Agency (IAEA)** (1989) Statute, Vienna <https://www.iaea.org/sites/default/files/statute.pdf> l.a.d. 02.02.2023.

It can be said that, since the establishment of the IAEA strong nuclear legal frameworks have been developed at the national, regional, and global levels. However, due to various challenges such as nuclear accidents, international terrorist attacks and discovery of clandestine nuclear weapons programs, international community has witnessed the emergence of new and strengthened existing international legal instruments on nuclear and radiation safety, nuclear security, safeguards, and civil liability for nuclear damage. International nuclear legal framework, in another words international nuclear law, acts as an umbrella for the establishment and development for these legal instruments.

This study first examines the concept of international nuclear law, and then respectively focuses on nuclear safety, nuclear security, nuclear safeguards and civil liability for nuclear damage within the framework of international nuclear law. It also aims to provide an historical perspective regarding the development of these four pillars of international nuclear law in order to assess the challenges they faced and put forward their respective replies to these challenges.

I. INTERNATIONAL NUCLEAR LAW

Each country's use of nuclear energy is governed by a framework of national laws, which are frequently based on internationally agreed-upon principles. Thus, in order to achieve assurance regarding the peaceful uses of nuclear energy, a complete and effective international legal framework must exist to protect the public's health, safety, and security as well as the environment. These frameworks include national regulations, bilateral and multilateral cooperation measures, and international harmonization of national policies and legislation via adherence to international conventions. These legal frameworks must be powerful enough to set and enforce boundaries while also being adaptable enough to keep up with technological improvements and address developing issues within the societies.

The focus of international nuclear law is on balancing the benefits of nuclear technology while reducing danger. As IAEA Director Rafael Grossi puts it clearly, its goal is to provide "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."[4]

II. INTERNATIONAL NUCLEAR LAW FRAMEWORK REGARDING NUCLEAR SAFETY

Nuclear power facilities are developed in accordance with the idea of defense in depth, which refers to "multiple layers of protection aimed at reducing risks to both the public and workers." A report by the International Nuclear Safety Advisory Group states that:

> "All safety activities, whether organizational, behavioral or equipment related, are subject to layers of overlapping provisions, so that if a failure should occur it would be compensated for or corrected without causing harm to individuals or the public at large. This idea of multiple levels of protection is the central feature of defence in depth"[5]

1979 Three Mile Island accident in the US helped to identify and eliminate flaws in defense in depth while also emphasizing the importance of human factors and the human-machine interface during times of crisis.[6] However, the most serious wake-up call regarding the nuclear safety was the Chernobyl nuclear power plant accident in the Union of Soviet Socialist Republics (USSR) on 26 April 1986. The 11 March 2011 catastrophe at Fukushima Daiichi nuclear power plant in Japan was the second most significant accident in the history of nuclear energy. It can be said that both of those accidents paved the way not only for thinking on new legal measures regarding safety of nuclear power plants but also, they have proved that nuclear accidents can happen, and higher standards of nuclear safety is needed both at the national and international

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4 **Grossi, Rafael Mariano** (2022) "Nuclear Law: The Global Debate": International Atomic Energy Agency (Editor), Nuclear Law. T.M.C. Asser Press, p. 4.

5 **International Atomic Energy Agency (IAEA)** (1996) Defence in depth in nuclear safety: INSAG-10. Report by the International Nuclear Safety Advisory Group. <https://www.pub.iaea.org/MTCD/publications/PDF/Pub1013e_web.pdf> l.a.d. 07.07.2023.

6 **Kim, Duyeon/Kang, Jungmin** (2012), "Where Nuclear Safety and Security Meet", Bulletin of the Atomic Scientists V: 68, I:1, p. 87.

levels. Particularly Fukushima accident "underlined the lack of a reliable universal liability framework, reflecting the inability of the international community to achieve a universal harmonized regime."[7]

International legal framework for nuclear safety which exists today is established following the Chernobyl accident. The "Convention on Early Notification of a Nuclear Accident"[8] and the "Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency"[9] were the first two international legal documents adopted in the same year just the months after this accident. The former Convention "establishes a notification system for nuclear accidents from which a release of radioactive material occurs or is likely to occur and which has resulted or may result in an international transboundary release that could be of radiological safety significance for another State."[10] It compels states to notify the time, location, nature, and other information necessary for assessing the situation. Notifications should be sent to impacted countries directly or through the IAEA. Agency should also be informed if the direct notification is the case. Any nuclear accident involving the facilities and activities described in Article 1 must be reported.

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7 **Abraham, Mohit** (2014) Nuclear Liability: A Key Component of the Public Policy Decision to Deploy Nuclear Energy in Southeast Asia, Cambridge, American Academy of Arts and Sciences, <https://www.amacad.org/sites/default/files/publication/downloads/nuclearLiability.pdf> l.a.d. 24.07.2023.

8 **International Atomic Energy Agency (IAEA)** (1986a) Convention on Early Notification of a Nuclear Accident, opened for signature in September 1986 and entered into force 27 October 1986. As of 11 February 2022, the Convention has 132 state parties. <https://www.iaea.org/topics/nuclear-safety-conventions/convention-early-notification-nuclear-accident> l.a.d. 02.02.2023.

9 **International Atomic Energy Agency (IAEA)** (1986) Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency, opened for signature in September in 1986 and entered into force 26 February 1987. As of 04 October 2022, the Convention has 127 state parties. <https://www.iaea.org/topics/nuclear-safety-conventions/convention-assistance-case-nuclear-accident-or-radiological-emergency> l.a.d. 02.02.2023.

10 **International Atomic Energy Agency (IAEA)** (1986b) INFCIRC/335, 18 November 1986, <https://www.iaea.org/sites/default/files/infcirc335.pdf> l.a.d. 02.02.2023.

The facilities and activities referred to in Article 1 are the following:

"(a) any nuclear reactor wherever located,

(b) any nuclear fuel cycle facility,

(c) any radioactive waste management facility,

(d) the transport and storage of nuclear fuels or radioactive wastes,

(e) the manufacture, use, storage, disposal and transport of radioisotopes for agricultural, industrial, medical and related scientific and research purposes; and

(f) the use of radioisotopes for power generation in space objects."[11]

On the other hand, the latter Convention focuses on establishing an international framework for cooperation among States Parties and with the IAEA in order to provide immediate aid and support in the event of a nuclear accident or radiological emergency. States are required to notify the IAEA of their available specialists, equipment, and materials for assistance.[12]

These two conventions which would be labeled as post-Chernobyl safety conventions were followed by another significant convention on nuclear safety in 1994: Convention on Nuclear Safety.[13] By outlining core safety standards that States would abide by the convention seeks to obligate Contracting Parties operating land-based civil nuclear power facilities to maintain a high level of safety. The Convention is founded on the Parties' shared desire to achieve higher standards of safety, which will be developed and promoted through frequent meetings. It requires Parties to submit reports on their compliance

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[11] **International Atomic Energy Agency (IAEA)** (1986b).

[12] **International Atomic Energy Agency (IAEA)** (1986c) INFCIRC/336, 18 November 1986, <https://www.iaea.org/sites/default/files/infcirc336.pdf> l.a.d. 02.02.2023.

[13] **International Atomic Energy Agency (IAEA)** (1994) Convention on Nuclear Safety was opened for signature 20 September 1994 and entered into force on 24 October 1996. As of 15 March 2021, the Convention has 91 state parties. <https://www.iaea.org/sites/default/files/infcirc449.pdf> l.a.d. 02.02.2023.

with their duties for "peer review" at meetings convened at IAEA Headquarters. This mechanism is the Convention's most "innovative and dynamic element".[14] Furthermore, in 1997, a complementary legal text has been opened for signature. The "Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management" was first legal instrument which addresses the issue of spent fuel and radioactive waste management safety.[15]

As it is very clear, these four cornerstone conventions dealing with nuclear safety on the global scale were all adopted before the Fukushima Daiichi nuclear accident dated 11 March 2011. Just after the accident, IAEA Member States came together and adopted an Action Plan on Nuclear Safety which aims to strengthen nuclear safety, emergency preparedness and radiation protection of people and the environment worldwide[16]

Significant importance of nuclear safety as a pillar of international nuclear law becomes clearer as concrete cases in nuclear history are taken into account. In his book titled "Command and Control: Nuclear Weapons, the Damascus Accident, and the Illusion of Safety" published in 2013, Eric Schlosser reveals that cases of "accidents", "near-misses", and "technological breakthroughs" with support of archive documents. Cuban missile crisis of October 1962 as a near-miss is regarded as the single most dangerous moment of the Cold War which brought the two superpowers of the Cold war on the edge of a nuclear war. The book also tells in a historical novel language how the usage of these weapons was

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[14] **Caruso, Gustavo (2018)** "IAEA's Nuclear Safety and Nuclear Security Worldwide": Maiani, Luciano et al. (Editors), International Cooperation for Enhancing Nuclear Safety, Security, Safeguards and Non-proliferation-60 Years of IAEA and EURATOM, Heidelberg: Springer, p.8.

[15] **International Atomic Energy Agency (IAEA)** (1997) Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management entered into force on 18 June 2001. As of 20 February 2023, the Convention has 89 state parties. <https://www.iaea.org/sites/default/files/infcirc546.pdf> l.a.d. 02.02.2023.

[16] **International Atomic Energy Agency (IAEA)** (2011) Draft IAEA Action Plan on Nuclear Safety, GOV/2011/59-GC (55)/14, <https://www.iaea.org/topics/nuclear-safety-action-plan> l.a.d. 02.02.2023.

very close due to the malfunctioning of some computer systems. For instance, the problems experienced in the system due to the failure of a computer chip worth 46 cents.[17]

In order to protect individuals and environment from ionizing radiation nuclear safety and nuclear security acts hand in hand in a legal framework. As is works in the nuclear security field, the Agency has been working towards to ensure nuclear security worldwide particularly following 9/11 terrorist attacks in the United States of America (the US). Nuclear security as the second major pillar of the international law, presents significant importance in order to keep the nuclear related materials and facilities outside of the hands of malicious actors.

III. INTERNATIONAL NUCLEAR LAW FRAMEWORK REGARDING NUCLEAR SECURITY

Nuclear security seeks to prevent non-State actors from obtaining nuclear and other radioactive material and using it for malicious purposes. Putting the development of international nuclear security framework in a historical perspective is important not only in order to understand and assess the need for changes in this pillar of nuclear law but also to clearly see the challenges it has faced.

1980 Convention on the Physical Protection of Nuclear Material (CPPNM)[18] can be regarded as the first security measures for the physical protection of nuclear material. The Convention is the only international legally obligatory undertaking in the field of nuclear material physical protection. It

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[17] **Schlosser, Eric** (2013) Command and Control: Nuclear Weapons, the Damascus Accident, and the Illusion of Safety, Penguin Press, 2013.

[18] **International Atomic Energy Agency (IAEA)** (2005) Convention on the Physical Protection of Nuclear Material (CPPNM), opened for signature 3 March 1980, entered into force 8 February 1987. CPPNM has been amended in 2005 following 9/11 terrorist attacks. Amendment to the Convention on the Physical Protection of Nuclear Material, entered into force 8 May 2016. As of 20 September 2021, the Convention has 164 state parties. <https://www.iaea.org/sites/default/files/infcirc274r1.pdf> l.a.d. 02.02.2023.

specifies measures for the prevention, identification, and punishment of nuclear-related offenses.[19] It also calls for increased collaboration between and across states in "locating" and "recovering" stolen or smuggled nuclear material, mitigating any radioactive repercussions of sabotage, and preventing and combating associated offenses.

The threat of nuclear and radiological terrorism invaded the international agenda following the 9/11 terrorist attacks. It can be said that these attacks demonstrated a significant challenge for this pillar and emphasized the necessity for major modifications in nuclear security systems designed to handle threats to nuclear plants. Furthermore, since 9/11, the term nuclear security has begun to be used to describe methods of preventing nuclear terrorism.[20] In order to reply to this challenge international efforts led by the US took place and states agreed to strengthen current international legal instruments for nuclear security. Furthermore, international community showed enthusiasm to create new nuclear security rules in order to improve global nuclear security and strengthen the IAEA's role.

In particular, in 2005 an agreement was achieved to as an Amendment to strengthen the CPPNM. It can be said that in a number of critical areas, the Amendment to the CPPNM greatly strengthens the original CPPNM. Firstly, it broadens the original convention's scope and includes physical safeguards for nuclear installations and radioactive material which are solely used for peaceful purposes in domestic use, storage, and shipping. Secondly, it also strengthens international collaboration in light of the expanded scope, such as support and information exchange in the event of sabotage. Furthermore, by criminalizing offenses related to illicit trafficking and sabotage of nuclear material or nuclear installations the Amendment significantly strengthens existing measures, "to ensure the prevention, detection and punishment of such offences."[21]

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19 **Caruso, Gustavo** (2018), p.8.

20 **Kim, Duyeon/Kang, Jungmin,** p. 88.

21 **International Atomic Energy Agency (IAEA)** (2005).

Another important convention on nuclear terrorism signed in 2005 came into force in 2007 under the United Nations (UN) auspices. On 13 April 2005 the UN the General Assembly unanimously approved the International Convention for the Suppression of Acts of Nuclear Terrorism (ICSANT).[22] By making a broader definition on materials and facilities covering both military and peaceful applications than the Convention on the Protection of Nuclear Materials, ICSANT covers a wide range of acts and possible targets, including nuclear power plants and nuclear reactors. Although the official definition of the term "nuclear terrorism" was not clarified in the Convention Article 2 puts a list of offences by a person committed "unlawfully" and "intentionally". In this regard, ICSANT criminalizes the planning, threatening, or carrying out acts of nuclear terrorism.[23] That is mainly because "acts of nuclear terrorism may result in the gravest consequences and may pose a threat to international peace and security" as it is stated in the preamble of the Convention.

Following the 9/11 terrorist attacks two significant UN Security Council (UNSC) Resolutions were also adopted unanimously. UNSC Resolution 1373 which as adopted on 28 September 2001 states that all states should "ensure that terrorist acts are established as serious criminal offences in domestic laws and regulations and that the seriousness of such acts is duly reflected in sentences served."[24] Furthermore, UNSC Resolution 1540 which was adopted unanimously on 28 April 2004, focuses on the "proliferation of nuclear, chemical and biological weapons", and states that these weapons of mass destruction (WMD) "constitutes a threat to international peace and security." UNSC aims to prevent the spread of weapons of mass destruction to non-state actors by deciding that all states "shall refrain from providing any form of

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22 **United Nations (UN)** (2005) Office for Disarmament Affairs, International Convention for the Suppression of Acts of Nuclear Terrorism (ICSANT) <https://treaties.unoda.org/t/icsant> l.a.d. 14.03.2023.

23 **Cameron, Gavin** (2016) "Formal and Informal Mechanisms for Countering Nuclear Terrorism: The ICSANT and the GICNT" in Knopf, Jeffrey W. International Cooperation on WMD Nonproliferation. University of Georgia Press, 2016.

24 **United Nations (UN)** (2001) Security Council Resolution 1373, S/RES/1373.

support to non-State actors that attempt to develop, acquire, manufacture, possess, transport, transfer or use nuclear, chemical or biological weapons and their means of delivery;[25]

In addition to high levels of safety and security, effective safeguards are a vital component of nuclear law. As the third pillar of the international nuclear law, IAEA's nuclear safeguards system has experienced important improvements due to the global challenges it has faced.

IV. INTERNATIONAL NUCLEAR LAW FRAMEWORK REGARDING NUCLEAR SAFEGUARDS

Since its establishment, the IAEA has been regarded as the sole international authority in charge of verifying and assuring that states are not developing nuclear weapons. The evolution of the IAEA safeguards system in order to safeguard nuclear material and related technology for peaceful uses began at a time when many governments throughout the world were concerned that nuclear weapons would dominate their arsenals. In 1959, the Agency signed the first safeguards agreement with Canada and Japan. After the entry into force of the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) in 1970, the IAEA's safeguards work redefined considerably.

NPT makes a distinction between nuclear-weapon states (NWSs) and non-nuclear-weapon States (NNWSs) in terms of their respective duties and responsibilities regarding its three-pillared structure. According to the NPT, NNWSs must enter into so-called 'comprehensive' or 'full-scope' safeguards agreements (CSAs) with the IAEA, which apply to "all source or special fissionable material in all peaceful nuclear activities within such State's territory, under its jurisdiction, or carried out under its control anywhere," according to the article III of the NPT.[26] In states with CSAs, safeguards implementation activities were

[25] **United Nations (UN)** (2004) Security Council Resolution 1540, S/RES/1540 <https://documents-dds-ny.un.org/doc/UNDOC/GEN/N04/328/43/PDF/N0432843.pdf?OpenElement> l.a.d. 11.03.2023.

[26] **United Nations (UN)** (2004).

primarily focused on verifying nuclear facilities and material declared by a State, such as verifying the "correctness" of State declarations as well as providing guarantees that declared nuclear material is not being diverted from peaceful nuclear activities in the State. That means the completeness of the State's declarations was not included.

As it is mentioned The IAEA CSAs do not authorize the Agency to manage other than the facilities and venues that states have notified to the Agency. Their only function is to monitor, direct and control states' use of nuclear elements for non-military purposes. It also does not aim to keep an account of the nuclear materials held by the states at the national level. The IAEA had the opportunity to realize the first application of the aforementioned safeguard controls in 1956, when Japan demanded three tons of natural uranium for a research reactor in its country. In accordance with the article XI of the IAEA Statute a bilateral agreement had to be signed between Japan and the Agency to ensure that the uranium to be provided would not be used for military purposes.[27]

In this period, there is strong evidence that many threshold states took advantage of the loopholes in the export control policies of the states to illegally obtain materials and materials for their nuclear activities that are not subject to security inspection. The most obvious example of this is the revelation that a uranium conversion (uranium hexafluoride) plant was smuggled into Pakistan by an agricultural engineering firm in West Germany. This experience led West Germany to change its export policy.[28]

IAEA inspectors, who entered the country in April after the First Gulf War in 1991, found that Saddam Hussein's regime was deployed in different parts of the country and was carrying out advanced nuclear program activities. According to David Sloss, the emergence of Iraq's nuclear program was important in two respects. First, the fact that a state party to the NPT and under

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[27] **Fischer, David** (1997) "Safeguards: Past, Present, and Future." IAEA Bulletin, V: 39, N: 4, p. 31-36.

[28] **Müller, Harald et. al.** (Editor) (1994) Nuclear Non-Proliferation and Global Order, Oxford University Press, p. 34.

the Agency's security controls had secretly carried out such a program pointed to the Agency's weakness in enforcing security controls. Second, the Iraqi experience convinced the international community that it was possible to uncover secret nuclear materials and facilities with a more aggressive approach.[29] In that case, even more surprising fact was that one of the nuclear facilities, which apparently had not been reported to the Agency, was located right next to the Tuwaitha Nuclear Research Reactor, which was inspected by IAEA inspectors.[30]

The uncovering of Iraq's clandestine nuclear weapons program and other undeclared nuclear activities in the beginning of 1990s highlighted the necessity for the IAEA's safeguards activities to take CSA States as a whole into greater consideration. After this experience, Director General Hans Blix, speaking at the IAEA General Assembly in 1991, stated that the Agency's safeguards system should have "more teeth". According to Blix, safeguards should have three basic features in order to reveal covert nuclear activities: i) The Agency should be able to inspect suspected areas with a short notice, ii) Member states should share intelligence information with the Agency so that the Agency can determine which areas to inspect, iii) Agency must have the full support of the Security Council in its oversight powers.[31]

This discovery, along with the IAEA's detection of possible undeclared plutonium in the Democratic People's Republic of Korea (DPRK) in 1992[32]

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[29] **Sloss, David** (1995) "It's Not Broken So Don 't Fix It: The International Atomic Energy Agency Safeguards System and the Nuclear Nonproliferation Treaty", Virginia Journal of International Law, I: 35, p. 862-863.

[30] **Scheinman, Lawrence** (1993) "Lessons from Post-War Iraq for the International Full-Scope Safeguards Regime", Arms Control Today, V: 23, I: 3, p. 3-6; Also see: **Keeley, James F.** (1993) The IAEA and the Iraqi Challenge: Roots and Responses, International Journal, Winter, 1993/1994, V: 49, N: 1, p. 126-155.

[31] **Müller, Harald** (Editors) p.139.

[32] **International Atomic Energy Agency (IAEA),** Fact Sheet on DPRK Nuclear Safeguards, <https://www.iaea.org/newscenter/focus/dprk/fact-sheet-on-dprk-nuclear-safeguards> l.a.d. 12.03.2023.

prompted efforts to strengthen the IAEA's capability to ensure that safeguards are applied as required by CSAs on all nuclear material in States with CSAs. These in line experiences in Iraq, the DPRK, and South Africa shaped the IAEA's future work to strengthen the safeguards system. In 1993, "Programme 93+2" established in order to increase the IAEA's capacity to identify nuclear material and activities that have not been declared in countries with CSAs.[33] Another legal measure in order to strengthen the Agency's safeguards system came in 1997 as the Model Additional Protocol (AP).[34] The AP which grants inspectors the ability to conduct through searches in the inspected state provides for extra information and greater access for the IAEA in order to access gaps required by CSAs in order to verify the "completeness" of the states' declarations. Thus, the Agency could more confidently guarantee the world that no nuclear material is missing or has been diverted. It is clear that the Model Additional Protocol is critical for the Agency to acquire a fuller picture of States with CSAs' present and proposed nuclear programs, nuclear fuel cycle related activities, and nuclear material holdings. Thus, the entry into force and implementation of an additional protocol (AP) in a State with a CSA is critical for the IAEA to provide assurances about the exclusive use of nuclear energy.[35]

As it has been emphasized, IAEA has safeguards authority over additional verification and monitoring procedures as well as the observance of safeguards

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[33] The term "93+2" refers to the original target of finishing a plan of action in two years, in time for the 1995 NPT Review and Extension Conference. By "Programme 93+2" IAEA implemented new monitoring methods, such as environmental sampling and the use of surprise inspections at significant measurement locations inside of declared nuclear plants, which did not call for the creation of new legal frameworks for their application.

[34] **International Atomic Energy Agency (IAEA)** (1997a) Model Protocol Additional to the Agreement(s) between State(s) and the International Atomic Energy Agency for the Application of Safeguards, INFCIRC/540 (Corrected) <https://www.iaea.org/topics/additional-protocol> l.a.d. 02.02.2023.

As of 28 November 2022, Additional Protocols are in force with 140 States and Euratom. Another 13 States have signed an Additional Protocol but have yet to bring it into force.

[35] **Rockwood, Laura** (2015) "The IAEA and International Safeguards" in Pilat, Joseph / Busch, Nathan E. (Editors), Nuclear Proliferation and Policy, Abingdon, Routledge, s.146-147.

agreements. In accordance with the Agency's statute, the Director General is empowered to inform the Board of Governors about problems with the implementation of safeguards in States with CSAs. In the past, the Board discovered that those States were not complying with their safeguards duties in some of those circumstances, and the UN Security Council was informed of this.

It is commonly argued that the major challenge for comprehensive safeguards reaching full effectiveness is their lack of universality. According to the IAEA, universality will be attained when all NNWSs Party to the NPT have fulfilled their commitment under Article III of the NPT to enter into a CSA with the IAEA. Today 8 NNWSs Parties to the NPT have not finalized a CSA with the agency. It can also be said that for the AP the challenge is more concrete since 47 states have not brought into force an AP to their standing CSAs.

The full picture of the international nuclear law would be regarded as complete with its fourth pillar: civil liability for nuclear damage. In addition to enforcing high standards of safety, security, and safeguards, nuclear law also regulates the legal methods to guarantee "adequate" and "prompt" compensation in the event of a nuclear incident which would also have transboundary effects. Nuclear accidents that the international community has witnessed so far also paved the way for the further development of this regime and to reinforce the rights to compensation.

V. INTERNATIONAL NUCLEAR LAW FRAMEWORK REGARDING CIVIL LIABILITY FOR NUCLEAR DAMAGE

In the 1950s, risks arising from peaceful uses of nuclear energy have been increased as the production nuclear energy for peaceful purposes advanced. The potential liabilities in the applicable legal jurisdictions determine civil liability for nuclear damage. Potential civil liabilities for nuclear damage arise in both international and national law in the nuclear liability field.[36] Thus, one can easily follow the national and international legal efforts in the field of nuclear liability

[36] **Bellamy Jonathan** (2019) "Civil Liability for Nuclear Damage in Countries Developing Nuclear New Build Programmes", Journal of World Energy Law and Business, I: 12, p. 108.

since "several states felt, that liability in the field of peaceful uses of nuclear energy should be subject to a special legal framework."[37] Due to the need for a specific legal framework to ensure adequate compensation for harm to people and property resulting from a nuclear accident, the establishment process for a general framework for third party nuclear liability was initiated.

The very first two conventions' negotiations in this field date back to 1960s. First of all, "Paris Convention on Third Party Liability in the Field of Nuclear Energy" which was opened for signature on 29 July 1960 finally entered into force 1 April 1968. Then, "Vienna Convention on Civil Liability for Nuclear Damage", opened for signature 21 May 1963, entered into force 12 November 1977. Both the Paris and Vienna Conventions seek to harmonize national laws governing civil liability for nuclear damage.[38]

As it has been mentioned under the nuclear safety pillar, similarly, 1986 Chernobyl accident was also a turning point for the development on the nuclear law regarding civil liability for nuclear damage. Following this date, international community has negotiated and adopted several multilateral treaties in order to strengthen international nuclear liability regime. First, the "Joint Protocol Relating to the Application of the Vienna Convention and the Paris Convention" (Joint Protocol) was established in 1988 under the joint auspices of the Organisation for Economic Co-operation and Development (OECD) and the IAEA to establish a treaty link between the Paris and Vienna Conventions. It entered into force on 27 April 1992. The adoption of the Joint Protocol is regarded as a major step forward in the post-Chernobyl development of international law governing the peaceful uses of nuclear energy.[39] Furthermore, the "Convention on Supplementary Compensation for

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[37] **Handrlica, Jakub/Novotná, Marianna** (2018) "The Vienna Convention on Civil Liability for Nuclear Damage: Past, Evolution and Perspectives", Juridical Tribune, V: 8, Special Issue October, p. 50.

[38] **International Atomic Energy Agency (IAEA),** Nuclear liability conventions. <https://www.iaea.org/topics/nuclear-liability-conventions> l.a.d. 02.02.2023.

[39] **Handrlica, Jakub/Novotná, Marianna**, p. 57.

Nuclear Damage" (CSC) and the "Protocol to Amend the Vienna Convention" were adopted in 1997 under the auspices of the IAEA. They entered into force on 15 April 2015 and 4 October 2003 respectively. Thirdly, the "Protocol to Amend the 1963 Vienna Convention on Civil Liability for Nuclear Damage" is opened for signature 29 September 1997 and entered into force 4 October 2003. Finally, Protocols to amend the Paris Convention and the Brussels Supplementary Convention were adopted in 2004 under the auspices of the OECD. Both instruments include significant enhancements in terms of the "amount of compensation available", the "scope of damage covered", and the "allocation of jurisdiction".

It should also be mentioned that the 1997 CSC which finally entered into force in April 2015, brings the world community one step closer to establishing an international nuclear liability regime. The 1997 CSC establishes a framework for establishing a worldwide system to which both nuclear and non-nuclear countries must abide. Although 1997 CSC has 11 state parties today it covers 117 reactors worldwide. Thus, it is regarded as the unique tool for international nuclear liability regime by addressing the interests of all states that may be impacted by a nuclear disaster by covering the biggest number of nuclear power reactors on earth. However, due to the fact that the majority of Paris Convention States have also signed the Joint Protocol, but none have signed the CSC, the CSC's work would be regarded as a critical "work in the progress" for the future of international nuclear liability regime. As a result, it can be argued that the most significant challenge that faces international nuclear liability regime today is the lack of universal adherence to its legal instruments by several countries with NPPs.

However, the international community has recently witnessed some positive developments for the regime as a result of the intensive international efforts. As it has been mentioned above, the protocols to amend two important legal instruments in the nuclear liability regime which have been adopted in 2004 were ratified on 17 December 2021. The "Protocol to amend the Paris Convention on Third Party Liability in the Field of Nuclear Energy" and "Protocol to amend the Brussels Convention Supplementary to the Paris Convention" "not only bring the highest guaranteed amount of compensation

available in case of nuclear accident" but also they enhance the "geographic scope" and filing claims over a longer period of time.[40] It is stated in the Nuclear Energy Agency of the OECD press release that "a total of 16 countries will be parties to the amended Paris Convention, covering 105 operating reactors and 7 under construction, out of a total of 442 operating reactors worldwide and 51 under construction. Of those countries, 13 are also parties to the amended Brussels Supplementary Convention."[41]

The above-mentioned treaties established an international legal regime based on a number of general principles. According to the IAEA these general principles can be summarized as the following:

> "(a) Exclusive liability of the operator of a nuclear installation, i.e., no other person may be held liable for nuclear damage ('legal channelling of liability'),
>
> (b) Strict liability of the operator, i.e., the operator is liable regardless of any fault on its part,
>
> (c). Minimum amount of liability, i.e., the operator's liability may be limited by the State but not below a certain amount, which differs depending on the applicable treaty,

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[40] **Organisation for Economic Co-operation and Development (OECD)** (2021) Nuclear Energy Agency, NEA Press Release: New Treaties to Strengthen Rights of People Affected by Nuclear Accidents, NEA/COM(2021)1, 17 December 2021, <https://one.oecd.org/document/NEA/COM(2021)1/en/pdf> l.a.d. 02.02.2023. According to the revised version of the Paris Convention, the operator will be liable for at least EUR 700 million, and the public funds made available under the Brussels Supplementary Convention will add up to EUR 1.5 billion (previously it as 5 million). Furthermore, a larger variety of damages, including economic loss, the cost of preventive measures, and the cost of steps to restore the damaged environment, may be claimed over a longer time period which is 30 years following a nuclear incident (instead of 10 years). It also broadens its "geographical scope", allowing affected persons in certain countries that are not parties to the Paris Convention to file claims "in case they suffer damage or loss as a result of ionising radiation emitted from an accident in a nuclear installation or a transport of nuclear substances, that are under the responsibility of a nuclear operator situated in a Paris Convention State."

[41] **Organisation for Economic Co-operation and Development (OECD)** (2021).

(d). Mandatory financial coverage, i.e., the operator's liability must be covered by insurance or other financial security, in order to ensure the availability of funds to compensate the victims,

(e) Exclusive jurisdiction of the courts of one State, normally the State where the s, so that the victims of nuclear damage do not need to bring their compensation claims in multiple forums."[42]

It is clear that, adherence of "an established, predictable legal framework", as well as the "availability of appropriate insurance for an operator's civil liability for nuclear damage", are critical components of a nuclear program's operation for all stakeholders which includes national governments, operators, supply chain contractors, and the populations affected.[43] However, the most serious challenge that the international nuclear liability framework faces today is a lack of universal adherence to its legal instruments by a number of countries having NPPs.

Furthermore, as Katia Boustany, a professor at the Legal Science Department of the University of Quebec puts it in her article in the OECD's Nuclear Law Bulletin "it is, naturally, essential that the operator or licence holder be subject to a regime of objective and exclusive liability. It is just as vital for a State to know that its international liability can be invoked for breach of a rule of international law or negligence in actually implementing this regime or doing so effectively."[44]

CONCLUSION

According to the Power Reactor Information System (PRIS) of the IAEA, as of July 2023, more than 410 power reactors are operating on a global scale,

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[42] **International Atomic Energy Agency (IAEA)** (2020) "Legal Framework on Civil Liability for Nuclear Damage", (2020/2) <https://www.iaea.org/sites/default/files/20/09/legal-framework-on-civil-liability-for-nuclear-damage.pdf> l.a.d. 15.03.2023.

[43] **Bellamy Jonathan**, p. 108.

[44] **Organisation for Economic Co-operation and Development (OECD) (1998)** Nuclear Energy Agency, Nuclear Law Bulletın N: 61, p. 53.

accounting for more than 10% of all electricity produced and more than a quarter of all low-carbon electricity. There are currently more than 50 reactors being built, nine of which are in nations building their first nuclear power plant.[45] The foundation for international nuclear law has arisen in response to the global spread of nuclear energy. It has been continuously enhanced, fostering the safe, secure, and long-term expansion of nuclear energy's peaceful applications, as the social, economic, scientific, and technological difficulties associated to its development are addressed.

An international nuclear law framework is therefore necessary for us in order to benefit from the advantages of the safe, secure, and peaceful use of nuclear technology and its uses in our daily lives. As IAEA puts it, international nuclear law arises on the four critical pillars: nuclear safety, nuclear security, nuclear safeguards and civil liability for nuclear damage. All of these pillars are closely interconnected with each other not only in terms of the actors in charge of law-making and implementing but also the challenges that they have faced. Thus, understanding the development of these four pillars an historical perspective is essential in order to assess the challenges they faced and analyze their respective replies to these challenges.

Chernobyl nuclear accident in 1986 sounded the alarm for the safety of nuclear energy worldwide. The Fukushima Daiichi nuclear disaster in 2011 refocused international attention on nuclear safety concerns while also providing an opportunity for the international community to re-examine the international nuclear legal framework. Further concerns about global nuclear liability have been expressed in the wake of the Fukushima Daiichi tragedy. However, unlike the Chernobyl event, which led to a number of adjustments to the global nuclear liability scheme, the Fukushima incident has not yet resulted in any reforms.[46]

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[45] **International Atomic Energy Agency (IAEA),** The Power Reactor Information System (PRIS), "The Database on Nuclear Power Reactors", <https://pris.iaea.org/pris/> l.a.d. 09.07.2023.

[46] **Abraham, Mohit** (2014) p.13.

The 11 September 2001 attacks raised considerable worries about nuclear terrorism and nuclear security. The clandestine nuclear operations of some NPT parties were exposed in the early 1990s, compelling the international community to create comprehensive safeguards and export control measures. Especially, the clandestine Iraqi programme underlined the weaknesses in the IAEA nuclear safeguards system. As a direct result of Iraqi experience, the Agency and the international community have taken initiative immediately and further strengthen international legal framework on nuclear safeguards. In this regard, the acceptance of the 1997 Model Additional Protocol is critical for the Agency to acquire a fuller picture of States with CSAs' present and proposed nuclear programs, nuclear fuel cycle related activities, and nuclear material holdings. As the production of nuclear energy for peaceful reasons evolved in the 1950s, risks associated with peaceful applications of nuclear energy rose. As a result, establishment process of a special legal framework regarding civil liability for nuclear damage became a necessity in order to assure equitable compensation for loss to people and property caused by a nuclear catastrophe. As it is emphasized in the study, all four pillars of international nuclear law have been expanded and improved due to the need in process and the particular challenges it faced.

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