

The Legal Foundation of Liability for Transboundary Pollution in Light of the Rules of International Environmental Law

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Abstract:

This article addresses the legal grounding of liability for transboundary pollution in light of international environmental law rules, considering it one of the most prominent forms of environmental damage whose effects transcend state borders. It aims to clarify the legal foundations of international liability through the principles of no-harm, prevention, precaution, and international cooperation, while highlighting the role of international jurisprudence in developing these rules. The study concludes that the effectiveness of liability for transboundary pollution faces challenges—most notably the difficulty of identifying the source of damage and proving a causal link—necessitating the strengthening of international cooperation and the development of legal mechanisms to prevent and remedy such harm.

Keywords: Transboundary Pollution; International Liability; International Environmental Law; No-Harm Principle; Prevention.

ملخص:

يتناول هذا المقال التأصيل القانوني للمسؤولية عن التلوث العابر للحدود في ضوء قواعد القانون الدولي البيئي، باعتباره من أبرز صور الضرر البيئي التي تتجاوز آثارها حدود الدولة. ويهدف إلى بيان الأسس القانونية للمسؤولية الدولية، في ضوء مبادئ عدم الإضرار والوقاية والاحتياط والتعاون الدولي، مع إبراز دور القضاء الدولي في تطوير هذه القواعد. وتوصلت الدراسة إلى أن فعالية المسؤولية عن التلوث العابر للحدود تواجه تحديات، أهمها صعوبة تحديد مصدر الضرر وإثبات العلاقة السببية، مما يستدعي تعزيز التعاون الدولي وتطوير الآليات القانونية للوقاية من هذه الأضرار ومعالجتها. الكلمات المفتاحية: التلوث العابر للحدود؛ المسؤولية الدولية؛ القانون الدولي البيئي؛ عدم الإضرار؛ الوقاية.

Introduction

The rapid evolution of industrial, economic, and technological activities has escalated environmental pressures. Environmental pollution effects are no longer confined to the territory of the state where the polluting activity originates; they increasingly transcend territorial boundaries to affect the territories of other states or areas beyond national jurisdiction. Transboundary pollution thus constitutes one of the most prominent forms of international environmental damage, raising critical legal issues regarding a state's obligation to prevent environmental harm beyond its territory and the legal basis for its responsibility when failing to uphold its international duties.

The evolution of international environmental law has contributed to establishing a set of rules and principles aimed at preventing and mitigating transboundary environmental damage. Chief

among these are the no-harm principle, the prevention principle, and the precautionary principle, alongside obligations regarding environmental impact assessment, notification, consultation, and international cooperation. International jurisprudence has also played a crucial role in consolidating these rules and clarifying their substance, particularly through cases concerning transboundary environmental harm. However, the unique nature of environmental damage—characterized by its cumulative character, the difficulty of identifying its source, and the complexity of establishing a causal link—continues to pose significant challenges to defining the basis and scope of responsibility.

Studying responsibility for transboundary pollution is vital because it addresses the balance between a state's right to exploit its resources and conduct activities within its territory, and its duty to respect the rights of other states by avoiding environmental harm beyond its borders. This study also holds practical significance given the rise in activities capable of generating far-reaching environmental impacts, necessitating effective international rules to prevent harm and assign responsibility when it occurs.

Accordingly, the study addresses the following research problem:

To what extent have the rules and principles of international environmental law contributed to establishing international responsibility for transboundary pollution, as well as defining its scope and implementation mechanisms in addressing transboundary environmental damage?

This study aims to clarify the conceptual and legal framework of transboundary pollution and analyze relevant international rules and principles. It also highlights the role of international jurisprudence in advancing states' preventive obligations and determining the scope of their responsibility, while examining the primary challenges that limit the effectiveness of the international system in addressing this type of environmental harm.

To address the core problem, a descriptive-analytical methodology is employed to analyze the concept, forms, and characteristics of transboundary pollution, alongside the legal rules governing responsibility for it. An inductive approach is also utilized to track relevant international agreements and international judicial decisions.

Based on this methodology, the study is structured into two main sections:

Section I: Examines the nature of transboundary pollution by exploring its concept, forms, and characteristics.

Section II: Focuses on the legal foundations of responsibility for transboundary pollution by examining the relevant international bases, rules, and principles, as well as their contribution to defining the scope and legal consequences of such responsibility.

Section I: The Nature of Transboundary Pollution

Transboundary pollution represents one of the main consequences of expanding activities with environmental impacts. Territorial borders are no longer capable of containing environmental harm within a single state. This reality has raised legal questions regarding the extent to which a state's environmental obligations extend beyond its territory, and how to address damage caused to another state's environment by activities originating elsewhere. Consequently, transboundary pollution has gained increasing attention in international environmental law, highlighting the need to develop rules and mechanisms to prevent such harm and mitigate its effects.

To fully understand this concept, Subsection I examines the definition of transboundary pollution, while Subsection II explores its primary forms and defining characteristics.

Subsection I: The Concept of Transboundary Pollution

Transboundary environmental pollution has emerged as one of the most prominent issues facing the modern international community, given that its impact extends beyond the originating state to affect neighboring environments. The severity of this pollution is heightened by its diverse manifestations and the difficulty of controlling or containing its spread; it can travel long distances via shared waterways or atmospheric currents, resulting in damage to other nations.

Accordingly, transboundary pollution can be defined as adverse environmental impacts resulting from human activities that alter the physical, chemical, or biological properties of the environment—whether air, water, soil, or climate—where the source of these activities is located wholly or partially within the territory or jurisdiction of one state, while their negative effects manifest within the territory of another state or in areas beyond national jurisdiction, threatening human health and natural ecosystems¹.

It refers specifically to pollution arising from activities conducted by a state within its territory or under its jurisdiction whose effects extend to the environment of another state or to areas outside any state's territorial jurisdiction². The 1979 Geneva Convention on Long-Range Transboundary Air Pollution defines it as pollution whose physical origin is situated wholly or in part within the area under the national jurisdiction of one state, and which has harmful effects in the area under the jurisdiction of another state³.

This definition highlights two essential elements: the state where the pollution originates and the state affected by its consequences. This dynamic generates a legal tension between a state's sovereign right over its territory and its obligation not to exercise that sovereignty in a manner that causes environmental harm to other states. International jurisprudence affirmed this principle notably in the landmark Trail Smelter arbitration, which established that no state has the right to use or permit the use of its territory in such a manner as to cause serious damage outside its borders⁴.

Transboundary pollution stems from activities under a state's jurisdiction—whether direct or indirect—that result in the transfer of pollutants to another state's territory. This adversely impacts environmental resources and infringes upon the affected state's sovereign right to a healthy environment⁵.

Subsection II: Forms and Characteristics of Transboundary Pollution

Transboundary pollution is a global environmental phenomenon whose impacts transcend a state's territorial boundaries, giving it a unique legal character compared to traditional forms of localized pollution. The diversity of its sources and pathways yields multiple manifestations, raising distinct challenges regarding far-reaching environmental harm.

Part I: Forms of Transboundary Pollution

Transboundary pollution can be classified based on the direction of pollutant flow, as well as the environmental medium through which the pollutants are transported.

- **Unidirectional Transboundary Pollution:** This occurs when polluting activities originate in one state and spread to the territory or jurisdiction of another state. The state hosting the

¹- Souheir Ibrahim Hajim Al-Hiti, *International Responsibility for Environmental Damage*, Dar Raslan, Damascus, Syria, 2016, p. 41.

²- Salah Abdel Rahman Abdel Hadithi, *The International Legal System for Environmental Protection*, Al-Halabi Legal Publications, Lebanon, 2010, p. 130.

³- Ben Qatatt Khadidja, *International Trade and Its Impact on the Environment*, Master's Thesis in Law, Faculty of Law and Political Sciences, Abdelhamid Ibn Badis University – Mostaganem, 2013/2014, p. 63.

⁴- Alexandre Kiss, *Droit International de l'environnement*, Éditions A. Pédone, Paris, 1989, p. 74.

⁵- Ibid., p. 68.

source activity is the state of origin, while the adverse impacts manifest within the affected state⁶. As one of the most identifiable forms, pollutants move predominantly from the source state to the receiving state without a reciprocal polluting activity. Examples include industrial emissions and atmospheric gases transported across borders by prevailing wind currents⁷, or riverine pollutants flowing from an upstream state to a downstream state⁸. Legally, this highlights a state's duty of due diligence—requiring the origin state to implement necessary preventive measures to ensure activities within its borders do not cause harm abroad⁹.

- **Bidirectional (or Reciprocal) Transboundary Pollution:** This refers to situations where pollution sources exist in neighboring states, resulting in a mutual exchange of pollutants across shared borders. Consequently, states are not strictly categorized as either solely polluters or victims; each state simultaneously acts as a source and a recipient of pollution¹⁰. Addressing this form poses complex legal challenges when overlapping pollution sources blend together. Distinguishing each state's exact contribution complicates establishing causation and assigning proportionate legal liability¹¹.
- **Transboundary Atmospheric Pollution:** Refers to the transport of air pollutants from the territory of one state to others via wind and atmospheric currents. These pollutants stem from human activities such as industrial operations, power plants, transportation, and fuel combustion¹². The severity of this pollution lies in the fact that air currents disregard political boundaries, enabling harmful emissions to travel vast distances from their source. This inflicts severe damage on human health, ecosystems, agricultural yields, water bodies, and soil¹³. The transboundary nature of atmospheric pollution becomes particularly evident when emissions cross into neighboring states, making its mitigation deeply reliant on international cooperation, information sharing, early warning systems, and coordinated preventive measures¹⁴.
- **Transboundary Water Pollution:** Involves the discharge and transfer of pollutants across borders through shared rivers, lakes, aquifers, and groundwater systems. It is especially prominent in international river basins where industrial, agricultural, mining, or municipal waste discharges in an upstream state degrade the water quality reaching downstream states¹⁵. The legal complexity of this form stems from shared water resources being a common natural asset. States are obligated to utilize these waters equitably while respecting the sovereign rights of co-riparian nations by avoiding activities that cause significant harm downstream¹⁶.

⁶- Article 2, paragraphs (c) and (d), International Law Commission, Draft Articles on Prevention of Transboundary Harm from Hazardous Activities, 2001.

⁷- Article 1, paragraph (b), Convention on Long-range Transboundary Air Pollution, Geneva, 1979.

⁸- Article 21, United Nations Convention on the Law of the Non-Navigational Uses of International Watercourses, 1997.

⁹- Article 3, International Law Commission, op. cit.

¹⁰- Convention on Long-range Transboundary Air Pollution, Geneva, 13 November 1979, Art. 1(b).

¹¹- Ibid., Art. 1(b).

¹²- Article 1, paragraphs (a) and (b), Convention on Long-range Transboundary Air Pollution, op. cit.

¹³- Convention on Long-range Transboundary Air Pollution, 1979, Art. 1(b), op. cit.; UNECE, Air Pollution and the Convention on Long-range Transboundary Air Pollution.

¹⁴- Ibid., Arts. 3–4, 8.

¹⁵- Article 21, paragraphs 1 and 2, United Nations Convention on the Law of the Non-Navigational Uses of International Watercourses, op. cit.

¹⁶- Articles 5 and 7 of the same Convention.

- **Transboundary Marine Pollution:** Arises from the transfer of pollutants across seas and oceans from one state to another, originating from both land-based and vessel-based operations. Primary causes include oil spills, chemical discharges, waste dumping, and maritime industrial accidents¹⁷. Marine contaminants spread extensively via ocean currents, displacing environmental damage across distant maritime zones and devastating marine biodiversity, fisheries, coastal lines, and fragile aquatic ecosystems¹⁸.
- **Pollution from Hazardous Wastes and Substances:** Occurs when hazardous or toxic wastes are transferred across borders for disposal, treatment, or storage, and subsequently managed unsafely in the receiving state¹⁹. This risk escalates dramatically when hazardous wastes are exported to developing nations lacking the technological or financial capacity for safe disposal. Uncontained hazardous waste causes severe long-term contamination of soil, air, and groundwater while raising legal issues regarding liability during transit and disposal²⁰.
- **Transboundary Radiological Pollution:** Takes place when a nuclear accident or radiological activity releases—or poses a significant threat of releasing—radioactive substances across borders, creating serious safety consequences for other states²¹. This form is acute due to the long persistence of radioactive isotopes, the difficulty of containment, and the catastrophic, long-term risks posed to human health and natural habitats through contaminated air, water, and soil²².

Part II: Characteristics of Transboundary Pollution

Transboundary pollution is defined by distinct characteristics that set it apart from localized environmental harm confined within a single state's borders.

- **Transgressing Territorial Borders:** The defining feature of transboundary pollution is that the adverse effects of a polluting activity do not remain contained within the state of origin, but extend beyond its frontiers to impact one or more other states²³. This geographical spread elevates the issue to an international scale. Rather than a strictly internal domestic matter between a sovereign state and its citizens or domestic environment, it directly affects the legal rights and interests of other nations, invoking the direct application of international environmental law²⁴.
- **Indivisibility and Non-Containment of Environmental Harm:** Environmental damage inherently defies political borders. Pollutants travel fluidly through atmospheric currents, river networks, or ocean tides to locations far removed from their point of origin²⁵. Consequently, establishing a precise geographic boundary where pollution effects will cease is remarkably difficult. Furthermore, damage often extends across multiple nations

¹⁷- Article 1, paragraphs 1 and 4, and Article 194 of the United Nations Convention on the Law of the Sea, 1982.

¹⁸- Articles 192 and 194 of the same Convention.

¹⁹ Article 2, paragraph 3, Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal, 1989.

²⁰- Article 4 of the same Convention.

²¹- Article 1, IAEA Convention on Early Notification of a Nuclear Accident, 1986.

²²- Article 1 of the same Convention; IAEA, Convention on Early Notification of a Nuclear Accident, 1986, Arts. 2–5.

²³- International Law Commission, Draft Articles on Prevention of Transboundary Harm from Hazardous Activities, 2001, Art. 2(c).

²⁴- Ibid., Arts. 2(c), 3.

²⁵- Convention on Long-range Transboundary Air Pollution, 1979, Art. 1(b); United Nations Convention on the Law of the Non-Navigational Uses of International Watercourses, 1997, Art. 21; United Nations Convention on the Law of the Sea, 1982, Arts. 192–194.

simultaneously, complicating both the evaluation of total harm and the allocation of legal responsibility²⁶.

- **Complexity of Establishing Causation:** Proving a direct causal link is one of the most formidable legal challenges in transboundary pollution disputes. Contaminants often stem from diffuse sources spread across diverse geographic locations, resulting in cumulative damage from multiple contributing activities²⁷. Additionally, many environmental hazards involve a prolonged latency period, where symptoms only manifest long after exposure. Demonstrating through scientific and legal evidence that specific damage in a receiving state was directly caused by an activity within a foreign state remains highly complex²⁸.
- **Realized Damage vs. Potential Environmental Risk:** The legal framework surrounding transboundary pollution addresses both realized, actualized damage and potential environmental risks inherent in hazardous operations²⁹. This distinction is crucial in international environmental law, as it marks a shift from reactive remediation to proactive prevention³⁰. This preventive orientation underpins core legal obligations, including prior Environmental Impact Assessments (EIA), mandatory notification, consultation, and continuous information sharing³¹.
- **Temporal and Cumulative Nature of Environmental Harm:** The adverse effects of transboundary pollution do not always materialize immediately; environmental damage often develops gradually or surfaces long after the triggering activity has occurred. This characteristic is particularly prominent in cases of chronic or cumulative pollution, where damage results from recurring actions or emissions that interact over time to exacerbate environmental degradation. International jurisprudence and doctrine address this phenomenon under the concept of non-accidental or chronic damage, which arises from continuous or repeated acts that produce ongoing harmful effects³².
- **Difficulty of Identifying Pollution Sources:** Pinpointing the exact source of contamination grows highly complex when polluting activities are diffuse or distributed across multiple regions and sovereign states [11]. In atmospheric pollution, for instance, a receiving state may be impacted by pollutants originating from a combination of distinct industrial hubs, requiring advanced scientific and technical methodologies to isolate sources and quantify each contributor's share of the harm³³.
- **International Character of the Damage:** Environmental harm acquires an international character whenever the effects of an activity cross the borders of the origin state to impact another state or areas beyond national jurisdiction³⁴. Consequently, addressing such harm ceases to be a strictly domestic legal matter governed solely by the source state's national legislation; rather, it triggers the application of international legal rules and enforces state

²⁶- Convention on Long-range Transboundary Air Pollution, 1979, Art. 1(b).

²⁷- Ibid., Art. 1(b).

²⁸- Article 1, paragraph (b), Convention on Long-range Transboundary Air Pollution, op. cit.

²⁹- International Law Commission, Draft Articles on Prevention of Transboundary Harm from Hazardous Activities, Art. 2(a), (e).

³⁰- International Law Commission, Draft Articles on Prevention of Transboundary Harm from Hazardous Activities, Arts. 3–4.

³¹- ICJ, Pulp Mills on the River Uruguay (Argentina v. Uruguay), Judgment, 20 April 2010, paras. 204–205.

³²- Hanqin Xue, Transboundary Damage in International Law, Cambridge University Press, 2003, Chapter 4, “Liability for Non-Accidental Damage”.

³³- Convention on Long-range Transboundary Air Pollution, 1979, Art. 1(b).

³⁴- Ibid., Art. 1(b).

obligations to prevent activities within their jurisdiction from causing extraterritorial environmental harm³⁵.

- **Intrinsic Link to the No-Harm Principle:** Transboundary pollution is fundamentally linked to the customary international legal principle (*sic utere tuo ut alienum non laedas*), which mandates that states must not use—or permit the use of—their territory in a manner that causes environmental harm to other states or to areas beyond national jurisdiction³⁶.
- **Essential Need for International Cooperation:** Because an affected state cannot unilaterally halt a pollution source operating outside its territory, addressing transboundary environmental harm demands structured cooperation between the origin state and affected state(s). This entails mandatory information exchange, prior notification, meaningful consultation, joint preventive measures, and the sharing of scientific and technical data³⁷. Such cooperation becomes crucial when pollution impacts multiple jurisdictions or requires coordinated actions exceeding the capacity of any single state.

Section II: Legal Basis of Responsibility

The extraterritorial spread of pollution raises the critical issue of defining legal rules governing state conduct regarding environmental damage beyond its borders, particularly given state assertions of sovereignty over territory and natural resources. Regulating activities with transboundary effects depends on subjecting them to international obligations that protect the environment and respect other states' rights, providing the legal framework to establish responsibility for breaches.

Accordingly, this foundation is addressed through relevant international conventions in Subsection I, followed by the governing legal principles of responsibility in Subsection II.

Subsection I: Relevant International Conventions

International conventions constitute primary sources of legal rules regulating environmental protection against transboundary pollution by setting binding state obligations to mitigate extraterritorial impacts. Escalating risks have driven numerous treaties designed to prevent damage, foster cooperation, and define duties to curb pollution.

Part I: Global Conventional Rules for Environmental Protection Against Transboundary Pollution

International treaties provide the core legal framework for addressing transboundary pollution, granting environmental rules universal binding force and obligating states to enact domestic sanctions and fulfill commitments in good faith.

- **1982 United Nations Convention on the Law of the Sea (UNCLOS) (Montego Bay, Jamaica):** UNCLOS obligates states individually or jointly to protect and preserve the marine environment. It mandates all necessary measures to prevent, reduce, and control marine pollution from any source, including toxic or harmful substances introduced via dumping or the atmosphere. The treaty emphasizes global and regional cooperation through specialized international organizations to establish environmental standards, as well as to monitor, measure, and evaluate pollution risks and effects using available scientific means³⁸.

³⁵- International Law Commission, Draft Articles on Prevention of Transboundary Harm from Hazardous Activities, 2001, Art. 2(c).

³⁶- Ibid., Arts. 3–4.

³⁷- Rio Declaration on Environment and Development, 1992, Principle 2.

³⁸- International Law Commission, Draft Articles on Prevention of Transboundary Harm from Hazardous Activities, 2001, Art. 4.

- **1989 Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal (Switzerland):** A cornerstone treaty protecting the environment from hazardous waste risks, comprising a preamble, 29 articles, and nine annexes³⁹. It prohibits state parties from shipping hazardous waste across borders without providing complete data to transit and recipient states, regardless of whether those states are parties to the treaty⁴⁰. It mandates minimizing hazardous waste generation and bans exports to states—or regional economic integration organizations—lacking the capacity to manage and dispose of them in an environmentally sound manner⁴¹. The convention protects human health and environmental quality from waste disposal and transit, curtails transboundary movements, prevents shipments to nations lacking legal, administrative, or technical handling capacities, establishes a tracking system, and assists developing nations in formulating proper waste management policies⁴².
- **1992 United Nations Framework Convention on Climate Change (UNFCCC):** Adopted in Rio de Janeiro, the UNFCCC serves as a foundational multilateral environmental agreement designed to stabilize atmospheric greenhouse gas concentrations at a level that prevents dangerous anthropogenic interference with the climate system. It aims to allow ecosystems to adapt naturally, ensure food production is not threatened, and enable economic development to proceed sustainably⁴³. The Convention centers on defining international cooperation obligations—notably through the principle of common but differentiated responsibilities—and fostering joint efforts in technology transfer, mitigation practices, scientific research, and information exchange concerning climate systems⁴⁴.

To strengthen global climate action under this framework, the 2015 Paris Agreement was adopted at COP21, establishing a objective to keep the global average temperature rise well below 2°C above pre-industrial levels while pursuing efforts to limit it to 1.5°C through collective state responsibility⁴⁵. The UNFCCC framework underscores that the climate crisis demands substantial emissions reductions and international cooperation. Parties are urged to take precautionary measures to anticipate, prevent, or minimize the causes of climate change, explicit that a lack of full scientific certainty should not serve as a reason for postponing such action⁴⁶. Additional core objectives include safeguarding ecosystems for present and future generations, advancing climate monitoring, and supporting relevant scientific research⁴⁷. However, while crucial in establishing an international legal architecture, the original

³⁹- Articles 192, 194, 195 and 204 of the United Nations Convention on the Law of the Sea, concluded at Montego Bay, Jamaica, in 1982, which entered into force in 1994 and had been joined by 161 States as of 2010.

⁴⁰- Muammar Ratib Mohammed Abdel Hafiz, *The Basel Convention and Its Role in Protecting the Environment from Pollution by Hazardous Wastes*, Dar Al-Nahda Al-Arabiya, Egypt, 2008, p. 34.

⁴¹- Saleh Mohammed Badr El-Din, *Liability for the Transportation of Hazardous Wastes in International Law*, Dar Al-Nahda Al-Arabiya, Egypt, 2003, pp. 74–76.

⁴²- Article 4 of the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal, adopted in Switzerland in 1989, which entered into force in 1992 and had been joined by 175 States as of 2011.

⁴³- Youssef Outfat, “The International Obligation to Protect the Environment from Transboundary Environmental Harm,” *Maaref Journal*, Vol. 18, No. 2, December 2023, p. 83.

⁴⁴- Saleh Mohammed Mahmoud Badr El-Din, *The International Obligation to Protect the Environment from Pollution in Light of the Rules of International Environmental Law and the Decisions and Recommendations of International Organizations*, Dar Al-Nahda Al-Arabiya, Egypt, 2006, p. 42.

⁴⁵- Anas Arar, Souad Douba, Yamina Nezar, “International Interest in Non-Governmental Organizations and the Environment,” *Journal of the Researcher in Humanities and Social Sciences*, University of Batna, No. 12, 2020, p. 524.

⁴⁶- Youssef Outfat, *op. cit.*, p. 84.

⁴⁷- Article 3 of the United Nations Framework Convention on Climate Change in Kyoto (Japan) in 1992, which entered into force in 1994 and had been joined by 194 States as of 1994.

framework lacked unified, specifically binding emission reduction commitments for all parties, leaving many provisions as non-binding recommendations and highlighting the ongoing need for stronger legal mechanisms⁴⁸.

- **2001 Stockholm Convention on Persistent Organic Pollutants (POPs):** The 2001 Stockholm Convention represents a critical legal instrument aimed at eliminating or restricting the production and use of Persistent Organic Pollutants. These toxic chemical substances resist environmental degradation, bioaccumulate through food chains, and travel long distances via air and water currents to settle across terrestrial and aquatic ecosystems far from their source⁴⁹. To address these hazards, the treaty obligates party states to enact regulatory measures, develop National Implementation Plans (NIPs), and foster cooperation through global and regional organizations⁵⁰. It further emphasizes technical and financial assistance between industrialized and developing nations, promoting information exchange, joint monitoring, and tracking of regulated chemical compounds⁵¹. The agreement provides a comprehensive regulatory and technical framework to mitigate the persistent risks these pollutants pose to human health and the environment.

Part II: Regional Conventions for Protecting the Environment Against Transboundary Pollution

Regional conventions form a targeted legal architecture that complements the global regime. They focus on immediate environmental challenges among geographically proximate states to strengthen cooperation and swiftly control transboundary pollution within shared regions.

- **1991 Bamako Convention on the Ban of the Import into Africa and the Control of Transboundary Movement and Management of Hazardous Wastes Within Africa:** Adopted under the auspices of the Organization of African Unity (OAU) in Bamako, Mali, on January 30, 1991, this treaty entered into force on March 20, 1998, 90 days after ratification by 12 states⁵². Enacted following the 1989 Basel Convention, Bamako established a far stricter standard by imposing an absolute ban on importing hazardous wastes into the African continent—both individually and collectively—under the sovereign right of states to criminalize such imports⁵³. The convention prohibits importing radioactive and nuclear wastes into African nations, bars ocean dumping and disposal of hazardous wastes in inland waters⁵⁴, and codifies strict liability for damage resulting from hazardous waste handling, classifying illegal traffic as a "crime against Africa" and compelling the exporting state to repatriate illegally shipped waste at its own expense⁵⁵. Bamako stands

⁴⁸- Khaled Mustafa Fahmi, *Legal Aspects of Environmental Protection from Pollution in Light of National Legislation and International Conventions: A Comparative Study*, 1st ed., Dar Al-Fikr Al-Jami'i for Publishing and Distribution, Egypt, 2011, p. 282.

⁴⁹- Momen Amin, "International Efforts within the Framework of Legal Protection of the Environment," *Journal of Real Estate and Environmental Law*, Vol. 11, No. 1, 2023, p. 260.

⁵⁰- Preamble to the Stockholm Convention on Persistent Organic Pollutants, 2001, which entered into force in 2004 and had been joined by 179 States.

⁵¹- Articles 7 and 13 of the same Convention.

⁵²- Mohammed Fawzi Ben Chaabane, *The Legal System for Protecting the Environment from Pollution Resulting from International Trade in Chemicals*, Master's Thesis, International Law and International Relations Branch, University of Algiers, 2006/2007, p. 105.

⁵³- AUBIN Fred N'ZAOU, *Les déchets dangereux à l'épreuve du droit international*, Conference "Valorisation des déchets dans le monde et cadre juridique," organized by Centre Placet, Université catholique de Louvain, Wednesday, 26 March 2014, p. 6.

⁵⁴- Jean-Maurice Arbour, Sophie Lavallée, *Droit International de l'environnement*, Éditions Yvon Blais, 2006, p. 561.

⁵⁵- Jean-Marc Lavieille, *Droit International de l'environnement*, Éditions Ellipses, Paris, 2nd ed., 2004, p. 309.

out from Basel due to its uncompromising stance against waste transport to Africa, framing hazardous imports as a direct crime against African peoples and ecosystems while mandating environmentally sound disposal to curb health and ecological risks⁵⁶. Consequently, it serves as a robust regional framework protecting the African environment by banning hazardous waste imports, enforcing strict oversight over waste management, and assigning liability for resulting harm⁵⁷.

- **1976 Barcelona Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean:** Concluded under the United Nations Environment Programme (UNEP) in Barcelona on February 2, 1976, this agreement provides a comprehensive policy framework for regional cooperation to safeguard the Mediterranean marine environment against pollution⁵⁸. Party states commit to taking appropriate measures to prevent, abate, and combat pollution caused by dumping from ships and aircraft, seabed exploration and exploitation, and land-based discharges via rivers, pipelines, or coastal infrastructure⁵⁹. The treaty strictly prohibits dumping hazardous wastes into Mediterranean waters, territorial seas, or seabed strata, including incinerating waste at sea⁶⁰. Beyond preventive duties, the convention mandates emergency response cooperation, Mediterranean-wide pollution monitoring, the adoption of cleaner production technologies, and the enactment of strict domestic penal sanctions against illegal waste trafficking⁶¹. It continuously requires parties to limit pollution across all maritime operations through collaborative surveillance and data collection⁶². The Barcelona Convention thus constitutes an integrated regional legal instrument rooted in pollution prevention, source control, inter-state cooperation, and state responsibility for preserving the Mediterranean marine basin⁶³.
- **1978 Kuwait Regional Convention for Co-operation on the Protection of the Marine Environment from Pollution:** Concluded on April 22, 1978, among the Gulf states, the Kuwait Convention entered into force upon securing the required ratifications to establish a dedicated regional framework for protecting the Arabian Gulf marine environment⁶⁴. The treaty aims to prevent, abate, and combat marine pollution resulting from human activities, ensure resource sustainability, assess the state of the marine environment, establish legal and institutional mechanisms for inter-state cooperation, and systematically monitor pollution

⁵⁶- Muammar Ratib Mohammed Abdel Hafiz, *International Responsibility for the Transportation and Storage of Hazardous Wastes*, Dar Al-Nahda Al-Arabiya, Egypt, 2007, pp. 188–189.

⁵⁷- Laurence Boisson de Chazournes, Richard Desgagné, Makane Moïse Mbengue, Cesare Romano, *International Protection of the Environment*, Pédone, Paris, 2005, p. 489.

⁵⁸- Mohammed Bouat, *Environmental Protection from Hazardous Wastes in Light of the Provisions of Public International Law*, PhD Dissertation in Public Law, Abou Bekr Belkaid University – Tlemcen, Faculty of Law and Political Sciences, 2015/2016, p. 148. Al-Sayed Mustafa Ahmed Abu Al-Khair, *Legal Protection of the Marine Environment in the International Law of the Sea*, 1st ed., Ashtrak for Printing, Publishing and Distribution, Arab Republic of Egypt, 2012, p. 315.

⁵⁹- Articles 7, 8, 9 and 10 of the Barcelona Convention for the Protection of the Mediterranean Sea against Pollution, 1976.

⁶⁰- Article 4, paragraphs 2 and 4, of the same Convention.

⁶¹- Articles 7 to 10 of the same Convention.

⁶²- Abdel Salam Mansour Al-Shiwi, “International Protection of the Aquatic Environment from Pollution,” *International Journal of the Faculty of Commerce*, No. 10, Arab Republic of Egypt, January 2013, p. 468.

⁶³- Al-Sayed Mustafa Ahmed Abu Al-Khair, *op. cit.*, p. 315.

⁶⁴- Majid Ragheb Al-Hilu, *Environmental Protection Law in Light of Islamic Sharia*, Dar Al-Jami'a Al-Jadida for Publishing, Egypt, 2004, p. 219.

sources⁶⁵. Party states commit to implementing necessary measures to counter marine pollution—specifically from land-based sources, vessel operations, offshore installations, and waste dumping—in alignment with relevant international rules. It further mandates rapid emergency response protocols, prompt notification to the Regional Organization for the Protection of the Marine Environment (ROPME), and mandatory Environmental Impact Assessments (EIAs) for major projects posing significant risks to Gulf waters⁶⁶.

- **1979 Geneva Convention on Long-Range Transboundary Air Pollution (LRTAP):** Adopted on November 13, 1979, and entering into force in 1983 under the auspices of the United Nations Economic Commission for Europe (UNECE), the LRTAP Convention represents a landmark regional instrument regulating international cooperation against atmospheric pollution. The agreement defines long-range transboundary air pollution as air pollution whose physical origin is situated wholly or in part within the area under the national jurisdiction of one state, and which has harmful effects in the area under the jurisdiction of another state at such a distance that it is generally not possible to distinguish the contribution of individual emissions sources. It aims to protect human health and the environment from air pollution through scientific research, emissions monitoring, policy development, and the implementation of the Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe (EMEP)⁶⁷. The treaty obligates parties to develop strategies and policy measures to gradually reduce and prevent air pollution, with an initial emphasis on sulfur compounds. It calls for consultations whenever a risk of transboundary pollution transfer arises, alongside information exchange on emissions and joint research programs. The LRTAP framework was subsequently strengthened by specific protocols targeting concrete reduction goals for distinct air pollutants, solidifying regional cooperation to safeguard atmospheric quality⁶⁸.

Subsection II: Governing Legal Principles (No-Harm, Prevention, Precaution, Polluter-Pays)

Responsibility for transboundary pollution rests upon core principles of international environmental law that define the legal framework governing state obligations. These principles are pivotal in regulating state conduct regarding activities capable of causing extraterritorial environmental harm.

Part I: The No-Harm Principle as a Foundation for State Responsibility

The no-harm principle serves as the central pillar, creating a legal threshold that links a state's exercise of territorial sovereignty with the prohibition against using its territory to inflict transboundary environmental damage on other nations.

- **Substance of the No-Harm Principle:** The no-harm principle subordinates a state's territorial sovereignty to the legal duty of respecting the rights and environments of other nations and areas beyond national jurisdiction. A state may not use or permit the use of its territory in a manner that causes transboundary environmental damage. Permanent sovereignty over natural resources does not grant an absolute right to conduct activities that produce harmful

⁶⁵- Articles 2, 4, 5, 6 and 7 of the Kuwait Regional Convention for Cooperation on the Protection of the Marine Environment from Pollution.

⁶⁶- Article 1 of the Geneva Convention on Long-range Transboundary Air Pollution, 1979; Khaled Al-Iraqi, *The Environment: Its Pollution and Protection*, 1st ed., Dar Al-Nahda Al-Arabiya, Egypt, 2011, p. 152.

⁶⁷- Articles 2, 3, 5 and 6 of the same Convention.

⁶⁸- Rio Declaration on Environment and Development, 1992, Principle 2.

extraterritorial effects⁶⁹. Principle 2 of the 1992 Rio Declaration codifies this balance, affirming a state's sovereign right to exploit its own resources pursuant to its environmental and developmental policies, alongside its responsibility to ensure that activities within its jurisdiction or control do not cause damage to the environment of other states or areas beyond national jurisdiction⁷⁰.

- **Impact on the Establishment of International Responsibility:** The no-harm principle provides the foundational basis for defining a state's international obligations concerning transboundary pollution. It imposes a standard of due diligence, requiring states to take necessary measures to prevent activities within their territory or under their jurisdiction or control from causing extraterritorial damage. Consequently, a state's failure to exercise due diligence may give rise to international responsibility when other essential legal elements are met⁷¹. The International Law Commission (ILC), in its 2001 Draft Articles on Prevention of Transboundary Harm from Hazardous Activities, reaffirmed that the state of origin is bound to take all appropriate measures to prevent significant transboundary harm or to minimize the risk thereof⁷².

Part II: The Prevention Principle and Its Impact on Responsibility

This section explores the prevention principle as a governing legal framework directing states toward proactive measures to control pollution sources, thereby avoiding irreversible transboundary environmental damage.

- **Substance of the Prevention Principle:** The prevention principle dictates taking appropriate measures to avoid environmental damage before it materializes by controlling pollution sources and restricting hazardous operations. It rests on the rationale that remediating environmental damage *ex post* is far more difficult and costly than *ex ante* prevention, particularly when effects are irreversible or where ecological restoration is impossible⁷³. In transboundary pollution, prevention is critical because pollutants cross frontiers before an affected state can implement protective measures⁷⁴.
- **Preventive Obligations Incumbent Upon the State:** Preventive duties require states to adopt active legal, administrative, and technical measures tailored to the nature and severity of the risk. Key measures include licensing hazardous operations, continuous monitoring of pollution sources, gathering risk assessments, and adopting safety protocols to minimize harm⁷⁵. The obligation to prevent is closely tied to the duty of inter-state cooperation—specifically requiring prior notification, consultation, and information exchange to enable potentially affected nations to take protective action⁷⁶.

⁶⁹- International Law Commission, Draft Articles on Prevention of Transboundary Harm from Hazardous Activities, with Commentaries, 2001, General Commentary.

⁷⁰- International Law Commission, Draft Articles on Prevention of Transboundary Harm from Hazardous Activities, with Commentaries, 2001, Art. 3.

⁷¹- Ibid., Arts. 3–4.

⁷²- International Law Commission, Draft Articles on Prevention of Transboundary Harm from Hazardous Activities, with Commentaries, 2001, General Commentary, para. (1).

⁷³- Ibid., para. (2).

⁷⁴- ILC, Draft Articles on Prevention of Transboundary Harm from Hazardous Activities, with Commentaries, 2001, Art. 8.

⁷⁵- Ibid., Arts. 4, 9.

⁷⁶- Ibid., Art. 3 and General Commentary; Pulp Mills on the River Uruguay (Argentina v. Uruguay), Judgment, I.C.J. Reports 2010, para. 204.

- **Legal Consequences of Breaching Preventive Duties:** Recognizing the preventive dimension of transboundary pollution law means state responsibility is not triggered solely by actualized damage; it can also arise from a failure to perform due diligence obligations. This applies when a state fails to adopt reasonable, proportionate regulatory or supervisory standards corresponding to the risk level of an activity within its territory⁷⁷. Assessing state conduct thus centers on whether the state exercised due diligence and implemented necessary measures to mitigate foreseeable harm.

Part III: The Precautionary Principle and Its Impact on Determining Responsibility

This section highlights the precautionary principle as a protective framework obligating states to adopt necessary measures when faced with threats of serious or irreversible environmental harm.

- **Substance of the Precautionary Principle:** The precautionary principle mandates adopting measures to protect the environment when there is a risk of serious or irreversible damage, even in the absence of full scientific certainty regarding the exact nature or occurrence of the harm. It seeks to ensure that a lack of scientific consensus is not used as a reason for postponing cost-effective protective action⁷⁸. Principle 15 of the 1992 Rio Declaration codifies this approach, affirming that where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing preventive measures⁷⁹.
- **Significance of Precaution in Transboundary Pollution:** The precautionary principle is critical in transboundary pollution disputes where an activity threatens severe environmental impacts but available scientific evidence remains inconclusive. In such scenarios, scientific uncertainty does not absolve the origin state of its obligation to take proactive measures to minimize potential hazards⁸⁰. The principle expands the scope of prospective environmental protection and reinforces state duties to manage grave or irreversible threats⁸¹.
- **Impact of Precaution on Assessing State Conduct:** The precautionary principle plays an important role in evaluating whether a state has fulfilled its international obligations when authorizing activities with potential transboundary effects. A state's failure to adopt precautionary measures despite credible indicators of potential severe damage may raise questions regarding its compliance with international standard of due diligence⁸².

Part IV: The Polluter-Pays Principle and Its Impact on the Scope of Responsibility

This section addresses the polluter-pays principle as an economic and legal framework that determines the scope of responsibility by assigning the financial burdens of pollution control and remediation to the entity responsible for causing the harm.

- **Substance of the Polluter-Pays Principle:** The polluter-pays principle holds that the party responsible for environmental pollution must bear the costs of necessary prevention, control, and remedial measures, ensuring that society or affected states do not shoulder these financial burdens⁸³. It promotes equity in allocating environmental protection costs

⁷⁷- Rio Declaration, 1992, Principle 15.

⁷⁸- Ibid., Principle 15.

⁷⁹- Ibid., Principle 15.

⁸⁰- ILC, Draft Articles on Prevention of Transboundary Harm from Hazardous Activities, with Commentaries, 2001, General Commentary.

⁸¹- Rio Declaration, 1992, Principle 15.

⁸²- Rio Declaration, 1992, Principle 15.

⁸³- Ibid., Principle 16.

and incentivizes polluters to internalize environmental externalities within their operational expenses.

- **Application to Transboundary Pollution:** In transboundary contexts, the polluter-pays principle plays a critical role when activities in one state cause damage within another jurisdiction. It directs the allocation of prevention, containment, and restoration costs to the source entity, preventing victim states from bearing the financial burden of damage arising from activities beyond their control⁸⁴.
- **Limitations in International State Responsibility:** While important, the polluter-pays principle alone does not constitute a standalone basis for establishing the international legal responsibility of a state. State responsibility requires a breach of an international obligation under customary or conventional international law. Instead, the polluter-pays principle operates primarily as a cost-allocation tool for prevention, remediation, and reparation within applicable legal regimes⁸⁵.

Conclusion

The legal foundation of responsibility for transboundary pollution under international environmental law demonstrates that international law has progressively established a framework holding states to obligations aimed at preventing activities within their jurisdiction from causing environmental harm beyond their borders. This legal responsibility does not arise merely from the occurrence of environmental damage; rather, it is intrinsically tied to whether a state has breached its international duties—particularly those of a preventive nature. This assessment must account for the unique characteristics of environmental damage, including the challenges of identifying its source and establishing a clear causal link to the originating activity.

Furthermore, international jurisprudence has played a vital role in consolidating the no-harm principle and refining the scope of preventive obligations, due diligence, and inter-state cooperation, thereby strengthening the legal protection of the environment against transboundary activities. Consequently, in addressing the core research problem, it can be concluded that while international environmental law provides a substantial legal basis for transboundary pollution responsibility, the practical efficacy of this system remains contingent upon the clarity of international obligations, the availability of mechanisms to prove causation and harm, and the capacity of international settlement and cooperation mechanisms to ensure compliance.

This study yields several key findings:

- Transboundary pollution constitutes a major form of international environmental harm, distinguished primarily by the fact that its adverse effects extend beyond the territorial boundaries of the originating state.
- The diversity of transboundary pollution forms, sources, and pathways complicates the identification of exact pollution sources and the assignment of state responsibility.
- The no-harm principle serves as a primary legal foundation governing state conduct regarding activities capable of generating extraterritorial environmental impacts.
- Preventive obligations have assumed a central role in international environmental law, expanding state responsibility beyond *ex post* remediation to mandate proactive measures that prevent or minimize potential harm.

⁸⁴- Ibid., Principle 16; ILC, Draft Principles on the Allocation of Loss in the Case of Transboundary Harm Arising out of Hazardous Activities, 2006, Principles 3–5.

⁸⁵- Ibid., Principles 3–6.

- The precautionary principle is vital when dealing with activities that threaten serious or irreversible environmental harm, ensuring that a lack of full scientific certainty is not used to defer protective action.
- Establishing a direct causal link represents a primary obstacle to enforcing legal responsibility for transboundary pollution, particularly in cases involving cumulative or multi-source contamination.
- While the polluter-pays principle aids in allocating the costs of prevention, containment, and restoration, it does not independently establish international state responsibility, which strictly requires a breach of an international legal obligation.
- International courts and tribunals have contributed significantly to refining environmental rules and state obligations; however, ensuring effective protection requires further development at both conventional and institutional levels.

Based on these findings, the following recommendations are proposed:

- **Enhance and Refine International Rules:** Strengthen and develop international frameworks governing responsibility for transboundary environmental damage to achieve greater clarity regarding the conditions and scope of legal liability.
- **Strengthen Preventive Obligations:** Fortify state preventive duties, particularly regarding Environmental Impact Assessments (EIAs), prior notification, information exchange, and consultations on activities with potential transboundary effects.
- **Promote International Cooperation Mechanisms:** Expand international cooperation in environmental monitoring and the exchange of scientific and technical data to facilitate the prompt detection of pollution sources and the establishment of causation between activities and harm.
- **Develop Effective Dispute Settlement Mechanisms:** Formulate more effective international mechanisms for settling transboundary environmental disputes to ensure the swift remediation and reparation of environmental damage.
- **Broaden Multilateral Cooperation:** Extend the scope of inter-state cooperation in preventing transboundary pollution, particularly in cases involving multi-source contamination or impacts crossing multiple national jurisdictions.
- **Institutionalize the Polluter-Pays Principle:** Encourage the adoption of the polluter-pays principle within national and international prevention and remediation frameworks, while maintaining a clear distinction between cost-allocation mechanisms and the legal basis for state responsibility.
- **Integrate Environmental Considerations into Policy:** Urge states to incorporate environmental safeguards into national industrial and developmental policies to balance economic growth with the duty to protect the environment from transboundary harm.

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