

Invisible Pollution, Inadequate Law: Rethinking Civil Liability for Non-Persistent Oil Spills in International Maritime Law

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Abstract: Non-persistent oil spills, involving substances such as gasoline, kerosene, and jet fuel, pose acute yet under-recognized threats to marine ecosystems due to their rapid dissipation and toxic effects. Despite existing international liability frameworks principally, the International Maritime Organization's (IMO) Civil Liability Convention (CLC) 1969 and the International Oil Pollution Compensation (IOPC) Fund Conventions—the treatment of non-persistent oil remains legally and ecologically inadequate. This article critically analyzes these conventions alongside national legal regimes, particularly the United States' Oil Pollution Act (OPA) 1990 and India's jurisprudence on absolute liability, to assess gaps in compensation, enforcement, and environmental redress. While the CLC imposes strict liability and sets tonnage-based limits, many jurisdictions find these provisions insufficient for addressing the full spectrum of ecological harm. The IOPC Fund provides supplemental compensation but often struggles with quantifying damage from non-persistent oil spills due to their volatile and short-term nature. The article highlights the divergence between international and domestic systems, noting that some states, like India, rely on broader constitutional mandates and judicial innovation to protect environmental rights. Through doctrinal and comparative legal analysis, this research advocates for a hybrid liability regime that blends strict and absolute liability principles, raises or abolishes compensation caps, and mandates ecological restoration for even short-lived oil spills. The study underscores the urgent need for reform in global maritime liability laws to ensure effective, fair, and science-based compensation frameworks capable of addressing evolving environmental risks.

Keywords: Non-persistent oil, civil liability, IMO conventions, environmental compensation, absolute liability.

1. Introduction

Oil pollution remains one of the most critical environmental threats to marine ecosystems worldwide. Whether it stems from operational discharges, accidental spills, or deliberate acts, the impact on ocean and coastal habitats can be both immediate and long-lasting. While efforts have been made at the international and national levels to establish liability regimes and compensation mechanisms, certain legal and practical gaps persist especially when dealing with non-persistent oil pollution. Non-persistent oils, such as gasoline and kerosene, disperse more rapidly than heavier crude oils; yet they can produce intense but

short-lived toxicity in marine organisms, corals, and shoreline habitats. Their lower viscosity often leads to dispersal challenges that require distinct treatment approaches compared to traditional heavy-oil spill scenarios (Smallwood, 2024).

The legal and ecological challenges posed by non-persistent oils are not merely theoretical but are underscored by empirical evidence and historical incidents. Data from the International Tanker Owners Pollution Federation (ITOPF) indicates that spills of refined petroleum products such as gasoline, jet fuel, and kerosene account for a significant proportion of maritime pollution incidents, with hundreds of recorded cases over the past two decades. Yet, compensation for such spills under international regimes often falls short of the actual ecological and economic costs. A illustrative example is the 1991 *Araevo* spill in the Mediterranean, where approximately 1,000 tonnes of gasoline caused severe acute toxicity to marine life, including mass mortality of benthic organisms. Despite the clear ecological harm, compensation proceedings struggled to account for the rapid dissipation of the pollutant and the subsequent underestimation of long-term habitat damage. This gap between the measurable impact of non-persistent oils and the compensatory responses of existing legal frameworks highlights the urgent need for doctrinal and procedural reform.

The International Maritime Organization (IMO) conventions, particularly the Civil Liability Convention (CLC) 1969 (amended by later protocols) and the International Oil Pollution Compensation (IOPC) Fund Convention, set the global standards for liability and compensation. While these conventions tackle core principles such as strict liability, limitation of liability based on ship tonnage, and the creation of compensation funds the practical adequacy of these standards for non-persistent oil spills remains contested. This tension is magnified by the comparatively broad liability regimes under domestic laws like the United States Oil Pollution Act (OPA) 1990, which eschews many of the limitations under IMO conventions, and the evolving jurisprudence in other jurisdictions, notably India, which embraces an ‘absolute liability’ principle for certain types of industrial and environmental hazards (Smallwood, 2024).

The comparative legal study of these frameworks IMO conventions, domestic laws such as OPA 1990, and Indian

environmental jurisprudence reveals both convergence and divergence in how legal regimes address the multifaceted nature of oil pollution. This article aims to explore the strengths, limitations, and prospective areas for reform within the existing liability and compensation mechanisms. By focusing on non-persistent oils, the research highlights the urgent need for a hybrid liability regime that amalgamates strict and absolute liability principles, introduces tailored financial limits or eliminates them in scenarios where ecological harm is extensive and ensures prompt and adequate compensation.

2. Scope and Significance

In light of the escalating volumes of maritime trade, the occurrence of oil pollution incidents has become a global concern. While large-scale crude oil spills often garner public attention due to their visible impact, smaller but frequent spills involving non-persistent oils can cumulatively cause substantial harm. The legal frameworks governing these incidents vary considerably, raising critical questions about harmonization, enforcement, and fairness for affected coastal communities and marine ecosystems. The significance of a robust comparative examination is manifold.

Ecological Imperative

Marine ecosystems are fragile, and non-persistent oil spills can devastate fish stocks, seabirds, and corals despite their relatively rapid dissipation. Thus, the adequacy of compensation for remediation and restoration work is of paramount importance.

Legal Harmony

Fragmented liability regimes and inconsistent compensation thresholds can hinder effective international collaboration, undermining the broader objectives of maritime environmental protection. A comparative analysis clarifies points of divergence and potential harmonization among different jurisdictions.

Policy Implications

As climate change amplifies the risks of extreme weather events, maritime incidents involving hazardous substances may increase. Policymakers must anticipate evolving threats to maritime safety and environmental protection by strengthening existing legal tools.

Empowerment of Domestic Stakeholders

Countries such as India have advanced notable legal principles like absolute liability to address industrial hazards. This article assesses the potential integration of such principles into global oil pollution regimes. By distilling the lessons and best practices from various jurisdictions, the article contributes to the ongoing scholarly discourse about refining maritime environmental liability. Ultimately, this serves the policy goal of ensuring that those harmed by oil pollution whether persistent or non-persistent receive timely and sufficient compensation.

Research Questions

To focus the inquiry, the article addresses the following core research questions.

1. Are the liability caps and fund-based compensation mechanisms under the Civil Liability Convention (1969) and IOPC Fund Convention sufficient to address the unique and often acute environmental harms caused by non-persistent oil spills?
2. How do national frameworks, particularly the United States' Oil Pollution Act (1990) and India's absolute liability jurisprudence, measure up against IMO standards in terms of holding polluters accountable and ensuring appropriate compensation?
3. Should a hybrid liability model be adopted that amalgamates the best elements of strict and absolute liability, thereby imposing heightened financial and legal accountability for environmental damage? What statutory and policy reforms might be necessary at the international level to implement such a model?

4. How have domestic courts, especially in India, applied the principle of absolute liability in environmental cases such as industrial disasters, and can these rulings inform global approaches to maritime oil pollution?

Methodology

This paper adopts a doctrinal legal research approach, analyzing primary legal sources including statutes, conventions, and judicial decisions and secondary legal sources such as scholarly journals, authoritative legal commentaries, and reputable online legal databases. While the focus is on the IMO conventions, the Civil Liability Convention 1969, the IOPC Fund Conventions (1971, 1992, and subsequent protocols), and leading national statutes like the U.S. Oil Pollution Act 1990, the study also closely examines Indian statutory instruments and case law to ensure jurisdictional relevance.

Comparative Jurisdictional Review

The article juxtaposes the international regime with national legal frameworks, focusing on:

United States

Oil Pollution Act 1990, particularly Sections 1002–1004, which remove many liability caps and provide a broader compensatory mechanism

India

Constitutional provisions (e.g., Article 21 on the right to life and environment), statutory norms, and pivotal judicial rulings like *MC Mehta v Union of India*, which have advanced an absolute liability principle for environmental harm.

Feature	IMO CLC/IOPC Regime	United States (OPA 1990)	India (Absolute Liability)
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Liability Principle	Strict liability	Strict liability, broader scope	Absolute liability (no defenses for ultra-hazardous activities)
Liability Cap	Tonnage-based limit (SDRs)	Higher caps, often uncapped in practice	No statutory cap in environmental cases
Key Defenses	Act of war; third-party intent; negligence of government	Limited (acts of God, war, third party)	No defenses for inherently dangerous activities
Ecological Damage Compensated?	Limited, often undervalued	Yes, includes assessment & restoration	Yes, broad interpretation under Article 21
Non-Persistent Oil Covered?	Ambiguous, often overlooked	Explicitly included under definition of “oil”	Covered under “environmental harm” in case law
Compensation Source	Shipowner + IOPC Fund	Responsible party + Oil Spill Liability Trust Fund	Polluter (absolute) + possible state intervention
Judicial Role	Limited by convention terms	Active in interpretation and enforcement	Proactive, constitutional mandate (Article 21)

Table 1. Comparative Analysis of Oil Pollution Liability and Compensation Regimes

Other Notable Jurisdictional Approaches

The comparative landscape of oil spill liability is further diversified by the approaches of other major maritime actors. The European Union,

through Directive 2005/35/EC on ship-source pollution (as amended), emphasizes administrative penalties and criminal sanctions alongside civil liability (Directive 2005/35/EC, 2005) While it reinforces the IMO conventions' framework within member states, its focus on "serious negligence" as a basis for penalties creates a distinct layer of deterrence that operates in parallel to the CLC/IOPC compensation system. This model showcases a regional preference for augmenting international civil rules with stronger public enforcement mechanisms (Smallwood, 2024).

Conversely, China, as a leading flag and coastal state, presents a hybrid model. Its Maritime Code and Marine Environmental Protection Law formally incorporate principles from the IMO liability conventions. However, in practice, domestic enforcement and compensation mechanisms are often shaped by strong state oversight and a focus on rapid cleanup, sometimes prioritizing restoration costs over protracted litigation. The evolving nature of China's environmental jurisprudence, including the development of its own "ecological damage" claims system, suggests a potential future divergence where domestic public law remedies may supplement or influence the application of international civil liability frameworks. These examples underscore that the global response to oil pollution, particularly for complex cases involving non-persistent oils, is not merely a binary between IMO standards and the U.S./Indian models, but a spectrum of integrated and evolving approaches (Boyle & Redgwel, 2021).

Critical Appraisal of Case Law

Indian courts have articulated a robust legal doctrine for industrial and environmental accidents, often imposing strict or absolute liability on polluters. The article discusses how these principles, alongside foreign precedents, could inform modifications to the global maritime liability regime

The analysis culminates in synthesizing doctrinal insights and policy recommendations aimed at strengthening compensation mechanisms for non-persistent oil pollution. This synthesis also accounts for the interplay between environmental conservation objectives and the economic realities of maritime transport.

3. The Role of the Indian Legal Framework

Although India ratified many international maritime conventions, its domestic legal order encompasses constitutional and statutory provisions that can amplify or modify the conventions' application. Under Article 253 of the Indian Constitution, Parliament has the power to implement international treaties through domestic legislation. Additionally, judicial innovation has led to the recognition of environmental rights as part of the fundamental right to life under Article 21 of the Constitution. This judicial activism is exemplified by cases such as *MC Mehta v Union of India*, wherein the Supreme Court of India expanded the state's responsibilities to protect and improve the environment.

India's statutory landscape includes the Environment (Protection) Act 1986, the Indian Ports Act 1908, and the Merchant Shipping Act 1958, each addressing aspects of maritime safety and pollution control. In the realm of industrial accidents, Indian courts have sometimes bypassed conventional notions of strict liability, adopting a more stringent rule of absolute liability for inherently dangerous activities. The rationale is that entities engaged in hazardous activities bear an obligation to prevent any harm, and if harm does occur, they are liable to compensate without the defenses typically available under strict liability. This approach may influence how Indian courts might interpret and apply the Civil Liability Convention or analogous frameworks, thus making India a particularly compelling jurisdiction to examine in the context of non-persistent oil pollution (Salako, 2012).

4. Literature Review

Literature on oil pollution liability and compensation has evolved considerably since the 1970s. Seminal works analyze the development of the Civil Liability Convention and the Fund Convention, highlighting the balancing act between environmental concerns and the shipping industry's economic interests (International Maritime

Organization [IMO], n.d.). More recent scholarship has turned its attention to emerging environmental challenges, including the proliferation of non-persistent oil products in global trade and the potential inadequacies of existing legal regimes to tackle their acute toxic effects (Smallwood, 2024).

Studies that compare international standards with domestic laws especially the U.S. Oil Pollution Act 1990 often reveal a gap in coverage and compensation (Boyle & Redgwell, 2021). The OPA 1990 imposes higher levels of liability on polluters, which many argue acts as a stronger deterrent (Salako, 2012). Critics, however, note that the patchwork adoption of international protocols can hamper uniform responses to cross-border oil pollution incidents, underscoring the need for global harmonization (Adetoro, 2009).

Indian legal scholarship, in particular, has examined how the absolute liability principle, once primarily associated with industrial accidents on land, might extend to maritime contexts (Divan & Rosencranz, 2022). This scholarship observes that in the event of an oil spill in Indian territorial waters, an Indian court could invoke constitutional protections and common law doctrines to ensure comprehensive redress (*M. C. Mehta v. Union of India*, 1987). However, the literature also emphasizes the tension between statutory frameworks derived from IMO conventions where liability is limited and domestic case law that supports unlimited or absolute liability (Divan & Rosencranz, 2022).

This article seeks to add to existing scholarship by focusing specifically on the under-addressed issue of non-persistent oil spills, using a doctrinal, comparative lens to identify pathways for legal reform that effectively merge the strengths of international conventions and domestic legal principles.

5. Legal framework under IMO conventions

5.1. Historical Context and Evolution of the

Conventions

The international community's response to oil pollution liability has been shaped by a series of catastrophic spills. The wreck of the *Torrey Canyon* off the coast of Cornwall in 1967 is widely regarded as a pivotal event that accelerated the development of modern maritime pollution conventions. (The evolution of maritime law, n.d.) The immense damage caused by that incident highlighted the inadequacy of existing legal regimes to hold polluters accountable and ensure compensation for affected coastal states, prompting urgent reforms under the aegis of the International Maritime Organization (IMO).

In the late 1960s, recognizing the need for a unified international approach, states began negotiating what became the International Convention on Civil Liability for Oil Pollution Damage (CLC) in 1969. (International Maritime Organization [IMO]) The CLC 1969 introduced the concept of strict liability for shipowners, thus reducing the evidentiary burdens on claimants. It also codified defenses such as force majeure or sabotage and importantly, allowed shipowners to limit their liability to a specific sum based on vessel tonnage.

Following the entry into force of the CLC 1969, it soon became apparent that even with strict liability, claimants sometimes faced challenges in receiving full compensation when damages exceeded the limits set by the convention. In response, the International Oil Pollution Compensation (IOPC) Fund Convention was introduced in 1971, establishing the IOPC Fund as a supplementary source of compensation. This initial "two-tier" system was further expanded through subsequent protocols, culminating in the 1992 Protocols, which modernized and increased liability limits (International Maritime Organization [IMO]).

Despite periodic amendments and updates, critics assert that the IMO Conventions have often not kept pace with the evolving risks associated with newer types of cargo, including non-persistent oil products like gasoline, kerosene, and jet fuel (Aguzzi et al., 2025). Inadequate compensation caps, coupled with a lack of clarity on ecological damage assessments, are recurring concerns that underscore the need for reforms.

5.2. Civil Liability Convention (CLC) 1969: Key Provisions

The CLC 1969, alongside its later protocols, remains the cornerstone of international oil pollution liability. Its primary objective is to establish a uniform framework that ensures prompt and adequate compensation for victims of oil pollution damage.

5.2.1. Strict Liability and Limited Defenses

Under Article III of the CLC 1969, liability is imposed on the registered owner of vessel carrying oil in bulk as cargo, regardless of fault. This approach mitigates the burden on claimants to prove negligence, streamlining recovery efforts. Strict liability is deemed essential for pollution incidents, where harm can be immediate and evidence of fault difficult to ascertain (Adetoro, 2009).

Article III outlines three main defenses for ship owners:

- i. The incident resulted from an act of war, hostilities, civil war, or insurrection.
- ii. The damage was wholly caused by a third party's intentional act or omission.
- iii. The damage arose from the negligence of any government responsible for the maintenance of navigational aids.

These defenses often align with standard maritime practices, acknowledging that certain extraordinary events may lie outside the scope of a ship owner's control. Nonetheless, some scholars argue that these defenses, albeit narrow, can still pose hurdles for claimants if invoked in complex spill scenarios involving multiple actors (Sundaram, 2016).

5.2.2. Limitation of Liability: Ton-Based Limitation

Article V of the CLC 1969 grants ship owners the right to limit liability to an amount tied to the gross tonnage of the ship, multiplied by a fixed rate of Special Drawing Rights (SDRs). Over time, these limits have been increased through protocols (e.g., 1976, 1992, 2000 amendments), reflecting inflationary changes and acknowledging the rising costs of oil spill remediation (International Maritime Organization [IMO]). While the rationale for limitation is to protect the shipping industry from catastrophic financial liabilities thus encouraging maritime trade critics highlight that it can undercut full compensation for large-scale or particularly harmful spills.

5.2.3. Breaking the Limitation:

Ship owners may lose the right to limit liability if it is proven that the pollution damage resulted from their personal act or omission, committed with the intent to cause such damage or recklessly with knowledge that such damage would likely result. However, establishing the requisite level of fault can be difficult in practice, meaning that the limitation is seldom broken (De La Fayette, 2001).

5.2.4. Scope of Application

The CLC 1969 applies primarily to pollution damage suffered in the territory or territorial sea of a contracting state. Amendments have extended its applicability to exclusive economic zones (EEZs), ensuring broader geographical coverage (International Maritime Organization [IMO]). Still, uncertainties persist about the precise scope of compensation for environmental and ecological harm especially with non-persistent oils that may cause severe but localized and short-lived damage.

5.3. International Oil Pollution Compensation (IOPC) Fund Convention

The IOPC Fund Convention established a supplementary compensation regime to support victims when shipowner liability under the CLC is insufficient. Initially adopted in 1971, it underwent a major overhaul in 1992, increasing compensation limits and adjusting the funding structure.

5.3.1. Funding Mechanism

One of the distinctive features of the IOPC Fund is that it is financed through contributions levied on entities receiving more than 150,000 (One lakh fifty thousand) tons of crude and heavy fuel oil per year. This broad-based approach distributes the financial burden among oil importers and cargo owners, reflecting a shared responsibility for mitigating spill risks.

Under the 1992 regime, victims of oil pollution can file claims against the ship owner's insurer up to the CLC limit; if that limit proves insufficient or unavailable, they may claim further compensation from the IOPC Fund (International Oil Pollution Compensation Funds [IOPC Funds]). In 2003, the Supplementary Fund Protocol introduced a third tier of compensation for extremely costly spills, significantly raising the overall amount available to claimants.

5.3.2. Eligibility and Claimable Damages

The IOPC Fund compensates individuals, businesses, and governments that have incurred oil pollution-related losses, including costs of clean-up operations and preventive measures (Fund Convention (n 12) art 4.). Environmental restoration costs may also be covered, though quantifying ecological harm often proves contentious and can involve complex scientific assessments.

5.3.3. Non-Persistent Oil Complexity:

While the IOPC Fund Convention does not differentiate between persistent and non-persistent oils, the rapid dissipation and volatile

nature of the latter complicate damage assessments. Critics posit that the Fund's existing procedures developed primarily for large-scale persistent spills may not adequately address the acute toxicity and short-term but severe environmental impact of non-persistent spills (Adetoro, 2009).

5.4. Core Principles in the IMO Liability Regime:

Despite the complexities, several core principles shape the IMO liability framework:

Uniformity and Predictability

By standardizing rules across contracting states, the CLC and IOPC Conventions facilitate global maritime trade while providing clarity for the shipping industry and claimants alike.

Strict Liability Coupled with Limited Defenses

This structure expedites compensation by reducing the need for protracted legal battles over fault.

Limitation of Liability

Ship owners benefit from predictability and security in their financial exposure, although this mechanism remains one of the most criticized aspects of the regime.

Shared Responsibility

The two-tier system, funded by both shipowners (through compulsory insurance) and oil receivers, acknowledges that pollution prevention is a collective concern (Dan & Xiao, 2024).

These principles have underpinned decades of oil pollution response efforts, yet numerous studies and high-profile incidents suggest that the regime requires regular updates to remain effective,

particularly in the context of emerging energy products and shifting environmental priorities.

5.4.1. Strengths and Shortcomings of the IMO Conventions:

With widespread ratification, the CLC and Fund Conventions supply a near-universal legal standard for oil pollution liability, reducing fragmentation.

Certainty for Stakeholders

Clear liability caps and established procedures streamline insurance arrangements, enabling quicker settlement of claims.

Supplementary Compensation

The IOPC Fund provides an additional safety net, alleviating concerns about insufficient ship owner coverage.

Shortcomings

Liability Caps

Critics argue that the financial ceilings under the Conventions do not always reflect the true costs of environmental restoration, particularly after major spills. This shortfall can be especially stark for accidents involving non-persistent oils, whose clean-up and restoration may be costly yet not fully recognized within the existing compensation framework.

Complex Claims Process

Claimants often need to navigate multiple layers of bureaucracy to secure compensation, which can delay recovery efforts and discourage smaller claimants with limited resources.

Insufficient Provision for Ecological Damage

While remedial and preventive measures are covered, intangible or long-term ecological harm remains difficult to quantify, often resulting in underestimated compensation.

Evolving Nature of Maritime Cargo

The original design of the CLC and IOPC Fund primarily addressed spills of persistent crude oil and heavy fuel. Non-persistent oil cargoes such as gasoline introduce distinct challenges that the drafters of these instruments may not have fully envisioned.

5.4.2. Non-Persistent Oil Pollution Under the IMO Conventions

Characteristics of Non-Persistent Oils

Unlike heavier crude, non-persistent oils have a lower viscosity and evaporate more quickly. Their immediate impact can be severe, causing acute toxicity to marine organisms, yet they often leave fewer visible remnants like tar balls or thick sludge. This makes assessing long-term damage and securing corresponding compensation challenging.

Legal Ambiguities

Although the IMO Conventions do not explicitly differentiate between persistent and non-persistent oils, the compensation machinery leans heavily on post-incident evaluations of environmental harm and economic loss. These evaluations can underestimate the ramifications of non-persistent oil spills if the ecosystem appears to “recover” swiftly, even though critical and sometimes irreversible damage may have occurred at a microscopic or subtidal level (Adetoro, 2009).

Calls for Reform

Environmental advocates have repeatedly lobbied the IMO to consider specialized guidelines or protocols addressing non-persistent oil pollution. Suggestions include revising the evidentiary standards for compensation, mandating real-time environmental monitoring in spill-affected areas, and raising the liability ceiling for such incidents. However, consensus remains elusive, reflecting broader disagreements about the shipping industry's financial liabilities and the extent of ecological restitution owed.

5.5. Interaction with Domestic Frameworks:

Given that many states adopt the CLC and IOPC Fund Conventions with modifications or supplement them with domestic legislation, the practical application of these rules can vary. Two noteworthy examples discussed further in Part III are the United States and India:

5.5.1. United States (Oil Pollution Act 1990)

Though the United States is not a party to the CLC and Fund Conventions, it has developed OPA 1990, which imposes broader liability and tougher penalties. In some cases, U.S. courts apply OPA 1990 extraterritorially if the pollution affects U.S. waters or shoreline.

5.5.2. India

India has ratified many of the IMO conventions but also imbues its domestic legal framework with robust constitutional protections for the environment (Constitution of India, 1950, art. 253). Given the judiciary's tendency to adopt or endorse 'absolute liability' in severe environmental harm cases, the interplay between international

conventions and local jurisprudence can shape unique outcome (Divan & Rosencranz, 2022).

These dual approaches highlight that while the IMO Conventions provide a baseline standard; national frameworks can diverge significantly leading to disjointed global enforcement for non-persistent oil spills.

Emerging Debates and Potential Revisions

The IMO has occasionally revisited liability ceilings under the CLC and IOPC Fund Conventions, adjusting them to reflect inflation and shifting economic realities. Yet calls to address the unique challenges of non-persistent oils persist. These calls often focus on:

Enhanced Compensation for Ecological Harm

Proposals include the creation of specialized funds or procedures specifically for rapid-assessment spills involving volatile petroleum products.

Hybrid Liability Regimes

Scholars and environmental activists suggest blending strict liability with absolute liability concepts to ensure that in certain contexts where the activity is inherently dangerous no defenses or caps apply (Divan & Rosencranz, 2022).

The proposed hybrid liability model seeks to balance the shipping industry's need for predictable risk management with the ecological imperative of adequate compensation for non-persistent oil spills. In practice, this model would operate through several key mechanisms:

Tiered Liability Standards: For routine spills within normal operational parameters, strict liability under modified IMO standards would apply, but with significantly higher compensation caps that reflect modern cleanup costs and ecological valuation. However, for spills occurring in ecologically sensitive zones (marine protected areas, coral reefs, critical habitats) or resulting from gross negligence or willful misconduct, absolute liability principles would be

triggered, removing compensation caps entirely and eliminating conventional defenses.

Dynamic Compensation Calculation: Rather than relying solely on tonnage-based formulas, compensation would be calculated using a two-track system: (1) immediate cleanup and restoration costs, and (2) ecological damage valuation using standardized scientific protocols specifically designed for non-persistent oils. This would account for acute toxicity even when visible residues disappear rapidly.

Procedural Innovations: The model would include presumptive compensation for certain categories of harm (e.g., fishery closures in the immediate aftermath of a spill), shifting the burden to the polluter to disprove causation rather than requiring victims to prove complex scientific links.

Improved Scientific and Claims Procedures

Advocates emphasize the need for a global scientific protocol on assessing short-term but severe ecological disruptions. A unified approach could reduce legal uncertainties and streamline compensation.

Greater Transparency and Enforcement

Enhanced reporting requirements, real-time spill data collection, and stronger enforcement mechanisms could improve the efficacy of the existing conventions.

Implementation Challenges

Navigating Real-World Constraints

While theoretically sound, the hybrid model faces significant practical and political hurdles that must be addressed.

Industry Resistance and Economic Concerns

The shipping and petroleum industries have historically opposed liability expansions, citing increased costs, reduced competitiveness, and trade disruption. Industry groups argue that uncapped absolute liability creates unpredictable financial exposure, potentially deterring

investment and raising consumer prices. The International Chamber of Shipping maintains that the current CLC/IOPC framework balances environmental and commercial interests.

Treaty Amendment Hurdles and Political Feasibility

IMO amendments require approval by two-thirds of contracting states representing 50% of world tonnage a threshold favoring flag states with large registries. This dynamic systematically resists cost-increasing proposals. Additionally, the “no more favourable treatment” principle complicates relations with non-parties like the United States.

Transitional Implementation Pathways

A phased approach may prove most viable:

- i. Opt-in protocols allowing willing states to adopt enhanced liability standards;
- ii. Regional agreements to implement hybrid principles in sensitive marine areas;
- iii. Pilot programs for high-risk vessel or cargo categories;
- iv. Temporary compensation buffers to ease market transition.

Insurance Market Adaptation and Financial Mechanisms

Insurers would need new products and risk models. Adaptation could be facilitated through government-backed reinsurance pools, risk-based premiums rewarding safety, mutual insurance arrangements, and gradual phase-in periods.

Enforcement and Compliance Considerations

Effective enforcement would require harmonized national legislation, enhanced port state controls, international judicial cooperation, and transparent claims procedures.

These challenges are substantial but not insurmountable. Historical precedents such as the gradual strengthening of CLC limits show that incremental progress is possible with sustained advocacy, scientific evidence, and strategic coalition-building among coastal states.

6. Conclusion

The IMO Conventions, particularly the Civil Liability Convention 1969 and the IOPC Fund Convention, constitute the bedrock of international law concerning liability for oil pollution at sea. Their establishment of strict liability and supplementary compensation funds has facilitated a more predictable legal environment. Yet, the distinctive challenges posed by non-persistent oils underscore the need to reassess and refine these regimes. Critics note that the current structure originally designed for persistent oil cargoes may underestimate the ecological damage from rapidly dispersing yet highly toxic oils.

Furthermore, an increasing number of states have opted to implement domestic laws that exceed or deviate from the IMO Conventions. This trend reflects growing dissatisfaction with liability caps and perceived gaps in the existing compensation structure, particularly around environmental restoration. As maritime trade evolves and non-persistent oil shipments increase, the international community faces a critical juncture: either it can continue to rely on incremental amendments to existing conventions or consider more radical reforms, potentially including a hybrid liability model uniting strict and absolute liability principles. In **Part III**, we shift focus to national frameworks, comparing the more expansive liability regimes in jurisdictions such as the United States and the evolving Indian approach – anchored in the constitutional right to a healthy environment and the principle of absolute liability. This comparative perspective helps elucidate how certain domestic systems might offer alternative models for strengthening international liability and compensation for non-persistent oil pollution.

Policy Implementation Roadmap

The compelling evidence of regulatory gaps surrounding non-persistent oil spills demands more than theoretical critique; it requires actionable pathways for change. To translate the proposed hybrid liability model into reality, the following concrete steps should be prioritized:

1. Establish a Dedicated IMO Working Group on Non-Persistent Oil Liability

The International Maritime Organization should immediately convene a specialized working group under the Legal Committee, tasked exclusively with addressing liability gaps for volatile petroleum products. This group's mandate should include: (a) drafting amendments to the CLC specifically addressing non-persistent oils, (b) developing guidelines for compensation valuation of acute ecological harm, and (c) proposing transitional implementation mechanisms that balance environmental protection with shipping industry feasibility.

2. Develop a Model National Law Incorporating Hybrid Liability Principles

A coalition of coastal states, environmental organizations, and legal experts should collaborate to draft a comprehensive model national law that implements the hybrid liability approach. This instrument would serve as a template for domestic legislation, featuring: (a) tiered liability standards differentiating routine spills from those in sensitive areas, (b) enhanced compensation mechanisms for ecological restoration, and (c) procedural innovations for expedited claims processing. The model law would demonstrate practical viability and encourage harmonized national reforms.

3. Create an International Scientific Protocol for Non-Persistent Oil Damage Assessment

Recognizing that compensation disputes often hinge on scientific uncertainty, the IMO in partnership with UNEP and scientific bodies should establish a standardized protocol for assessing ecological damage from volatile petroleum spills. This protocol must: (a) define methodologies for quantifying acute toxicity impacts despite rapid dissipation, (b) establish baseline monitoring requirements for pre- and post-spill ecological conditions, and (c) create presumptive damage categories to streamline compensation for common harm scenarios.

4. Launch Regional Pilot Programs for Gradual Implementation

Given the political challenges of immediate global reform, willing coastal states should establish regional pilot programs particularly in ecologically vulnerable areas like coral reef regions or Arctic waters

where enhanced liability standards would apply. These programs would generate empirical data on implementation challenges, compensation adequacy, and industry adaptation, building evidence-based momentum for broader adoption.

The journey toward adequate liability for non-persistent oil spills will undoubtedly encounter resistance, but the cost of inaction measured in compromised marine ecosystems and inadequately compensated coastal communities is simply too high. By pursuing these concrete, sequential policy steps, the international community can begin closing the liability gap that currently leaves oceans vulnerable to the invisible yet acute threat of non-persistent oil pollution.

Conflict of interest

The authors declare that there is no conflict of interest.

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The authors contributed equally to the preparation of the manuscript.

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