Liability for Nuclear Damage: Perspectives of International Conventions, Indonesian Positive Law, and Islamic Law

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Abstract: Utilization of nuclear energy for nuclear power plants (PLTN/NPP) has great benefits for human life and, at the same time, can also cause an enormous negative impact in the event of an accident. And it is necessary to take responsibility for nuclear losses that might occur. This article examines the liability for nuclear damage from the perspective of international conventions, Indonesian positive law, and Islamic law. This article is a normative-doctrinal study. Using a conceptual, statutory, and comparative approach, this article concludes that there are similarities regarding the principle of liability for nuclear damage in the three legal systems (international conventions, Indonesian positive law, and Islamic law), namely that both adhere to the principle of strict liability, although in Islamic law it is not stated explicitly. On the other hand, some differences between the three legal systems, especially regarding the form of liability and the amount of compensation or compensation that must be given. In international conventions and Indonesian positive law, the responsibility for nuclear damage is attached to the nuclear operator, while in Islamic law, the responsibility for losses is borne by the party carrying out the damage. As for the limit for giving compensation, international conventions and Indonesian positive law have definitively determined it, while in Islamic law, the limit for giving compensation can be determined according to several models, namely: according to mutual agreement (*at-taqdīr al-ittifāqi*); based on the judge's decision (*at-taqdīr al-qadāi*), and based on the provisions of the legislature (*at-taqdīr asy-syār'i*).

Keywords: *Liability for nuclear damage; international conventions; Indonesian positive law; Islamic law*

Abstrak: Pemanfaatan energi nuklir untuk pembangkit listrik tenaga nuklir (PLTN) memiliki manfaat yang besar bagi kehidupan umat manusia dan sekaligus juga dapat menimbulkan dampak negatif yang besar apabila terjadi kecelakaan. Oleh karena itu diperlukan pertanggungjawaban atas kerugian nuklir yang mungkin saja terjadi. Artikel ini mengkaji pertanggungjawaban kerugian nuklir dari sudut pandang konvensi internasional, hukum positif Indonesia, dan hukum

Islam. Artikel ini merupakan kajian normatif-doktriner. Menggunakan pendekatan konseptual, perundang-undangan, dan perbandingan, artikel ini menyimpulkan bahwa terdapat persamaan mengenai prinsip pertanggungjawaban kerugian nuklir dalam ketiga sistem hukum tersebut (konvensi internasional, hukum positif Indonesia, dan hukum Islam), yakni sama-sama menganut prinsip tanggung jawab mutlak (*strict liability*), meskipun dalam hukum Islam tidak dinyatakan secara eksplisit. Di sisi lain, artikel ini juga menemukan adanya beberapa perbedaan di antara ketiga sistem hukum tersebut, terutama mengenai bentuk pertanggungjawaban dan besaran konpensasi atau ganti rugi yang harus diberikan. Dalam konvensi internasional dan hukum positif Indonesia, pertanggungjawaban kerugian nuklir melekat pada operator nuklir, sementara di dalam hukum Islam, pertanggungjawaban kerugian dibebankan kepada pihak yang melakukan tindakan kerusakan. Adapun berkaitan dengan batas pemberian ganti rugi, konvensi internasional dan hukum positif Indonesia telah menetapkannya secara definitif, sementara di dalam hukum Islam, batas pemberian ganti rugi bisa ditetapkan dengan beberapa model, yakni sesuai kesepakatan bersama (*at-taqdir al-ittifaqi*); berdasarkan keputusan hakim (*at-taqdir al-qadai*), dan berdasarkan ketetapan pembuat undang-undang (*al-taqdir al-syar'i*).

Kata kunci: *Pertanggungjawaban kerugian nuklir; konvensi internasional; hukum positif Indonesia; hukum Islam*

Introduction

The development and utilization of nuclear energy stand as one of the most outstanding achievements of the 20th century, with profound impacts on technological advancements and the progression of civilization.[1] In addition to its use as a weapon, nuclear energy can also be harnessed through nuclear reactors or *Pembangkit Listrik Tenaga Nuklir* (PLTN) / Nuclear Power Plants (NPPs).[2] NPPs can serve as a solution to the limitations and challenges of conventional electricity sources.[3] Statistical data from the International Atomic Energy Agency

[1] Deng Ge, "Nuclear Laws for Peaceful Uses of Nuclear Energy," in *Nuclear Law The Global Debate* (Vienna: ASSER Press, 2022).

[2] Roberto Phispal, "Pengaturan Hukum Internasional Atas Pemanfaatan Tenaga Nuklir Dan Dampak Lingkungan Yang Mungkin Ditimbulkan," *Lex Et Societatis* I, no. 5 (2013), pp. 5–17.

[3] Tjipta Suhaemi, Napis, and Sudirman, "Partisipasi Masyarakat Dalam Pembangunan Pembangkit Listrik Tenaga Nuklir Di Indonesia," *Seminar Nasional Pendidikan Sains. Implementasi Pendekatan Saintifik Dan Karakter Dalam Penelitian Dan Pembelajaran Sains Menyongsong Generasi Emas Indonesia*, no. Pertimbangan terhadap Kelayakan Pembangunannya (2004), pp. 1–10.

(IAEA) shows that 427 operational NPP reactors and 56 reactors are currently under construction worldwide.[4] The benefits of nuclear energy always come with significant risks.[5] The immense potential of nuclear power can be likened to a "double-edged sword."[6] It brings numerous benefits to humanity, but its utilization can also substantially impact human beings, living organisms, and the environment. However, it is necessary to establish liability for nuclear operators in the event of accidents in any reactor that causes harm to society or the environment.[7] History records at least four tragic nuclear reactor accidents that resulted in severe consequences: the accident at the nuclear fuel processing plant in Ozyorsk, Soviet Union (now Russia) on September 29, 1957; the Three Mile Island Unit 2 accident in the United States on March 28, 1979; the Chernobyl accident in the Soviet Union (now Ukraine) on April 26, 1986, which is considered the worst nuclear disaster in the world to date; and the Fukushima Daiichi accident in Japan on March 11, 2011.[8]

Numerous researchers, including Jing Liu and Michael Faure, have conducted previous studies on liability for nuclear damage, providing comparative analyses from an economic perspective in the international regime, Japan, and China. While the Japanese system does not specifically outline the types of compensable damages, it is observed that the scope can be broad, encompassing pure economic losses and certain cleanup costs. In China, compensation can be sought for personal losses, property damage, and environmental harm,

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[4] IAEA, "Current Status of NPP," accessed November 6, (2022), https://pris.iaea.org/PRIS/home.aspx.

[5] Jie Yang et al., "How Social Impressions Affect Public Acceptance of Nuclear Energy: A Case Study in China," *Sustainability (Switzerland)* 14, no. 18 (2022), pp. 1–23, https://doi.org/10.3390/su141811190.

[6] Ismawati Septiningsih, Itok Dwi Kurniawan, and Muhammad Bintang Pratama, "Peluang Dan Tantangan: Pemanfaatan Potensi Tenaga Nuklir Berbasis Smart Electricity Guna Memaksimalkan Penggunaan Energi Baru Terbarukan Sebagai Upaya Mewujudkan Kedaulatan Energi Di Indonesia," *Prosiding Seminar Nasional Riset Teknologi Terapan: 2020*, (2020), pp. 1–9.

[7] BATAN, "Kajian Hukum Pembangunan, Pengoperasian Dan Dekomisioning Reaktor Daya NonKomersial" (Jakarta: BATAN, 2014), https://jdih.batan.go.id/unduh/kajian/Naskah Kajian Hukum RDNK Final.pdf.

[8] DuniaTempo, "4 Tragedi Ledakan Reaktor Nuklir Terparah Sepanjang Sejarah," accessed November 8, (2022), https://dunia.tempo.co/read/1569783/4-tragedi-ledakan-reaktor-nuklir-terparah-sepanjang-sejarah.

although further clarification is required regarding environmental damage.[9] Additionally, Jiu Liu, Bingyu Liu, and Dantao Chen identified issues with the current Chinese system, noting a lack of systematic organization, maneuverability, and detail in compensating nuclear damage. They highlight the importance of a legal system that includes clear legislative objectives, precise definitions and scopes of nuclear damage, strict and singular liability principles for operators, appropriate compensation amounts, stable financial guarantees, and enhanced liability from the state.[10] Meanwhile, Raphael J. Heffron, Stephen F. Ashley, and William J. Nuttall examined the issue of liability for nuclear damage in the aftermath of the Fukushima Daiichi accident in Japan in 2011. They advocate for a reassessment of the global nuclear liability regime, focusing on four main aspects: worldwide third-party nuclear liability regimes, international nuclear liability regimes post-Fukushima Daiichi, comparative evaluations of liability regimes in both nuclear and non-nuclear energy sectors, and future prospects for the potential development of a comprehensive global nuclear liability regime.[11]

This paper builds upon previous studies that have not yet explored the issue of liability for nuclear damage within the framework of international conventions, Indonesian positive law, and Islamic law. There are two established international compensation regimes for nuclear damage: the Organisation for Economic Co-operation and Development (OECD) regime and the International Atomic Energy Agency (IAEA) regime.[12] In Indonesian positive law, the liability for nuclear damage is governed by Law Number 10 of 1997 concerning Nuclear Energy (*Undang-Undang Ketenaganukliran*/UUK).[13] On the

[9] J Liu and M Faure, "Compensation for Nuclear Damage: A Comparison among the International Regime, Japan and China," *International Environmental Agreements: Politics, Law and Economics* 16, no. 2 (2016), pp. 165–87, https://doi.org/10.1007/s10784-014-9252-7.

[10] J Liu, B Liu, and D Chen, "Legislative Study on China's Compensation for Nuclear Damage Liability," *Sustainability (Switzerland)* 10, no. 7 (2018), https://doi.org/10.3390/su10072222.

[11] Raphael J. Heffron, Stephen F. Ashley, and William J. Nuttall, "The Global Nuclear Liability Regime Post Fukushima Daiichi," *Progress in Nuclear Energy* 90 (2016), pp. 1–10, https://doi.org/10.1016/j.pnucene.2016.02.019.

[12] Liu and Faure, "Compensation for Nuclear Damage: A Comparison among the International Regime, Japan and China."

[13] Law Number 10 of 1997 on Nuclear Energy.

other hand, in Islamic law, the liability for damages is already regulated to promote the well-being of every individual,[14] as it aligns with the fundamental objectives of Islamic law.[15]

Also, this article delves into the premise that liability for nuclear damage has been regulated within international conventions, Indonesian positive law, and Islamic law. However, each legal system has its own distinct regulatory framework for accountability. Consequently, an academic inquiry arises as to how nuclear damage liability compares across these three legal systems. Specifically, this paper aims to examine and discuss two primary aspects: the fundamental principles underpinning liability for nuclear losses and the specific forms of accountability. By providing a comparative overview, this article endeavors to shed light on the legal nature of nuclear damage liability and the level of protection afforded to victims of a nuclear incident.[16] Moreover, the existence of a nuclear liability regime is crucial to ensure prompt and efficient compensation for victims following a nuclear accident.[17]

This research is a normative-doctrinal study, also known as dogmatic research. This study's data is based on primary and secondary legal sources. The primary legal materials in this article consist of legislation, primary sources of Islamic law (Al-Qur'an and Hadith), international conventions related to nuclear damage liability, and Nuclear Energy Law. The secondary legal materials include relevant scholarly works such as books, journals, proceedings, and research findings pertaining to the topic of this study. The collected data is then

[14] Hengki Firmanda, "Hakikat Ganti Rugi Dalam Perspektif Hukum Ekonomi Syariah Dan Hukum Perdata Indonesia," *Jurnal Hukum Respublica* 16, no. 2 (2018): 236–51, https://doi.org/10.31849/respublica.v16i2.1438.

[15] Ramdan Wagianto, "Asy-Syir'ah Reformasi Batas Minimal Usia Perkawinan Dan Relevansinya Dengan Hak-Hak Anak Di Indonesia Perspektif Ramdan Wagianto," *Jurnal Ilmu Syari'ah Dan Hukum* 51, no. 2 (2017).

[16] Iyad Mohammad Jadalhaq and Enas Mohammad Alqodsi, "Tort Law Makes a Quantum Leap: A Review of the Civil Liability Regime for Nuclear Operators in UAE Law," *Journal of Property, Planning and Environmental Law* 13, no. 1 (2021), pp. 17–30, https://doi.org/10.1108/JPPEL-05-2020-0023.

[17] Heffron, Ashley, and Nuttall, "The Global Nuclear Liability Regime Post Fukushima Daiichi."

analyzed using conceptual, comparative, and statutory approaches.[18] Through this process, answers to the focal issues of this study are obtained.

Framework for Nuclear Liability in International Conventions, Indonesian Positive Law, and Islamic Law

Nuclear law is necessary as an effective tool to regulate its development and respond to the risks and hazards involved.[19] Nuclear law is crucial in achieving the benefits, safety, and security in using nuclear technology.[20] It encompasses all aspects of nuclear energy, specifically four key areas: safety, security, safeguards, and liability.[21] According to *Kamus Besar Bahasa Indonesia* (Indonesian Dictionary), "pertanggungjawaban" refers to the act of being responsible or something that is being held accountable.[22] According to the Black Law Dictionary, "pertanggungjawaban" refers to parties' legal responsibility to a transaction or tort, which may be distributed or apportioned among them by statute or agreement.[23] Provisions on liability are necessary to regulate how compensation should be provided to those who may become victims or suffer losses due to a nuclear accident at a nuclear facility. While the likelihood of a nuclear accident is considered small, it could lead to significant damages and claims if it were to occur.[24]

The legal framework regarding international nuclear liability is governed by two international conventions: the Paris Convention of 1960,[25] supplemented by the Brussels Supplementary Convention of

[18] Peter Mahmud Marzuki, *Penelitian Hukum,* Revised Edition (Jakarta: Kencana, 2005).

[19] Ge, "Nuclear Laws for Peaceful Uses of Nuclear Energy."

[20] Rafael Mariano Grossi, "Nuclear Law: The Global Debate," in *Nuclear Law The Global Debate* (Vienna: ASSER Press, 2022).

[21] OECD NEA, "Nuclear Law," n.d., https://www.oecd-nea.org/jcms/c_12886/nuclear-law.

[22] Badan Pengembangan dan Pembinaan Bahasa, "Kamus Besar Bahasa Indonesia," n.d., https://kbbi.web.id/tanggung jawab.

[23] Henry Campbell Black et al., *Black's Law Dictionary*, 1990.

[24] Moendi Poernomo and et. al., "Analisis Dan Evaluasi Peraturan Perundang-Undangan Tentang Ketenaganukliran," *Kemenkumham* 1, no. 1 (2013): 1–85.

[25] IAEA, "Paris Convention on Nuclear Third Party Liability," in *Compendium of International Legal Instrument* (Vienna: IAEA, 2012).

1963,[26] and the Vienna Convention on Civil Liability for Nuclear Damage of 1963.[27] The Paris Convention and the Brussels Supplementary Convention of 1963 are regional conventions agreed upon by OECD member countries, with the possibility of being open to other countries if all Parties consent.[28] On the other hand, the Vienna Convention on Civil Liability for Nuclear Damage of 1963, which was later amended by the 1997 Protocol revising the Vienna Convention,[29] is supplemented by the 1997 Convention on Supplementary Compensation for Nuclear Damage[30] and the 1988 Joint Protocol Relating to the Application of the Vienna Convention and the Paris Convention (the Joint Protocol).[31] These conventions operate at the international level and are open to all countries.[32]

The Joint Protocol is a combined protocol that connects the Vienna Convention with the Paris Convention. This protocol establishes a link between the two conventions, resulting in a unified and expanded liability regime. Parties to this joint protocol are treated as though they are parties to both conventions, with the option of choosing which convention to apply, thereby overriding the other in the event of a similar accident.[33] The Vienna and Paris Conventions establish a comprehensive and virtually identical regime for civil liability for nuclear damage. The Brussels Supplementary Convention aims to provide additional compensation from national and international public funds in cases where the compensation based on the Paris Convention is insufficient to cover all damages. The Convention on Supplementary Compensation for Nuclear Damage, which is based on

[26] IAEA, "Brussels Suplementary Convention on Nuclear Third Party Liability," in *Compendium of International Legal Instrument* (Vienna: IAEA, 2012).

[27] IAEA, "Vienna Convention on Civil Liability for Nuclear Damage," in *Compendium of International Legal Instrument* (Vienna: IAEA, 2012).

[28] Carlton Stoiber et al., *Handbook on Nuclear Law*, 2003.

[29] IAEA, "Protocol to Amend the Vienna Convention on Civil Liability for Nuclear Damage," in *Compendium of International Legal Instrument* (Vienna, 2012).

[30] IAEA, "Convention on Supplementary Compensation for Nuclear Damage," in *Compendium of International Legal Instrument* (Vienna, 2012).

[31] IAEA, "Joint Protocol Relating to the Application of the Vienna Convention and the Paris Convention," in *Compendium of International Legal Instrument* (Vienna, 2012).

[32] Stoiber et al., *Handbook on Nuclear Law*.

[33] BATAN, "Kajian Hukum Pembangunan, Pengoperasian Dan Dekomisioning Reaktor Daya NonKomersial."

either the Vienna Convention or the Paris Convention or national laws in accordance with the Convention's annex, also provides additional compensation from international public funds.[34]

According to the Vienna Convention, liability for nuclear damage is assigned in the event of a nuclear accident at a nuclear installation located within a country's territory and/or during the transportation of nuclear material to or from such an installation. The Vienna Convention also provides a definition of nuclear installations, which includes: Nuclear Reactors, factories for the production or processing of nuclear material, and facilities for the storage of nuclear material.[35] The 1997 Protocol to Amend the Vienna Convention extends the understanding of what constitutes a nuclear installation to include additional types of facilities as decided by a competent international body, such as waste disposal facilities and decommissioned installations.[36]

The definition of nuclear damage as set out in the Vienna Convention on Civil Liability for Nuclear Damage includes loss of life, personal injury, or loss of or damage to property arising from or as a result of radioactive material, toxic radioactive material, explosive or other harmful substances, nuclear fuel or radioactive waste, or nuclear material coming from, originating from, or sent to a nuclear installation.[37] The Revision Protocol to the Vienna Convention and the Convention on Supplementary Compensation also cover the cost of measures to restore environmental damage, the cost of preventive measures, and other forms of economic loss as determined by the law of the competent court.[38]

In Indonesian positive law, the legal framework of liability for nuclear damage is governed in Chapter VII of Law Number 10 of 1997 on Nuclear Energy (UUK).[39] Government Regulation Number 46 of 2009 on Nuclear Damage Liability Limits (*Batas Pertanggungjawaban Kerugian Nuklir*) was established to review the liability limits of nuclear

[34] Stoiber et al., *Handbook on Nuclear Law*.

[35] IAEA, "Vienna Convention on Civil Liability for Nuclear Damage."

[36] IAEA, "Protocol to Amend the Vienna Convention on Civil Liability for Nuclear Damage."

[37] IAEA, "Vienna Convention on Civil Liability for Nuclear Damage."

[38] IAEA, "Convention on Supplementary Compensation for Nuclear Damage."

[39] Law Number 10 of 1997 on Nuclear Energy.

installation operators within the legal framework in Indonesia.[40] Technically, the magnitude of nuclear damage liability limits is further regulated in the Presidential Regulation of the Republic of Indonesia Number 74 of 2012 on Liability for Nuclear Damage.[41] Indonesia is not a party to the International Convention, but the Nuclear Energy Law (UUK) already provides provisions regulating nuclear accidents. While Indonesia does not yet have a Nuclear Power Plant (PLTN), it possesses three research reactors in Bandung, Yogyakarta, and Serpong. In addition, Indonesia has also been transporting nuclear fuel. Although the probability of a nuclear accident is low, it is still a possibility.[42]

The term "Nuclear Damage" as per the Nuclear Energy Law (UUK) is described in Article 1 number (16) of this law as any loss that may result in death, disability, injury or illness, damage to property, pollution, and environmental damage caused by radiation or a combination of radiation with toxic, explosive properties, or other hazards as a result of nuclear fuel criticality in nuclear installations or during transport, including loss due to preventive action and loss due to environmental recovery actions.[43] Operators of nuclear installations, who could be individuals or legal entities, are obligated to bear liability for any nuclear damage inflicted on third parties due to nuclear accidents within their facilities.[44] The third parties referred to in this law are those (individuals or bodies) who suffer nuclear damage, excluding the operators of nuclear installations and workers in nuclear installations who are organizationally subordinate to the operators of nuclear installations.[45]

If a nuclear accident occurs during the transport of nuclear fuel or used nuclear fuel, the party responsible for the nuclear damage suffered by third parties is the nuclear installation operator sender. The

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[40] Peraturan Pemerintah Nomor 46 Tahun 2009 Tentang Batas Pertanggungjawaban Kerugian Nuklir.

[41] Peraturan Presiden Nomor 74 Tahun 2012 Tentang Pertanggungjawaban Kerugian Nuklir.

[42] Poernomo and et. al., "Analisis Dan Evaluasi Peraturan Perundang-Undangan Tentang Ketenaganukliran."

[43] Article 1 paragraph (16), Law Number 10 of 1997 on Nuclear Energy (Undang-Undang Nomor 10 Tahun 1997 Tentang Ketenaganukliran).

[44] Article 28, Law Number 10 of 1997 on Nuclear Energy.

[45] Article 1 paragraph (18), Law Number 10 of 1997 on Nuclear Energy.

sender nuclear installation operator can shift its liability to the recipient or transport operator if it has been agreed in writing (Article 29 UUK).[46] Suppose the liability for nuclear damage involves more than one nuclear installation operator and it is impossible to definitively determine the portion of nuclear damage caused by each nuclear installation operator. In that case, the operators are jointly and severally liable. Each nuclear installation operator's liability does not exceed its liability limit. If there are several nuclear installations in one location managed by one nuclear installation operator, the operator must be responsible for each nuclear damage caused by each nuclear installation.[47]

Article 35 of the Nuclear Energy Law states that if a location contains multiple nuclear installations managed by a single nuclear installation operator, the operator must account for its liability for each installation it manages.[48] Meanwhile, Article 36 declares: If the coverage amount decreases due to being used to pay for nuclear damage, the nuclear installation operator must ensure that the coverage amount remains consistent with the initial coverage amount. If the insurance agreement has ended or is cancelled due to some reason, the nuclear installation operator must promptly renew its insurance agreement. If the nuclear installation operator hasn't renewed its insurance agreement, and a nuclear accident occurs, the operator is still liable for the damage resulting from the nuclear accident.[49] The provisions on coverage do not apply to government agencies that are not State-Owned Enterprises/*Badan Usaha Milik Negara*.[50]

In Islamic law, there are no rules specifically discussing nuclear liability. However, there are provisions about legal liability for an action that results in damage to others. In Islamic law, all legal provisions are fundamentally intended to realize the goodness and welfare of human life, both in this world and the hereafter, and simultaneously to avoid

[46] Law Number 10 of 1997 on Nuclear Energy.

[47] BATAN, "Kajian Hukum Pembangunan, Pengoperasian Dan Dekomisioning Reaktor Daya NonKomersial."

[48] Pemerintah Republik Indonesia, "Undang-Undang Nomor 10 Tahun 1997 Tentang Ketenaganukliran."

[49] Article 35, Law Number 10 of 1997 on Nuclear Energy.

[50] Article 36, Law Number 10 of 1997 on Nuclear Energy.

harm and damage.[51] This human welfare is manifested in the form of protection for five fundamental matters (*ad-darūriyyāt al-khams*), namely protection of religion (*hifdz ad-dīn*), protection of life (*hifdz an-nafs*), protection of progeny (*hifdz an-nasl*), protection of intellect (*hifdz al-'aql*), and protection of property (*hifdz al-māl*).[52] Therefore, everyone is required to respect these five basic human rights.[53] Protection of these five aspects is also declared in the Cairo Declaration on Human Rights, which states that life in this world is a gift from Allah and all people are guaranteed and protected their lives; humans should not be harmed and especially not killed without a Sharia-justifiable reason.[54] In state life, this becomes the responsibility of the government.[55] Therefore, the government is obliged to realize the welfare of its citizens, that is, to protect and safeguard the welfare of religion in a country, to protect and safeguard the welfare of each citizen's life, to protect and safeguard the human intellect from various damages, to protect and safeguard progeny from extinction, and to protect and safeguard human property from damage.[56]

Besides these five fundamental matters (protecting religion, life, progeny, intellect, and property), Islam also emphasizes protecting the environment from pollution hazards and/or environmental destruction. This is also part of the efforts to realize the objectives of Sharia (*maqāsid asy-syari'ah*).[57] In relation to this, Yusuf al-Qaradhawi

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[51] Jaya Miharja, "Konsep Ganti Rugi Perspektif Hukum Islam," *Mu'amalat: Jurnal Kajian Hukum Ekonomi Syariah* 8, no. 2 (2016), pp. 133–55, https://doi.org/10.20414/mu.v8i2.1997.

[52] Izomiddin, *Pemikiran Dan Filsafat Hukum Islam* (Jakarta: PrenadaMedia, 2018).

[53] Asmuni Mth, "Teori Ganti Rugi (Dhaman) Perspektif Hukum Islam," *Millah* VI, no. 2 (2016), pp. 97–120, https://doi.org/10.20885/millah.volvi.iss2.art7.

[54] Muchammad Ichsan, M N Islami, and M Sardi, *Harmonisasi Hak Asasi Manusia* (Lembaga Pengembangan Pendidikan, Pelatihan, dan Masyarakat (LP3M) Universitas Muhammadiyah Yogyakarta, 2016).

[55] Kiki Muhamad Hakiki, "DISKURSUS PERANG DALAM PERSPEKTIF ISLAM," *Al-Adyan:Jurnal Studi Lintas Agama* 14, no. 2 (2019), pp. 211–41.

[56] Achmad Musyahid Idrus, "Kebijakan Pemimpin Negara Dalam Perspektif Kaidah Fikih : Tasarruf Al-Imam Manutun Bil Maslahah," *Al Daulah : Jurnal Hukum Pidana Dan Ketatanegaraan* 1, no. 1 (2021), p. 123, https://doi.org/10.24252/ad.v1i1.26278.

[57] Muhammad Akbar Eka Pradana, "Pertanggungjawaban Perdata Korporasi Dalam Perlindungan Dan Pengelolaan Lingkungan Hidup Komparasi Hukum Positif Dan Hukum Islam (Studi Kasus: Kebakaran Hutan Dan Lahan PT. National Sago

stated that preserving the environment is equivalent to preserving the objectives of Sharia (*maqāsid asy-syarī'ah*).[58]

Concerning human responsibility for all actions taken, Al-Qur'an affirms: indeed, hearing, sight, and heart - all will be called to account.[59] Meanwhile, a Hadith of the Prophet reported by Ibnu Majah states that one should not harm oneself or others. From this Hadith, legal scholars derived a principle that harm must be eliminated. In other words, this principle indicates that religion does not permit an action causing damage or harm. Anyone causing damage or harm to others must accept responsibility and provide compensation for the result of their actions.[60]

In contemporary jurisprudence, the term compensation (*dhaman*) is often associated with the term *al-mas'ūliyah* (responsibility). *Dhaman* carries the meaning of compensation, while *al-mas'ūliyah* implies responsibility. The legal basis of Shari'a regarding *dhaman* and *al-mas'ūliyah* includes QS. al-Maidah [5]: 101); QS. al-Furqon: 59; and QS. al-Isra' [17]: 36). Asmuni Mth states that compensation is an individual's obligation to fulfill rights related to physical and emotional aspects, such as defamation. It applies to any harm or damage resulting from violating an agreement, engaging in forbidden actions, or failing to carry out actions mandated by law.[61]

Based on the above, we can see differences in the legal framework of nuclear damage liability in these three legal systems (international convention, Indonesian positive law, and Islamic law). The legal framework for nuclear damage liability in international conventions uses two regimes: the Paris Convention with its additional conventions and amendments for countries under the Organization for Economic Cooperation and Development (OECD) regime, and the Vienna Convention on Civil Liability for Nuclear Damage with its additional conventions/protocols and amendments open to all countries. In Indonesian Positive Law, the legal framework for nuclear damage liability is based on the Nuclear Energy Law. Whereas in

Prima (NSP) Di Kabupaten Kepulauan Meranti, Provinsi Riau)," *Jurnal: Al-Mazahib* Vol. 7, no. No. 2 (2019), pp. 145-165.

[58] Pradana.

[59] QS. al-Isra' (17):36.

[60] Pradana.

[61] Mth, "Teori Ganti Rugi (Dhaman) Perspektif Hukum Islam."

Islamic law, the legal framework for nuclear damage liability is based on the principles of the objectives of Islamic law, that is, to protect and realize the welfare of human life in this world and the hereafter, and to avoid harm and damage. This compensation regulation is contained in the general principles of *dhaman* or compensation.

As for the meaning of nuclear damage in these three legal systems (international convention, Indonesian positive law, and Islamic law), there is a common ground; all forms of human suffering, whether in the form of death, disability, injury or illness, property damage, pollution or environmental damage are covered. Although Islamic law does not explicitly mention nuclear damage, there is a general rule that an action that can cause damage or harm is prohibited, as it can disturb or even damage the existence of humans and their environment.

Basic Principles of Liability for Nuclear Damage in International Conventions, Indonesian Positive Law, and Islamic Law

Based on international conventions, nuclear installation operators must bear responsibility, regardless of their fault. This is referred to as strict liability, sometimes also called absolute liability or objective liability (*strict liability*).[62] All international conventions adopt this model of strict liability. According to the Paris Convention, the operator is liable for damage caused by a nuclear incident at a nuclear installation or involving nuclear substances originating from the installation.[63] Therefore, the plaintiff does not need to prove negligence or any other type of fault on the part of the operator. The simple cause of damage is the basis of the operator's responsibility. Strict liability, providing an adequate basis for claims, facilitates the submission of claims by or on behalf of the victims.[64] The centralization of this responsibility is based on two reasons: to avoid complicated legal procedures for identifying the responsible party and to enable the concentration of insurance capacity.[65]

The principle of absolute liability (strict liability) was first introduced in the United Kingdom in 1868. In the case of Rylands vs.

[62] Stoiber et al., *Handbook on Nuclear Law*.

[63] Liu and Faure, "Compensation for Nuclear Damage: A Comparison among the International Regime, Japan and China."

[64] Stoiber et al., *Handbook on Nuclear Law*.

[65] Liu and Faure, "Compensation for Nuclear Damage: A Comparison among the International Regime, Japan and China."

Fletcher, the Court of Exchequer Chamber ruled that activities or operations that carry danger or risk, if they cause harm to others, are considered to meet the element of fault. The responsible party can only be exempted from liability if they can prove that the damage arose due to the plaintiff's fault or a natural disaster.[66]

Strict liability is an exception to the conventional responsibility developed since the time of Napoleon and later codified in the Civil Code. Since it is an exception to the primary civil liability, its application is inclusive, limited to sectors using hazardous and toxic materials or activities that pose serious environmental threats.[67]

Strict liability refers to the responsibility attached to a legal subject conducting certain activities classified as extrahazardous or abnormally dangerous. Therefore, they are obliged to take responsibility for any damage that may occur, even if they have acted with great caution to prevent it and even if it was done without intention. This principle does not rely on the defendant's fault; the element of fault on the defendant's part no longer needs to be proven by the plaintiff. Instead, the defendant must prove that they have genuinely not damaged/polluted the environment (reverse proof).[68]

In Indonesian Positive Law, the basic principle of nuclear damage liability is that third parties suffering nuclear damage due to a nuclear accident are given more certain protection with an strict liability system. In principle, in the event of a nuclear accident, the liability is only charged to one party, the nuclear installation operator. That is, the strict liability that the Installation Operator must bear for damage to its installation or damage occurring during the transport of nuclear material or used nuclear fuel caused by the criticality of the nuclear

[66] Sutoyo, "Pengaturan Tanggung Jawab Mutlak (Strick Liability) Dalam Hukum Lingkungan," *Jurnal Ilmiah Pendidikan Pamcasila Dan Kewarganegaraan* 4, no. 11 (2011), pp. 58–66.

[67] Anita Afriana and Efa Laela Fakhriah, "Inklusivitas Penegakan Hukum Lingkungan Melalui Tanggung Jawab Mutlak: Suatu Tinjauan Terhadap Gugatan Kebakaran Hutan Di Indonesia," *Adhaper: Jurnalhukumacaraperdata* 02, no. 02 (2016), pp. 271–288.

[68] Andria Luhur Prakoso, "Prinsip Pertanggung Jawaban Perdata Dalam Perpspektif Undang Undang Hukum Perdata Dan Undang Undang Nomor 32 Tahun 2009 Tentang Perlindungan Dan Pengelolaan Lingkungan Hidup," *Journal of Chemical Information and Modeling* 53, no. 9 (2019), pp. 211–22.

fuel.[69] Thus, no other party other than the nuclear installation operator can be held accountable.

Under the strict liability system, to receive compensation, the third party suffering nuclear damage is not burdened with proving whether or not the nuclear installation operator is at fault. To avoid compensation falling to the wrong party, the third party merely needs to provide valid evidence that their damage was caused by a nuclear accident.[70]

According to the Strict Liability doctrine or teaching, liability can be demanded without the need to prove the wrongdoer's fault.[71] Strict liability implies that the victim is freed from proving fault. The principle is expediency in handling. In case of accidents, the operator (power plant, enrichment facility/fuel, processing facility) is responsible for faults or negligence that can be proven. This simplifies the legal process, removing any obstacles, especially the burden of proof, considering the complexity of nuclear science. In layperson's terms, strict liability means the plaintiff does not need to prove how the accident occurred.[72] The application of the principle of absolute liability (strict liability) in Indonesian nuclear law is expected to provide protection and certainty for the community and the environment. This aligns with the law's general purpose, which is to achieve material and spiritual societal welfare, and to avoid undesirable actions, specifically those that cause societal harm.[73]

In Islamic law, the basic principle of liability for damage is the presence of harm to the victim. The benchmark for compensation, both in quality and quantity, corresponds to the damage suffered by the

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[69] Poernomo and et. al., "Analisis Dan Evaluasi Peraturan Perundang-Undangan Tentang Ketenaganukliran."

[70] Explanation of Article 28, Law Number 10 of 1997 on Nuclear Energy.

[71] Syarif Nurhidayat and Arif Rusman Sutiana, "Pertanggungjawaban Pidana Korporasi Pada Kasus Pembakaran Lahan Di Indonesia Berdasarkan Teori Strict Liability," *Undang: Jurnal Hukum* 1, no. 1 (2018), pp. 43–63, https://doi.org/10.22437/ujh.1.1.43-63.

[72] Nurlaila, Elok S Amitayani, and June Mellawati, "Pertanggungjawaban Kerugian Nuklir Untuk Pembangkit Listrik Tenaga Nuklir Indonesia," in *Prosiding Seminar Nasional Teknologi Energi Nuklir* (BATAM, 2016).

[73] Yeni Widowaty, "Pertanggungjawaban Pidana Korporasi Terhadap Korban Dalam Kasus Tindak Pidana Lingkungan Hidup," *Jurnal Yudisial* 5, no. 2 (2012): 154–69, https://jurnal.komisiyudisial.go.id/index.php/jy/article/view/152.

victim, although in certain cases, multiplication of damages can be carried out according to the offender's circumstances.[74] In contemporary jurisprudence, there are three pillars of compensation (*dhaman*), namely the presence of the offender (*muta'addi*), occurrence of harm (*dharar*), and the victimized party (*madhrur*). The conditions that must be met for a person's actions to be deemed to warrant compensation are:

1. The action contradicts Shari'ah.

An act is said to contradict Shari'ah when it crosses the boundary determined by *nash* (violates the law) and does not consider the safety of a certain event (*salamat al-aqībah*).

2. Compensation is caused by the actions of others.

This means the action is caused by someone else, not the victim. If the person themselves causes the action, then others are not obligated to take responsibility to provide compensation.

3. The action that contradicts Shari'ah inherently results in *dharar*.[75]

The goal of compensation is to provide relief to the victim. This covers two aspects. First, compensation for damages related to life, honor, and a person's reputation. Second, compensation for damages related to property.[76] Compensation for damages related to life includes loss of life, loss of body parts, or their functions and penalties for wounds which have been predetermined or not specified in *nash*. Unspecified compensation in the text (*nash*) is often referred to as *hukūmat al-'adl*, as the measure of its quality and quantity is handed over to the judicial authority.[77]

As for compensation related to property, such as confiscation, destruction of goods or their benefits include two things: (1) *jawabir naqdiyah*, which is compensation by returning the sale value of goods,

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[74] H Abd Salam and SH MH Ketua Pengadilan Agama Magetan A Pendahuluan, "Ganti Rugi Menurut Hukum Perdata Dan Hukum Islam," 2005.

[75] Pradana, "Pertanggungjawaban Perdata Korporasi Dalam Perlindungan Dan Pengelolaan Lingkungan Hidup Komparasi Hukum Positif Dan Hukum Islam (Studi Kasus: Kebakaran Hutan Dan Lahan PT. National Sago Prima (NSP) Di Kabupaten Kepulauan Meranti, Provinsi Riau)."

[76] Asmuni, "Teori Ganti Rugi Dalam Perspektif Hukum Islam The Compensation Theory in Islamic Law Perspectives," *Jurnal Hukum Dan Peradilan* II, no. 1 (2013): 45–66.

[77] Asmuni.

and (2) *jawabir `ainiyah*, which is compensation by returning the item itself, or replacing it with a similar item in cases of confiscation and illegal possession of other people's property.[78]

Based on the above explanation, it can be stated that the basic principles of liability for nuclear damage in international conventions, Indonesian positive law, and Islamic law have several similarities. The basic principles of liability for nuclear damage in international conventions and Indonesian positive law adhere to the principle of strict liability. Meanwhile, in Islamic law, the basic principle of liability for damage is the occurrence of harm suffered by the victim. Thus, this is also in line with the principle of strict liability.

Types of Liability for Nuclear Damage in International Conventions, Indonesian Positive Law, and Islamic Law

Liability for nuclear damage according to international conventions is imposed on the responsible party. One of the principles of the liability for nuclear damage regime is the exclusive responsibility of the nuclear installation operator.[79] The exclusive obligation implies that the responsibility is imposed on the nuclear installation operator if an accident occurs at a nuclear installation. Likewise, if an accident occurs during the transportation of nuclear materials, the responsibility is imposed on the shipping operator.[80] Under the Paris Convention, responsibility is channeled to the operator. Aside from the operator, no one else is responsible for damage resulting from a nuclear incident. The "operator" is defined as "the person designated or recognized by the competent public authority as the operator of that installation". Based on this provision, other parties that will also be involved in nuclear activities cannot be held accountable.[81]

The operator is held accountable even if the incident is caused by force majeure, an "act of God". Only certain special circumstances exempt the operator from responsibility. The operator will be

[78] Asmuni.

[79] M Tazaki, "A Nuclear Third Party Liability Regime of a Multilateral Nuclear Approaches Framework in the Asian Region," *Sustainability (Switzerland)* 6, no. 1 (2014): 436–48, https://doi.org/10.3390/su6010436.

[80] BATAN, "Kajian Hukum Pembangunan, Pengoperasian Dan Dekomisioning Reaktor Daya NonKomersial."

[81] Liu and Faure, "Compensation for Nuclear Damage: A Comparison among the International Regime, Japan and China."

exempted from liability if it is proven, for example, that the nuclear incident was directly caused by armed conflict, hostility, civil war or insurrection, or that it was entirely or partly caused by the victim's negligence or actions, or the victim's negligent acts intended to cause harm.[82]

Second, regarding the limitation on the amount of compensation, the Nuclear Liability Convention allows contracting countries to limit the liability of nuclear installation operators in amount. Without a clear limit, the operator's liability would be unlimited. Only a few countries apply the concept of unlimited obligation to nuclear installation operators, namely Austria, Germany, Japan, and Switzerland.[83] The Paris Convention sets the operator's maximum liability at 15 million Special Drawing Rights (SDRs) (17.03 million Euros) but allows Signatory Parties to establish by law a larger or smaller amount considering insurance capacity and financial security. Many parties set a higher limit than that stipulated in the Paris Convention. Sweden, for example, sets a liability limit of 300 million SDRs (340.55 million Euros) under the Nuclear Liability Act. Germany even adopts a system with unlimited liability. Under the Vienna Convention, the liability limit must not be less than 5 million US dollars (5.68 million Euros).[84] After revision, the minimum liability amount under the revised Vienna Convention is 300 million Special Drawing Rights (SDRs) of the International Monetary Fund. Meanwhile, the minimum amount under the revised Paris Convention is 700 million euros[85]

In addition, to fulfill the principle of financial protection, the operator must have insurance, and ensure that the operator or their insurance company will provide funds to pay for damages/losses. The minimum amount of protection required is regulated by national law, which often depends on international agreement obligations. Over time, this mandatory guarantee amount increases: some is adjusted for

[82] Stoiber et al., *Handbook on Nuclear Law*.

[83] Stoiber et al.

[84] Liu and Faure, "Compensation for Nuclear Damage: A Comparison among the International Regime, Japan and China."

[85] Stoiber et al., *Handbook on Nuclear Law*.

inflation and some is intended to allow for increases in liability burden that can be passed on to nuclear operators.[86]

Liability for nuclear damage in Indonesian positive law can also be categorized into two: those related to the party responsible for nuclear damage and the amount of compensation that must be borne. Article 28 of the Nuclear Energy Act states that the responsible party is the nuclear installation operator, an individual or legal entity responsible for operating the nuclear installation. They must be responsible for nuclear damage suffered by third parties caused by a nuclear accident within the nuclear installation.[87] Then Article 29 of this law states that if a nuclear accident occurs during the transportation of nuclear fuel or used nuclear fuel, the party responsible for the nuclear damage suffered by third parties is the nuclear installation operator sender. However, if it has been agreed in writing, the sender nuclear installation operator can shift their responsibility to the recipient nuclear installation operator or the transportation operator.[88]

In this case, the nuclear installation operator is exempted from liability if the damage caused by the nuclear accident directly results from international or non-international conflict or extraordinarily high-level natural disasters that exceed the set safety requirement limits (force majeure).[89] However, suppose the nuclear installation operator, after carrying out their responsibilities, can prove that the victim's own intention caused the third party who suffered nuclear damage. In that case, the operator can be exempted from the responsibility to pay all or part of the suffered damage.[90]

Even though the nuclear installation operator is burdened with responsibility for nuclear damage, there is also a guarantee of protection given to them. This is in order to develop and utilize the nuclear industry. This protection is manifested in the form of limiting the amount of nuclear compensation payments.[91] Article 34 of the Nuclear Energy Act states that nuclear compensation is as much as 9

[86] Nurlaila, Amitayani, and Mellawati, "Pertanggungjawaban Kerugian Nuklir Untuk Pembangkit Listrik Tenaga Nuklir Indonesia."

[87] Article 28, Law Number 10 of 1997 on Nuclear Energy.

[88] Article 29, Law Number 10 of 1997 on Nuclear Energy.

[89] Article 32, Law Number 10 of 1997 on Nuclear Energy.

[90] Article 33, Law Number 10 of 1997 on Nuclear Energy.

[91] BATAN, "Kajian Hukum Pembangunan, Pengoperasian Dan Dekomisioning Reaktor Daya NonKomersial."

billion rupiahs,[92] which is further expanded in the Presidential Regulation of the Republic of Indonesia Number 74 of 2012 concerning Liability for Nuclear Damage. The maximum coverage is 4 (four) trillion rupiah and must be guaranteed through insurance or other financial guarantees.[93] The amount of liability that Indonesia must provide if it builds a nuclear power plant is a maximum of 4 trillion and must be guaranteed through insurance or other financial guarantees. Given the magnitude of this nuclear liability cost, no insurance companies in Indonesia can bear the risk of a nuclear power plant accident. The solution is to use pool-based insurance, include the maximum value into capital costs, or store/invest its funds with a third party.[94]

Islamic law has no definitive regulations regarding forms of nuclear liability. However, several legal regulations are related to liability for damages in general. In Islamic law, the party who must be responsible for a disaster resulting in damage is the party who committed the act. Thus, they are also the ones who must provide compensation due to their actions.[95] However, the obligation to provide compensation can only be carried out if it has met its terms and pillars, the existence of the perpetrator (*muta'addi*), the existence of damage or loss (*dharar*) resulting from their actions, and the existence of a party being harmed (*madhrur*).[96]

While related to the limit of the amount of compensation or compensation that must be given, in Islamic law there is no certain limit. In Islamic law, the calculation of compensation to be provided by the party or perpetrator of damage is based on several following models. First, compensation calculation based on agreement (*al-taqdīr al-ittifāqi*). Second, compensation replacement determined by the judge

[92] Article 34, Law Number 10 of 1997 on Nuclear Energy. See too Nurlaila, Amitayani, and Mellawati, "Pertanggungjawaban Kerugian Nuklir Untuk Pembangkit Listrik Tenaga Nuklir Indonesia."

[93] The Presidential Regulation of the Republic of Indonesia Number 74 of 2012 concerning Nuclear Damage Liability.

[94] Nurlaila, Amitayani, and Mellawati, "Pertanggungjawaban Kerugian Nuklir Untuk Pembangkit Listrik Tenaga Nuklir Indonesia."

[95] Pradana, "Pertanggungjawaban Perdata Korporasi Dalam Perlindungan Dan Pengelolaan Lingkungan Hidup Komparasi Hukum Positif Dan Hukum Islam (Studi Kasus: Kebakaran Hutan Dan Lahan PT. National Sago Prima (NSP) Di Kabupaten Kepulauan Meranti, Provinsi Riau)."

[96] Pradana.

(*al-taqdīr al-qadāi*). Third, calculating compensation according to what is set by the legislator (*al-taqdīr al-shar'i*).[97] The calculation and estimation of the compensation are based on several principles as follows: (1) compensation is not intended to enrich the injured party, help them, or make contributions to them, but is intended to restore the situation as before the damage/loss occurred; (2) compensation is charged to the party that causes damage/loss directly. Indirect damage/loss that cannot be linked to the perpetrator's actions cannot be charged compensation; (3) the calculation and estimation of compensation are adjusted to the level of existing damage/loss, no more and no less.[98]

In determining compensation, it should at least be based on four principles. First, the principle of ease (*al-yusr*) in calculating and measuring the compensation to avoid lengthy processes and procedures in court. Second, consistency in the sense that the quality and quantity of compensation is uniform in the same case. Third, equality (*al-musawwah*) between all residents in receiving compensation. Fourth, it is necessary first to identify and determine the level of involvement of the perpetrators because it will determine the quality of compensation charged to them.[99]

The principle of equality (*al-musawwah*) and correspondence (*al-mumāsalah*) in compensation is determined based on QS. asy-Syura: 40: "And the recompense of an evil is an evil like thereof." QS. al-Baqarah also strengthens the principle of equality [2]: 194 "Therefore, whoever attacks you, attack him in the same way as he attacked you." Regarding this, az-Zaila'i, a Hanafi jurist, stated that the compensation for violation must be the same based on nash and *ijmā'* (consensus of Ulama).[100]

Based on a comparative analysis of the form of nuclear damage liability according to international conventions, Indonesian positive law, and Islamic law, it can be seen that there are similarities and differences at once. The resemblance is related to the exception of liability for damage, if it is proven that the damage arose due to the

[97] Miharja, "Konsep Ganti Rugi Perspektif Hukum Islam."

[98] Miharja.

[99] Miharja.

[100] Asmuni, "Teori Ganti Rugi Dalam Perspektif Hukum Islam The Compensation Theory in Islamic Law Perspectives."

fault/negligence of the victim himself then there is no obligation for others to be responsible and provide compensation.

The differences are: first, related to the party responsible. According to international conventions and Indonesian positive law, responsibility is exclusively attached to the nuclear installation operator entrepreneur. In Islamic law, there is no explicit mention of nuclear damage liability because there are no definitive rules. However, the basic principle or rule that applies in Islamic law is that someone who does something that causes damage or loss to others must be responsible for providing compensation due to their actions. Second, related to the limit of nuclear damage liability. According to international conventions, there are two standard limits of compensation. According to the revised Vienna convention, the limit of nuclear compensation is as much as 300 million Special Drawing Rights (SDRs) of the International Monetary Fund while according to the revised Paris convention it is as much as 700 million euros. Meanwhile, according to Indonesian positive law, the amount of liability for compensation is 4 trillion rupiah. Islamic law has no regulation regarding the limit of nuclear damage liability. The determination of compensation can be determined by several models, namely: (1) compensation calculation based on agreement (*al-taqdīr al-ittifāqi*); (2) compensation replacement based on court decision (*al-taqdīr al-qadāi*); and (3) calculating compensation according to what is set by the legislator (*al-taqdīr al-shar'i*).

Conclusions

Based on a study and comparative analysis of the legal framework, basic principles, and forms of nuclear liability in three legal systems - international conventions, Indonesian positive law, and Islamic law - we can draw the following conclusions:

First, there are several similarities in the understanding, scope, and principles of nuclear liability within the legal frameworks of international conventions, Indonesian positive law, and Islamic law. In all three legal systems, nuclear liability includes responsibility for death, disability, injury or illness, property damage, pollution and environmental damage. In addition, nuclear liability in all three legal systems also adopts the same principle, namely strict liability. However, in all three legal systems, there are also provisions for exceptions to liability, namely that if the damage is caused by the fault or negligence

of the party suffering the damage or loss, the nuclear installation operator cannot be held responsible.

Second, there are differences regarding the form and limits of nuclear liability in international conventions, Indonesian positive law, and Islamic law. In international conventions and Indonesian positive law, the responsibility for nuclear damage is exclusively attached to the nuclear installation operator. Meanwhile, Islamic law has no definitive rule on who should be responsible for nuclear damage. The primary liability principle for damage in Islamic law rests on the party that performs the act causing damage or loss. There is also a difference in the limit of the compensation amount to be given to the victim. In international conventions and Indonesian positive law, this has been definitively and certainly regulated, while in Islamic law there is no definitive rule on the limit of the compensation amount to be borne. The calculation pattern of compensation provision in Islamic law is based on several models, either by mutual agreement, a judge's decision, or statutory provision.

This study is limited to discussing nuclear liability in three legal systems - international conventions, Indonesian positive law, and Islamic law - covering the definition of nuclear damage, basic principles, and forms of responsibility. In the future, further studies also need to be carried out on the technical implementation of nuclear liability in the context of nuclear law updates, both at the general international level and specifically in Indonesia.

Conflicts of Interest

The author has no conflict of interest with any party in writing this article.

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