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CENTER for INTERNATIONAL ENVIRONMENTAL LAW

Offshore, Off-Limits

Making Oceans Off-Limits to Offshore Oil and Gas

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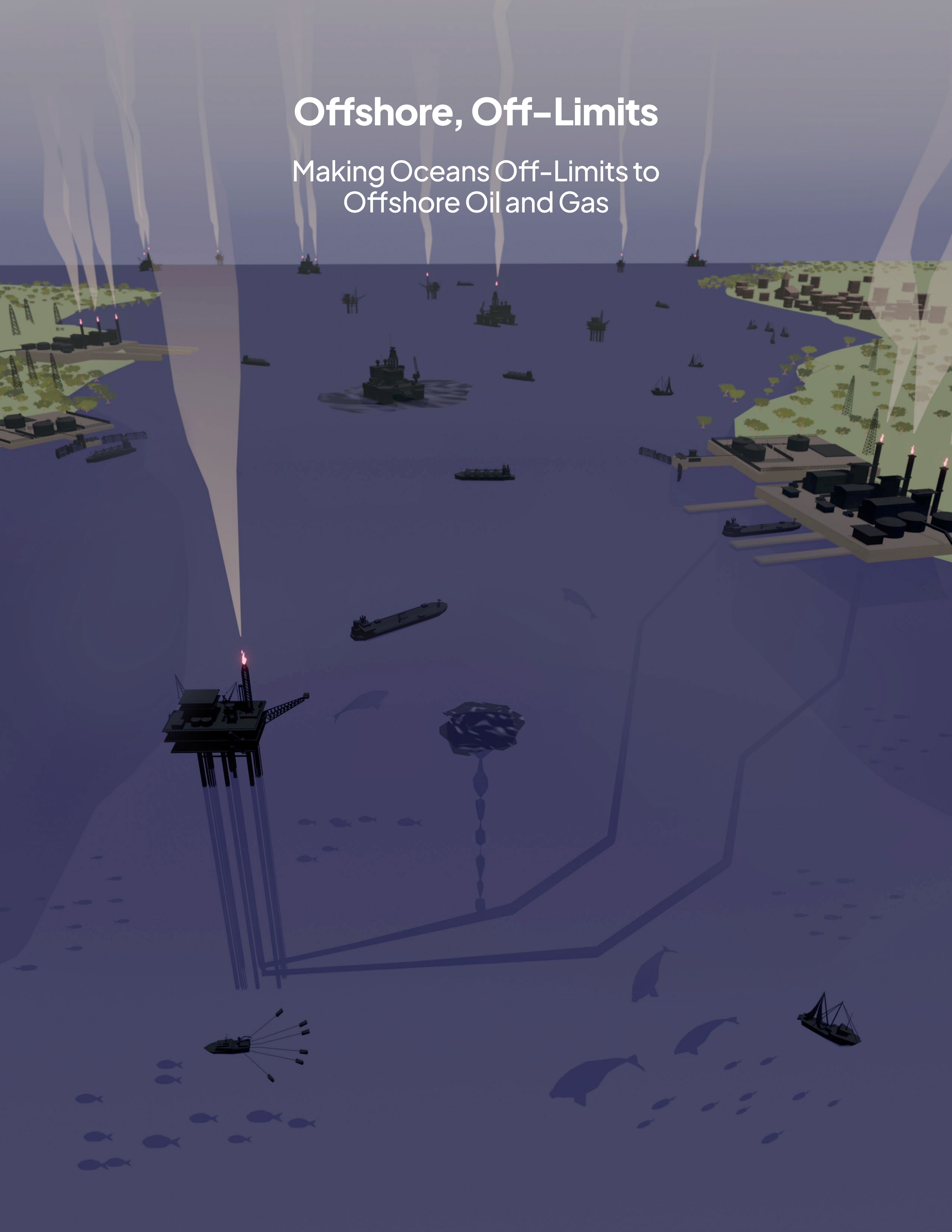

About CIEL

Founded in 1989, the Center for International Environmental Law (CIEL) uses the power of law to protect the environment, promote human rights, and ensure a just and sustainable society. CIEL is dedicated to advocacy in the global public interest through legal counsel, policy research, analysis, education, training, and capacity building.

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Introduction

From seismic exploration and drilling in the seabed to coastal processing and overseas transportation of fossil fuels, offshore oil and gas activity threatens two global commons on which all life on Earth depends: the oceans and the atmosphere. Offshore projects are growing in number and today represent more than 30 percent of global oil and gas production. Fossil fuel companies are sinking ever more money into undersea reserves, taking their operations to ever deeper and more remote waters.

Transporting massive volumes of crude oil or highly flammable gas over long distances and through fragile marine ecosystems is an inherently hazardous activity. And it's on the rise. Fully 40 percent of maritime trade now consists of shipping fossil fuels and fossil fuel products from one place to another. The buildout of infrastructure and shipping routes for expanded oil and gas production and trade is coming on top of decades' worth of oil and gas wells and pipelines that the industry has left behind, many of which are leaking and abandoned.

One of the most significant and growing threats to oceans is the recent boom in the production of liquified natural gas (LNG). Designed to be transported over long distances, LNG has entrenched the use of oceans as conduits for the global trade in dirty energy and littered coastlines with polluting processing plants, import and export terminals, and other infrastructure.

This intensified assault on our oceans compounds existing stressors posed by climate change, overfishing, plastic pollution, and resultant biodiversity loss. Oceans play a critical role in stabilizing the global climate. They are Earth's biggest carbon sink and have a tremendous capacity to store and release heat over long periods of time. However, this role is jeopardized by continued greenhouse gas emissions, overwhelmingly from fossil fuels. And the rising wave of offshore oil and gas activity only amplifies this threat.

Offshore production activities have outsized yet largely underreported climate footprints. Recent developments in satellite technology have revealed that methane leaks and other emissions due to flaring at offshore oil and gas platforms and coastal facilities far exceed official accounts. Enormous quantities of greenhouse gases are further generated during the transport and end use of the produced oil and gas. By increasing concentrations of carbon dioxide in the atmosphere and accelerating climate change, oil and gas activity exacerbates sea level rise, ocean warming and acidification, and other impacts already degrading marine and coastal ecosystems and threatening human rights and the survival of coastal communities. These climate consequences compound the local ecological impacts of offshore activity, such as air pollution, water contamination, and disturbance of marine habitats. However, because offshore oil and gas projects are often "out of sight, out of mind" and technically difficult to monitor, many of these impacts go unnoticed and unaddressed.

This series, *Offshore, Off-limits*, examines the many risks and impacts of offshore oil and gas activity across its phases, from exploration and production to transportation and decommissioning. Each brief looks at a different phase of oil and gas activity and discusses how the hazards inherent in routine operations and the risks of accidents endanger the world's oceans and the communities, ecosystems, and climate that depend on them. The briefs address some of the applicable legal frameworks and principles that can help prevent harm and hold industry actors accountable. **As this series makes clear, whether it's from new deepwater exploration or legacy wells, offshore projects have profound impacts on human rights and the global commons at every stage. To ensure a livable future for all, we need to make oceans everywhere off-limits to oil and gas.**

Exploration

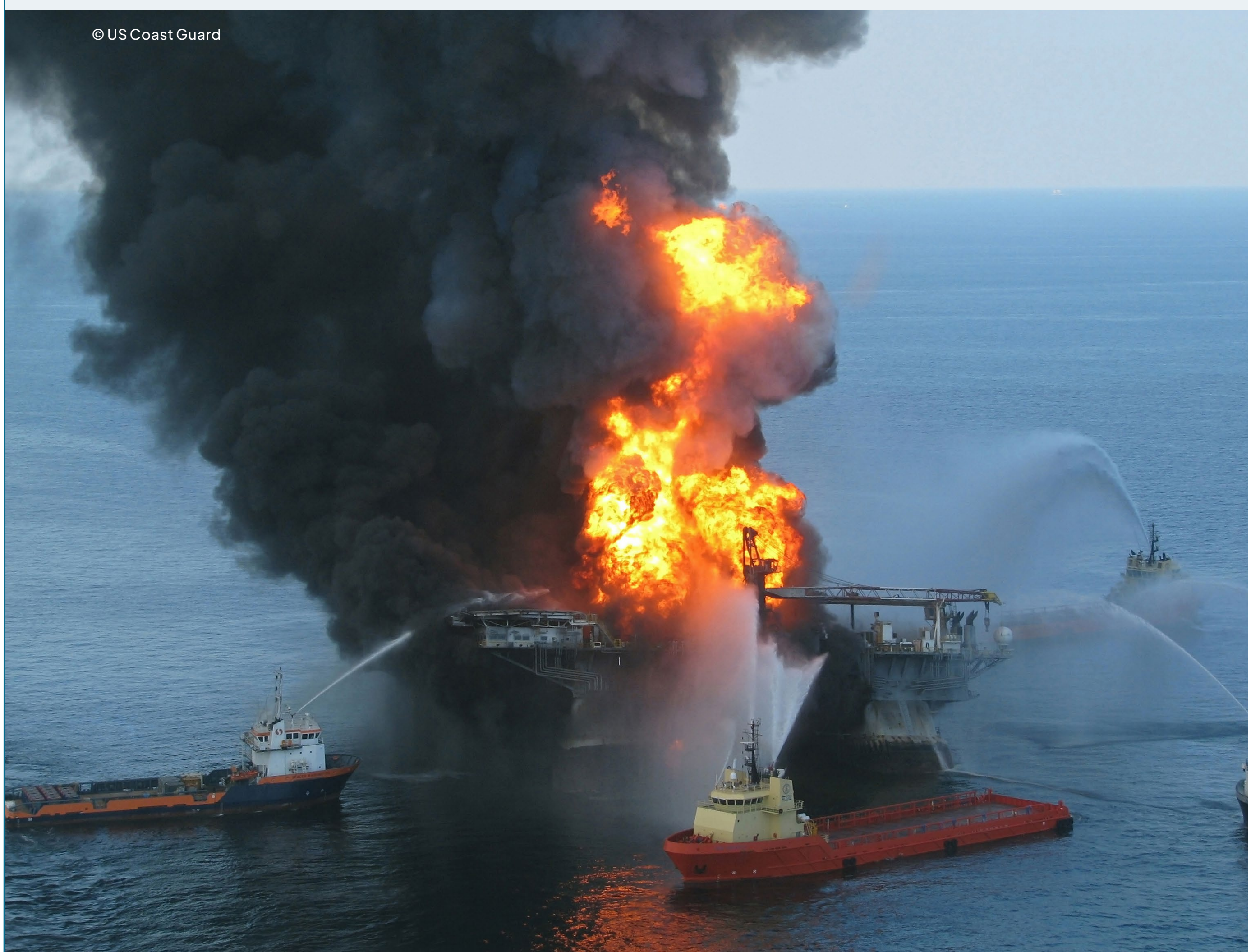
The damage begins long before any oil or gas is produced, when companies explore for new fields off the coast. Surveyors use air guns to map underwater oil and gas deposits to send sound waves toward the seabed. These blasts can be louder than a rocket launch. Noise pollution generated by subsea exploration activities can seriously harm marine life, from microorganisms to whales, by inducing stress responses and behavioral changes that jeopardize survival.

Companies may also drill exploratory wells, which requires constructing rigs and other equipment and can introduce heavy metals and other toxins into the marine environment. These impacts threaten the health, productivity, and resilience of marine ecosystems crucial for biodiversity and coastal and fisherfolk communities around the world. Moreover, the installation of offshore infrastructure is often accompanied by the creation of exclusion zones that prevent local communities from accessing fish stocks critical for income and survival, leading to loss of livelihood and food insecurity.

Production

Once companies begin producing oil and gas, offshore operations release myriad pollutants that drive climate change and harm human and environmental health. Offshore oil and gas production platforms have enormous climate footprints due to greenhouse gas emissions from gas flaring, methane leaks from offshore infrastructure, and the massive amounts of energy needed to power operations. Many of these emissions are underreported due to the difficulty of monitoring installations at sea.

The greatest danger associated with offshore oil and gas production is from well blowouts, which trigger massive oil spills, threaten the lives of platform workers, and unleash ecologically devastating pollutants into the water and air. As companies increasingly move their operations to deeper, more remote waters, the risk of large-scale disaster from a blowout and spill increases. Such accidents can have devastating, long-term repercussions for the economies, livelihoods, and mental and physical health of impacted coastal communities. What's more, some oil spill cleanup practices commonly employed by the industry can be ineffective and exacerbate environmental harm by introducing additional toxic chemicals into marine and coastal ecosystems.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Transportation

After oil and gas are extracted from undersea reserves, companies typically transport the fossil fuels to onshore facilities where it can be processed and used as intended — typically combusted. The increasing use of the oceans as highways for the global trade in fossil fuels, especially LNG, only magnifies the sector's climate impacts. Moving LNG around the world is particularly emissions-intensive because of the energy required to liquefy, compress, ship, and regasify the product.

Beyond driving anthropogenic climate change, the movement of oil and gas via pipelines and ships carries myriad ecological risks. Routine discharges from transport vessels contaminate oceans with hydrocarbons, toxic metals, and dangerous chemicals that can bioaccumulate in the tissues of marine life and harm fishing communities. Undersea pipelines can also create safety hazards to fisherfolk by entangling fishing equipment and vessels, endangering life and property. Moreover, transportation- related oil spills can devastate large swathes of the ocean and coastlines, and more oil and gas tankers moving between offshore sites and markets means a risk of more accidents.

Decommissioning

Even after offshore wells have been tapped dry or shut off, the infrastructure continues to harm the marine environment and the climate. Many offshore platforms and wells have never been decommissioned. Abandoned wells and offshore platforms are proliferating in the world's oceans, leaking enormous amounts of planet-warming gases into the atmosphere and toxins into oceans. From impacts on fisheries and tourism to contaminants in the food chain, offshore oil and gas facilities can threaten the health and livelihoods of nearby coastal populations long after operation ceases. To add insult to injury, oil and gas companies often avoid paying decommissioning costs through loopholes in bankruptcy law, tax codes, and contracts, shifting the expense and burden of cleanup to host governments and taxpayers. While the proper decommissioning of oil and gas operations inevitably involves disruption to host ecosystems, it is necessary and far preferable to allowing abandoned or improperly closed infrastructure to leave a lasting legacy of harm in our oceans.

The world cannot protect the oceans from the triple planetary crises of climate change, pollution, and biodiversity loss without addressing the drivers of these global threats — namely, fossil fuels. Considering the full range of harms caused by intensifying oil and gas activity on coastlines and at sea, oceans everywhere should be off-limits to offshore oil and gas. **Making the sea fossil fuel-free is critical to protecting our oceans, our climate, and our collective future.**

CENTER for INTERNATIONAL ENVIRONMENTAL LAW

Offshore, Off-Limits

The Risks of Offshore Oil & Gas Exploration

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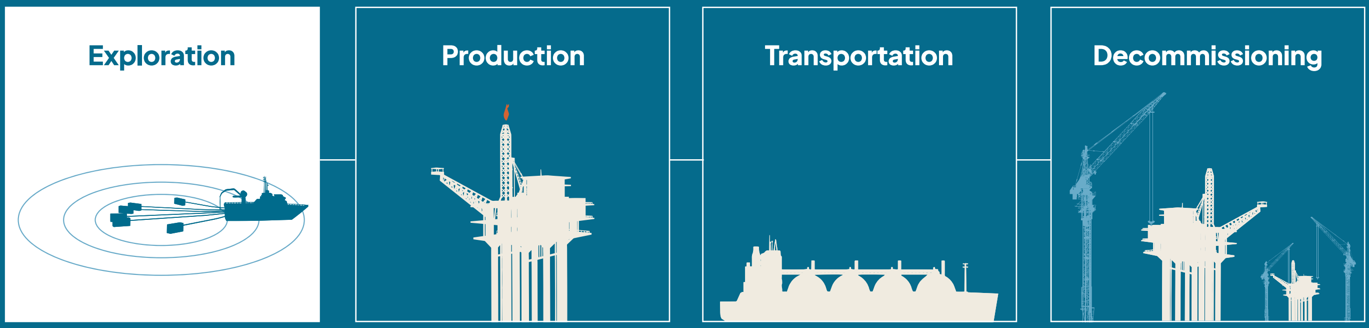
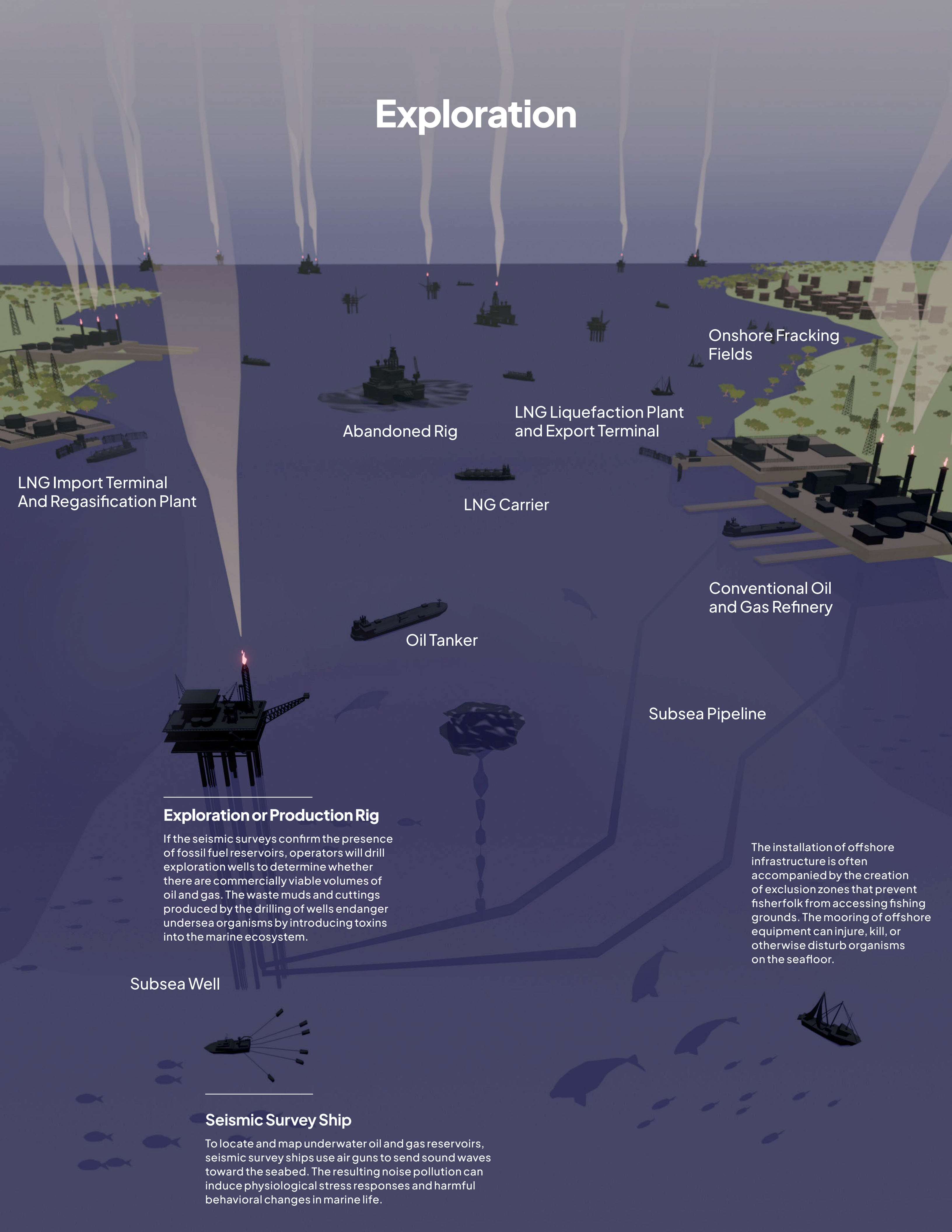


Exploration



Exploration or Production Rig

If the seismic surveys confirm the presence of fossil fuel reservoirs, operators will drill exploration wells to determine whether there are commercially viable volumes of oil and gas. The waste muds and cuttings produced by the drilling of wells endanger undersea organisms by introducing toxins into the marine ecosystem.

The installation of offshore infrastructure is often accompanied by the creation of exclusion zones that prevent fisherfolk from accessing fishing grounds. The mooring of offshore equipment can injure, kill, or otherwise disturb organisms on the seafloor.

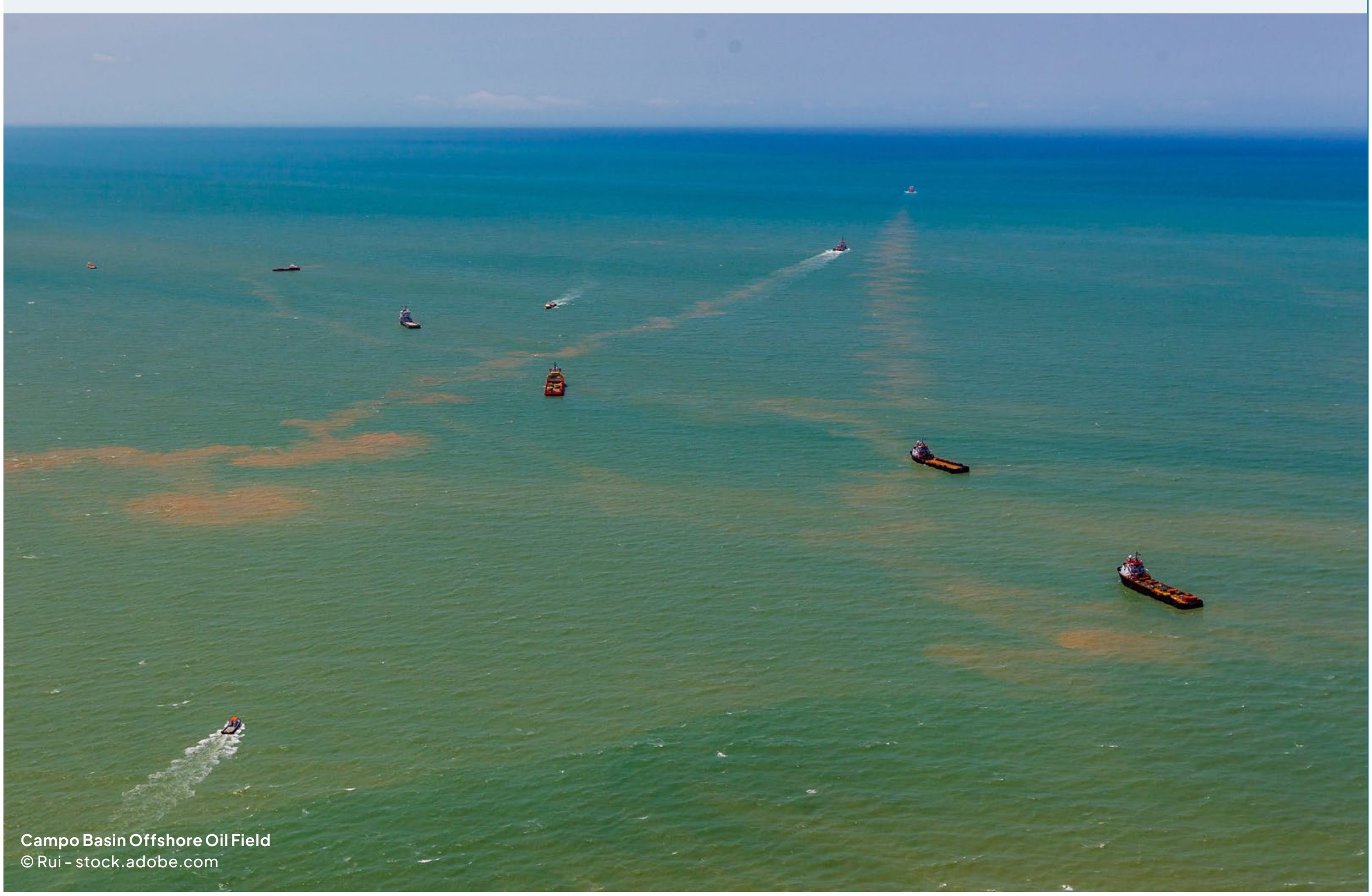
Seismic Survey Ship

To locate and map underwater oil and gas reservoirs, seismic survey ships use air guns to send sound waves toward the seabed. The resulting noise pollution can induce physiological stress responses and harmful behavioral changes in marine life.

Offshore oil and gas activity poses myriad threats to the environment and human rights across its life cycle, from exploration and production to transportation and decommissioning. *Offshore, Off-Limits* examines many of the relevant risks and impacts at each of these phases. This brief in the series focuses on the risks and impacts associated with the exploration of undersea oil and gas deposits.

Key Takeaways

- Exploration is the first step toward extracting more oil and gas, the production and use of which release planet-warming emissions that are driving the climate crisis.
- Noise pollution generated by subsea exploration activities can seriously harm marine life, from microorganisms to whales, by inducing physiological stress responses and behavioral changes that jeopardize organisms' survival.
- Exploration activities, from installing rigs and equipment to drilling test wells, can introduce heavy metals and other toxins into the marine ecosystem.
- These impacts threaten the health, productivity, and resilience of marine ecosystems, which are crucial for biodiversity and the well-being and livelihoods of coastal and fisherfolk communities around the world.



Campo Basin Offshore Oil Field

What Is Offshore Exploration?

Exploration is the first phase of offshore oil and gas production. Its purpose is to locate subsea oil and gas that can be commercially extracted. This phase generally begins with marine seismic surveys to identify and estimate the volume of oil and gas contained in geological formations under the ocean floor.[1] If a prospective reserve is located, operators will drill exploration wells to confirm whether there are commercial quantities of oil or gas under the seabed, a process that can take several months. Such exploration activities occur at varying depths. Although exact definitions may differ across jurisdictions, shallow water development typically occurs at depths below 1,000 feet (ft) (~300 meters (m)), deepwater development at around 1,000–2,500 ft (~300–800 m), and ultra-deepwater development at over 2,500 ft.[2]

Different ocean depths require different equipment and installations, but whether in shallow, deep, or ultra-deep waters, exploration activities can cause lasting harm to oceans. Seismic surveys, in which repeated sound waves are sent underwater, can significantly harm marine life. Exploratory drilling poses additional risks related to the installation, transportation, operation, and removal of heavy equipment, as well as the management of chemical inputs and toxic waste streams. More fundamentally, exploration is the first step toward unlocking potentially massive quantities of greenhouse gas emissions, which drive climate change and its devastating consequences for people and the environment around the globe.

How Is Offshore Exploration Carried Out?

Finding hydrocarbon reserves, determining their quantity and depth, and preparing for extraction is a technically complex process that combines geological mapping and drilling. Exploration typically comprises the following stages:

Geophysical Surveys

Marine seismic surveys map the subsurface geology of a prospective site.[3] The technologies used in such surveys can have significant adverse impacts on marine populations, as discussed below. Surveys are conducted from vessels that use an array of underwater air guns to send pulses of high-energy, low-frequency sound waves toward the seabed.[4] These are recorded by sensitive underwater microphones called hydrophones, which are towed behind a survey vessel on buoyant streamers.

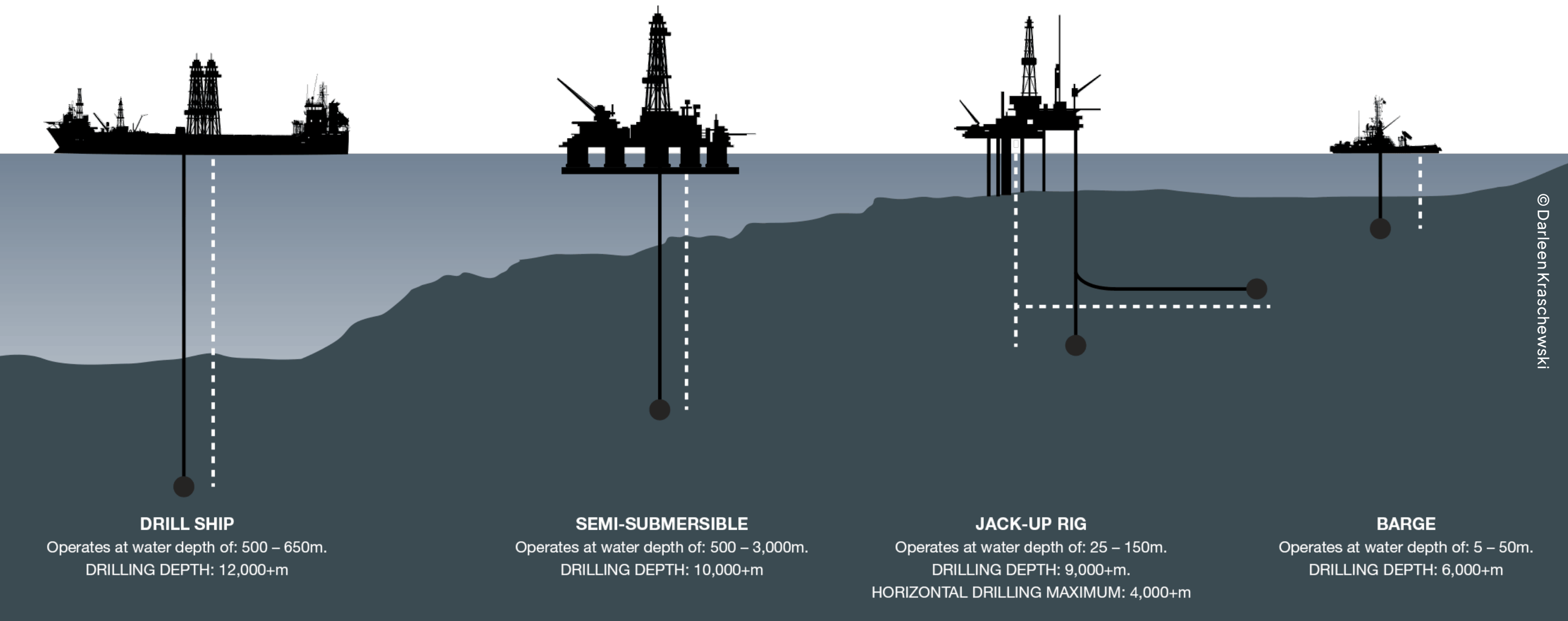
Air gun blasts can reach deafening sound levels of 260 decibels (dB), noise louder than a rocket launch (which is 160 dB for those nearby),[5] and can travel underwater up to 2,500 miles.[6] They are also relentless, firing approximately every 10 seconds for months at a time.[7] Although all seismic surveys create underwater noise pollution, 3D and 4D surveys involve more intense seismic disturbances to the marine environment than the 2D variety since they deploy multiple sound sources and are more repetitive.[8]

Exploratory Drilling

Drilling into the seabed to take samples of the underlying rock or "core" requires the erection of massive structures and the deployment of energy-intensive processes. This is an extremely risky undertaking as various types of mobile offshore drilling units (MODUs) are susceptible to accidents. Among the different types of MODUs, jack-up rigs are more common in shallower waters, whereas semi-submersible rigs and drill ships are typically used farther out at sea at greater depths.[9]

After erecting the drilling units, operators typically drill a well, in a process called spudding. Pipes are driven into the seabed before water is pumped at high pressure to remove rock and sediment. A blowout preventer (BOP) is then installed, which allows the well to be closed off in an emergency.[10] However, extremely dangerous high-pressure blowouts can occur unexpectedly, especially before the BOP has been installed.[11]

In exploratory drilling using chemical-laden drilling muds suspended in either water or oil, introduces additional risks. Those muds serve to lubricate and cool the drill, act as a medium to remove drill cuttings from the bottom of the well, and act as a sealant to prevent blowouts.[12] Drilling muds contain toxic additives such as diesel fuel and heavy metals that, when introduced into the surrounding waters, can smother and have a toxic effect on marine organisms.[13]



Appraisal Drilling

More wells may be drilled to substantiate initial findings and map the physical dimensions of the exploration area in greater detail.[14] Some of those appraisal wells may be used for production, while others will be abandoned. Because oil and gas companies often poorly manage the abandonment process (see the Decommissioning brief in this series), well leaks are common and extremely damaging. They expose marine life to toxic substances and release planet-warming gases like methane.

What Are the Risks Posed by Offshore Exploration?

Environmental and Biodiversity Risks

Routine oil and gas exploration activities can leave extensive environmental damage in their wake. The noise associated with seismic testing and drilling activities is a principal cause of harm to surrounding marine life. Direct physical disturbance of the marine ecosystem, from the discharge of drill cuttings and fluids, along with the construction and installation of drilling units, exacerbates these vulnerabilities.

Noise Pollution

During exploration, noise from air gun blasts, ship sonar, and general vessel traffic can have significant adverse impacts on marine life in at least two ways: (1) by inducing a physiological stress response and (2) by disrupting biologically-essential behavior such as mating or foraging.

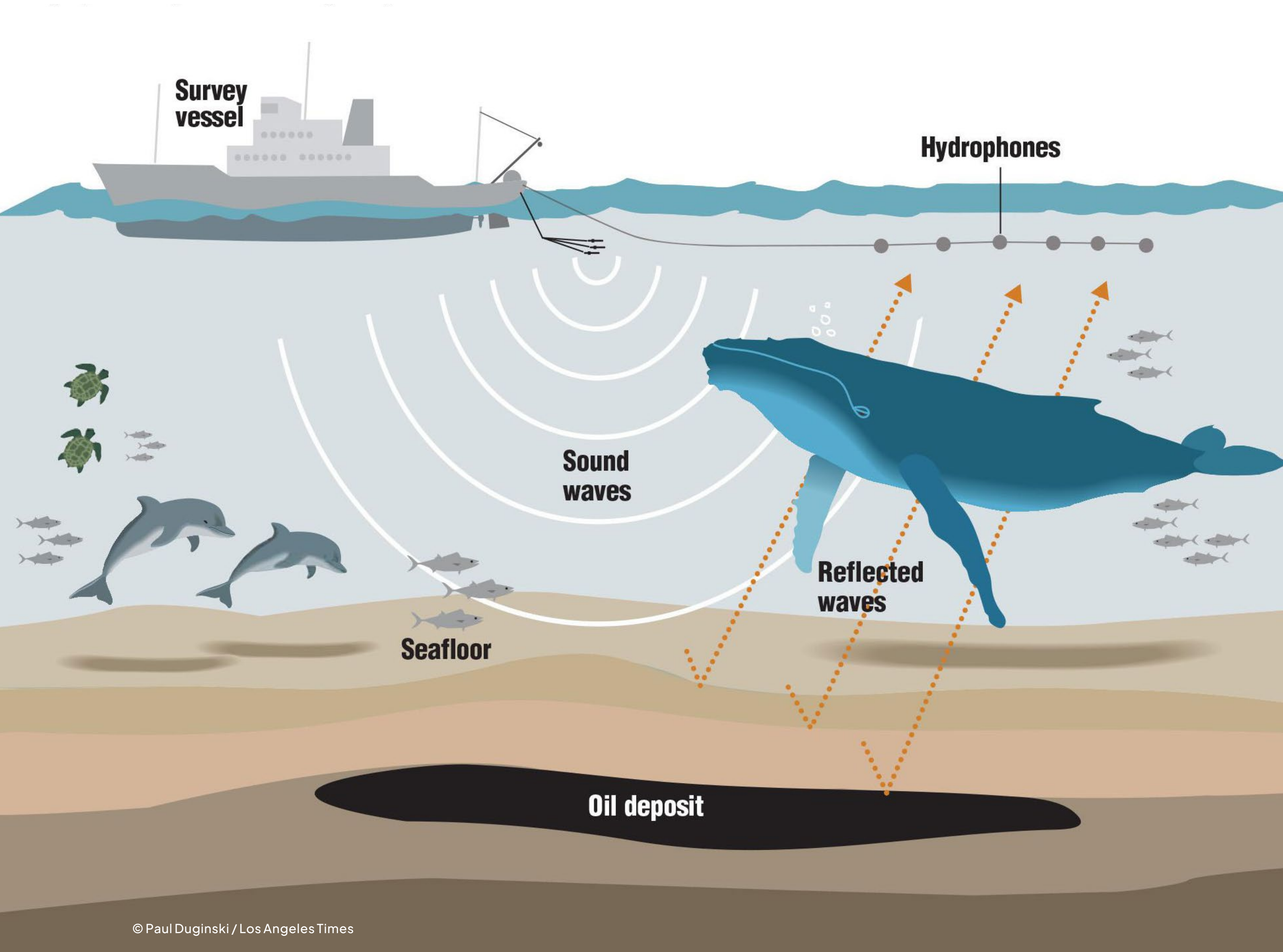
Seismic surveys can induce profound physiological stress in a wide array of ocean life, from shellfish to marine mammals. Loud noises can severely damage animals' sensory receptors, such as the statocyst, an organ responsible for orientation, balance, and predator response found in aquatic invertebrates such as lobsters and mollusks.[15] Noise pollution from seismic blasts can also damage neuromasts, a sensory organ in fish that likewise plays an important role in escape reactions.[16] At close range, air gun blasting can also induce chronic stress, permanent hearing loss, internal bleeding, and blindness, especially in fish with swim bladders.[17] Furthermore, studies of the effects of seismic air guns on the eggs and larvae of fish have observed decreased egg viability, increased embryonic mortality, or decreased larval growth with exposure to sound levels of 120 underwater decibels (dB re 1 µPa-m)[18] — far below typical noise levels from full-scale seismic survey activities, which reach 248–255 dB re 1 µPa-m.[19]

Marine seismic surveys also threaten the health and productivity of aquatic microorganisms, and thus have the potential to destabilize global marine ecosystems. Experimental air gun signal exposure has been shown to cause a two- to three-fold increase in the mortality of adult and larval zooplankton at a range of 1.2 km.[20] Because zooplankton are key components of the aquatic food chain — providing the main pathway for energy for small primary producers to large consumers like marine mammals, turtles, and fish[21] — a population decline could have resounding ecological impacts.

Noise from other machine and transport equipment involved in offshore exploration compounds the disruptive impacts of unrelenting seismic testing. The incessant noise of container ships, naval sonar, and shallow water jack-up rigs (which operate loud diesel engines, mud pumps, ventilation fans, and electrical generators) can affect animal health and behavior patterns, discussed further below. Cavitation, the sound from the synchronous collapse of bubbles created by a ship's propeller and the rumble of ship engines, is one of the main causes of background sound in the ocean.[22] Additionally, the construction of shallow-water platforms can also be a source of harmful noise.[23] This adds to the noise produced by general aircraft and vessel activity associated with rig construction, which increases the risk of ships colliding with marine mammals that may be forced to abandon their habitats.

The thundering sound of seismic surveys and other sources of noise pollution can also trigger harmful behavioral responses in marine life, especially for those animals that rely on their hearing to hunt, communicate, and navigate.[24] High stress levels induced by air gun blasting are known to change mating behavior and alter whales' dive and respiratory patterns.[25] This can, in turn, trigger decompression sickness and increase the likelihood of beach strandings.[26] Habitat displacement and slower migration speeds have also been recorded in response to seismic surveys.[27] For example, in 2019, a study found an 88 percent decrease in sightings of baleen whales and a 53 percent decrease in sightings of toothed whales during active oil and gas seismic surveys compared to control surveys.[28]

For some species of whale, dolphin, and porpoise — which hunt prey and communicate through echolocation — elevated noise levels in the ocean also spell disaster for their ability to find food. One study found that whale prey capture attempts may be 19 percent lower during air gun noise exposure.[29] A single seismic survey can cause endangered fin and humpback whales to stop vocalizing — a behavior essential to foraging — over an area at least 100,000 square nautical miles in size.[30] What's worse, 80 percent of communications of fin, humpback, and minke whales are "masked" by anthropogenic noise.[31] Similarly, seals have displayed dramatic avoidance behavior and disrupted feeding systems when exposed to air gun blasts.[32]



Legal Challenges to Offshore Exploration

The severe impacts of seismic testing on marine ecosystems, fisheries, and the communities whose livelihoods and cultures depend on them have led some courts to halt oil and gas exploration activity. In South Africa, for example, deepwater oil exploration using seismic testing has faced enormous backlash from local communities and environmental activists, prompting legal challenges.

The South African government first granted Shell and Impact Africa oil and gas exploration rights to the relatively untouched and ecologically sensitive Wild Coast in 2014, renewing these rights in 2021.[33] In November 2021, four environmental and human rights organizations filed an interdict application against Shell, Impact Africa, South Africa's Minister of Mineral Resources and Energy, and its Minister of Forestry, Fisheries and the Environment to stop the companies from conducting seismic surveys. The applicants alleged that Shell had failed to meaningfully consult the Indigenous and coastal communities whose livelihoods would be affected by the seismic blasting activities and presented evidence of the risk of irreparable harm to local fisheries and marine life, including vulnerable and threatened species of fish and cetaceans. The lawsuit invoked the precautionary principle — which is enshrined in South Africa's National Environmental Management Act[34] — arguing that "the precautionary approach on species of such dire conservation concern is imperative if we are to conserve them into the future."[35]

In 2022, the High Court of South Africa agreed with the applicants and ordered an immediate halt to Shell's seismic surveys. The court found that the government had failed to consider affected communities' spiritual and cultural rights and their rights to livelihood and that there had not been meaningful consultations, which "consist not in the mere ticking of a checklist."[36] The court also found that "the onus rests on [the respondents]" to show why the precautionary principle did not apply when there was disagreement on whether the adverse impacts of the seismic surveys had been adequately mitigated.[37] The government and companies appealed the decision, and in June 2024, the appellate court upheld the ruling but effectively reinstated exploration rights pending new consultations that "cure" the earlier deficiencies. As of the time of writing (January 2025), the situation remains ongoing.

Arguments related to the lack of consultation with affected communities, inadequate assessment and disclosure of risks, and the impacts on marine fauna have also been deployed and upheld by courts in other domestic legal challenges against offshore exploration, including in Argentina[38] and Australia.[39]

Physical Disturbances and Contamination

Massive offshore exploration rigs are susceptible to collapse, which risks permanent environmental damage and fatal consequences for rig workers. Shallow water jack-up rigs and deepwater semi-submersible rigs rely on ballast control systems, a network of pipes, valves, pumps, and tanks, to control the rig's buoyancy.[40] For semi-submersibles, pontoon-like structures are used as buoyancy tanks allowing the rig to float,[41] but malfunctions to the system can cause flooding that sinks the rig.[42] System failures can also lead to high-pressure explosions like the one on the Petrobras 36 Oil Platform in 2001, which killed eleven crew members and spilled 1,200 m^3 of diesel oil and 300 m^3 of oil into the Atlantic Ocean's Campos Basin.[43]

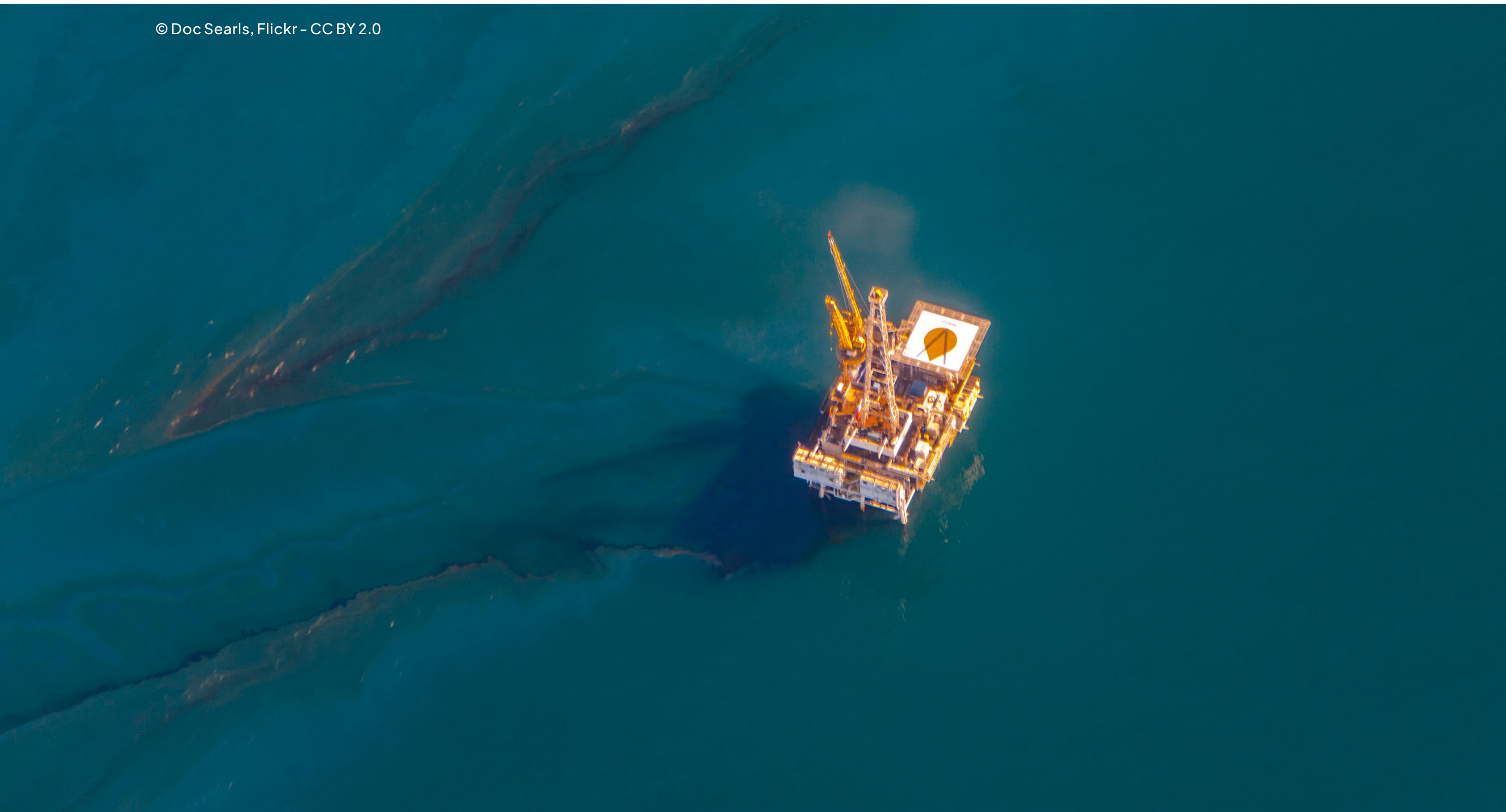
Jack-up rigs — floating barges with movable legs attached to the hull — are among the most common types of offshore platforms. To erect jack-up rigs, seawater is injected into the hull so the legs can properly grip the seabed.[44] The water is then discharged to lift the legs away from the surface, raising the drilling platform above the water line.[45] However, adding weight to the rig's base risks "punching through" the seabed,[46] causing its collapse, as happened in 2021 with ConocoPhillips' Naga-7 rig, which sank offshore Malaysia.[47]

Exploration activity, from the mooring of offshore equipment to the drilling of wells, can injure, kill, or otherwise disrupt marine organisms. In shallow waters, the legs of jack-up rigs and other movable structures extending to the bottom of the seafloor can cause ecosystem disturbances, including by affecting sedimentation patterns and facilitating the introduction of non-native and invasive species.[48] Such impacts can disrupt and degrade marine habitats in and near shallow waters — including coral reefs, mangroves, and seagrass meadows — which serve as nurseries and critical habitats for coastal and marine species, fishing grounds for local communities, and buffers against waves and storm surges. In deepwater settings, where semi-submersible rigs or drillships are moored, anchors dragged along the seabed harm benthic organisms (those that live at the bottom of the sea) like deep-sea coral and sponges.[49] Deep-sea organisms generally grow slower, live longer, and are less abundant than their shallow-water counterparts.[50] Thus, in most deep-sea ecosystems, benthic communities cannot recolonize quickly after disturbances[51] — with the process taking up up to 10 years in deeper colder water ecosystems[52] — making them very sensitive to oil and gas exploration.

The waste muds and cuttings produced by drilling exploration wells endanger benthic organisms further by introducing other toxic materials into the marine ecosystem.[53] Oil-based drilling muds contain clays, colloidal asphalts (insoluble molecular substances found in crude oil), emulsifiers, polymers, and other toxic additives, including weighting agents like calcium carbonate and barium sulfate.[54] Extensive discharges of oil-based cuttings result in large, toxic waste deposits beneath and around the platforms, hindering the rehabilitation of hard corals.[55]

Water-based drilling muds also pose numerous environmental hazards. While their main components may be heavily diluted, like other muds, water-based muds commonly contain chemical additives called polycyclic aromatic hydrocarbons (PAHs) and metals such as arsenic, barium, chromium, cadmium, copper, iron, lead, mercury, nickel, and zinc. The suspension of fine particles of PAHs, which are toxic and carcinogenic, can induce cardiac defects in fish and cause DNA damage, embryotoxicity, and developmental issues in other aquatic organisms.[56] Heavy metals pose a serious threat to marine ecosystems and the human communities that depend on them because, even in low concentrations,[57] they are highly toxic, long-lasting, and non-biodegradable.[58] Their biotoxicity also increases at lower pH levels,[59] which means that ocean acidification only amplifies their detrimental effects on the marine environment.[60] At the same time, in a dangerous feedback loop, marine pollutants like heavy metals and oil can cause the photosynthesis rates of microorganisms to drop while increasing their respiration rates, thereby boosting carbon dioxide (CO_2) levels and causing oceans to become even more acidic.[61]

Water-based muds also drive microplastic pollution. Chemicals used during exploratory drilling, including demulsifiers and corrosion inhibitors, contain microplastics, which are discharged into the marine environment.[62] Such discharges contribute to higher-than-average rates of microplastics detected in sediments and animals near oil and gas structures and exacerbate the global plastics pollution crisis.[63] It has been estimated that there are over 170 trillion plastic particles floating in the ocean, weighing between 1.1 and 4.9 million tons.[64]



Improper use of drilling muds can also lead to high-pressure well blowouts. Using the wrong density of mud can create problems with pressure related to the accumulation and movement of gas in the well, posing a potential risk of explosion at the surface.[65]

Indeed, the risk of blowouts is not unique to the production phase but can also occur during exploratory drilling. The 2010 Deepwater Horizon disaster in the Gulf of Mexico — the largest oil spill in the history of marine oil drilling operations — was caused by a blowout during exploratory drilling. Drilling during the exploration phase can have heightened risks because it occurs in areas where the geologic and underwater conditions are relatively uncertain.[66] However, because the ecological and human rights impacts of blowouts and accompanying oil spills are similar, whether during the exploration or production phases, these impacts and lessons drawn from Deepwater Horizon are discussed fully in the Production brief.

Climate Risks

The direct environmental impacts of offshore oil and gas exploration are compounded by its adverse impact on the global climate. Not only do zooplankton, threatened by offshore exploration, play a pivotal role in the ocean food chain[67] — they also play a critical role in climate regulation by photosynthetically fixing and storing massive amounts of carbon.[68] Oil and gas exploration activities interfere with that role through seismic air gun blasting and the artificial light at offshore oil and gas platforms, which disrupt the behavior and migration of zooplankton.[69]

By endangering whale populations, exploration activities also imperil the ocean's function as a carbon sink. Whales have a multiplier effect of increasing phytoplankton production. Phytoplankton contribute at least 50 percent of all oxygen to the atmosphere by capturing around 37 billion metric tons of CO_2, an estimated 40 percent of all CO_2 produced[70] — roughly equivalent to the amount of CO_2 captured from four Amazon forests' worth of trees.[71]

Running a rig's drilling equipment is inherently energy-intensive. While few published studies specifically assess the climate footprint of the oil and gas exploration phase in isolation, heavy reliance on exploration machinery on fossil power means considerable emissions. Offshore drilling units used for both exploratory and production wells are powered in part by diesel generators that use around 20–45 m^3 of fuel a day and emit potent greenhouse gases (GHG) like CO_2 and nitrogen oxides (NO_x),[72] in addition to carbon monoxide (CO),[73] which is highly poisonous and flammable.

More fundamentally, exploration is the first step toward extracting more oil and gas, which releases planet-warming emissions when used as intended. Fossil fuels are the overwhelming source of GHG emissions driving anthropogenic climate change and its catastrophic impacts on people and ecosystems. Oil, gas, and coal account for more than 75 percent of GHG emissions and nearly 90 percent of all CO_2 emissions.[74] Fossil fuel production — whether onshore or offshore — inevitably leads to emissions across its phases, from the extraction and processing of oil, gas, and coal to their transport and intended end use, primarily combustion. Thus, halting new exploration is the most effective way to avoid new fossil fuel pollution and the devastating consequences it engenders. Indeed, one study estimated that, in the US, ending the issuance of new exploration licenses for offshore oil and gas could prevent over 19 billion metric tons of GHG emissions — the equivalent of making roads in the country car-free for 15 years.[75]

Health, Livelihood, and Cultural Risks

Offshore oil and gas exploration threatens the health and productivity of marine ecosystems crucial for biodiversity, food security, and economic well-being. Worldwide, oceans provide around 182 million metric tons of seafood and 36 million metric tons of algae to the world's food supply every year.[76] Seismic air gun blasting decreases catch rates of commercial fish species by about 50 percent on average over thousands of square miles, with bigger losses closer to the source.[77] Exploration activities thus pose a threat to the livelihoods of nearly 30 million coastal Indigenous Peoples who depend on fishing worldwide and the 260 million who are employed by small-scale fisheries.[78] For instance, reportedly, when Shell began seismic surveys off the coast of Namibia in 2012, a sudden drop in catches led many seasonal fishermen in the albacore tuna industry to lose their jobs.[79]

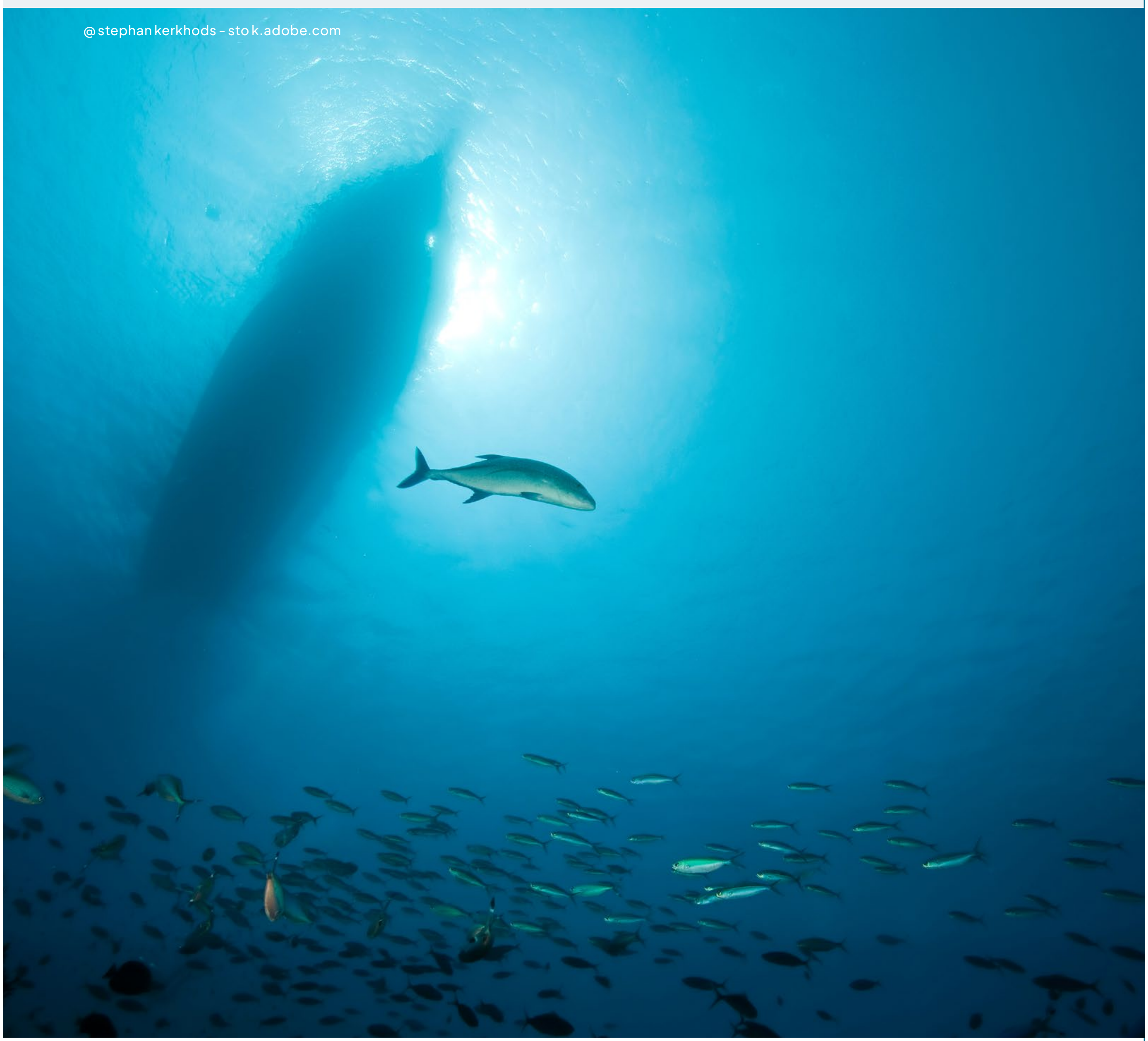
As ocean stakeholders, artisanal and small-scale fisherfolk are uniquely dependent on and knowledgeable about preserving a sustainable ocean. South Africa's Wild Coast — which has been the target of oil and gas companies and the site of ongoing legal challenges to proposed exploration activities, described above — hosts rock lobster, snoek, and other fish species critical to the livelihoods of deeply rooted communities whose cultures and histories are intrinsically tied to small-scale fishing.[80] Exploration activities thus jeopardize not just the food security and livelihoods of fishing communities but also their spiritual and cultural connections to their coasts and oceans.[81]

The economic consequences of seismic air gun blasting are readily apparent in coastal areas across the US. In 2018, US President Donald Trump issued an executive order to expedite permitting for seismic air gun surveys. An economic analysis by Oceana found that allowing such blasting and subsequent offshore drilling activities along the East Coast of the US would threaten over 1.5 million jobs dependent on healthy ocean resources and nearly $108 billion in GDP while yielding less than 7 months' worth of oil and less than 6 months' worth of gas.[82] In contrast, according to Oceana, permanently protecting US coasts from new oil development could prevent over $720 billion in damages to people, property, and the environment — the equivalent of losing the entire economy of a major US city for a year.[83]

In addition to impacts on local livelihoods and biodiversity, offshore oil and gas exploration may threaten cultural resources and practices. In a landmark ruling in November 2022, Australia's Federal Court halted Santos's work on the Barossa gas project near the Tiwi Islands in the Timor Sea because the company had not properly consulted the Indigenous islanders.[84] The concerns of the Tiwi people were rooted in the potential impacts on their "sea country" — the marine environment that is crucial to their way of life and holds deep cultural significance.[85] Then, in September 2023, the federal court stopped oil and gas company Woodside from carrying out seismic blasting for a major gas project in the Scarborough gas field off the shore of Western Australia.[86] In its ruling, the court found that government authorities had erred in approving Woodside's plans despite the company's failure to properly consult the Traditional Custodians of the Murujuga (Burrup) Peninsula.[87] The area that would have been affected by the seismic blasts — which supports populations of leatherback turtles, great white sharks, and pygmy blue whales — carries great cultural and spiritual significance for the local Indigenous population, as Woodside itself has acknowledged.[88]

Conclusion

Exploration for offshore oil and gas poses many risks to oceans, their ecosystems, and the communities and climate that depend on them — whether or not it leads to commercial extraction and production of fossil fuels. While often ignored, the impacts of seismic testing, drilling, and waste disposal threaten marine life and the environment. Those impacts are only compounded when exploration leads to commercial extraction and production of oil and gas, which unleashes climate-destroying emissions at a massive scale. Exploration, dangerous in its own right, opens the door for more drilling and even more damaging consequences for the ocean, biodiversity, communities, and the climate. Those risks and impacts are explored further in the other briefs in the *Offshore, Off-Limits* series, which can be found on CIEL's website.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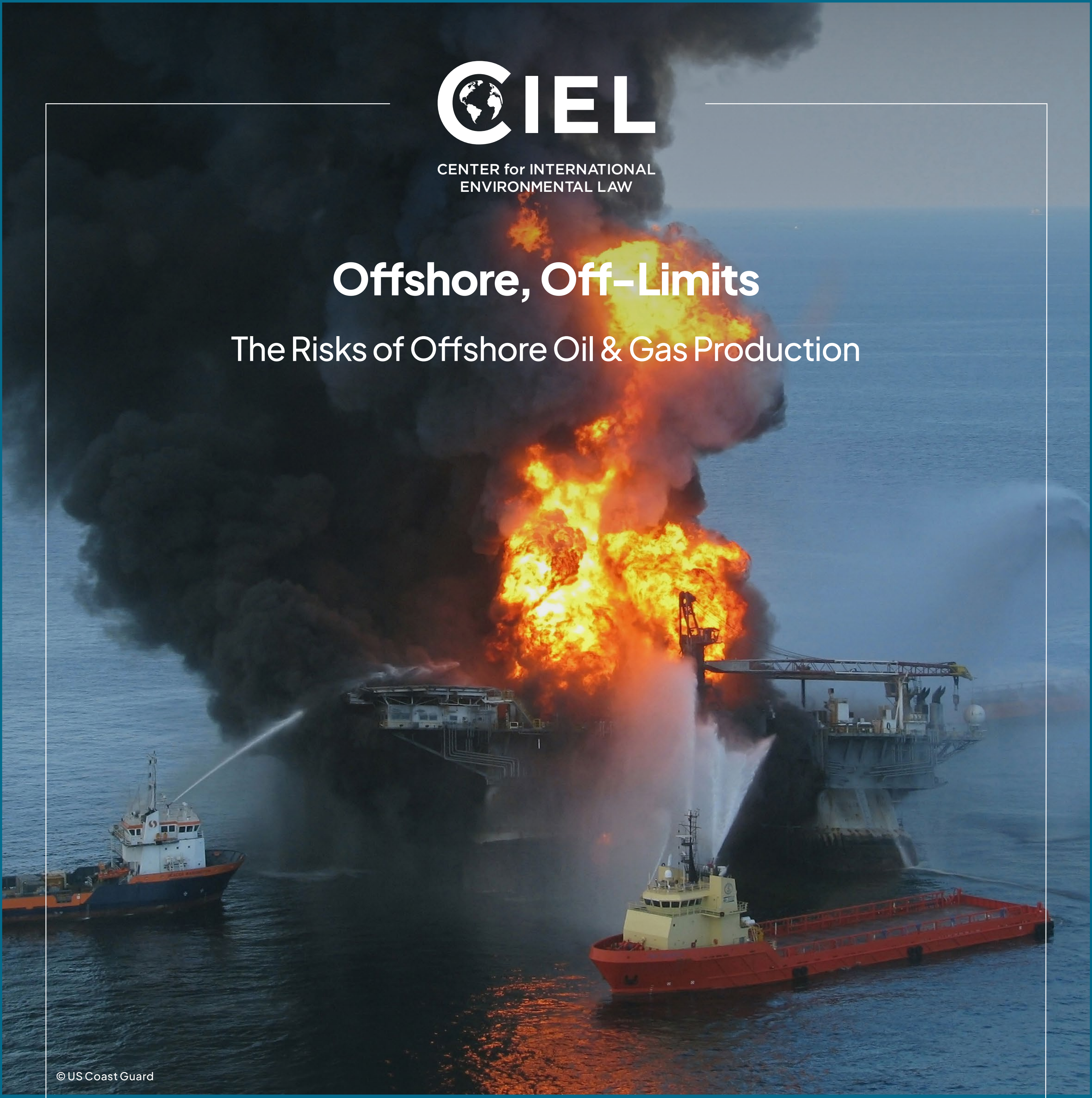
CENTER for INTERNATIONAL ENVIRONMENTAL LAW

Offshore, Off-Limits

The Risks of Offshore Oil & Gas Production



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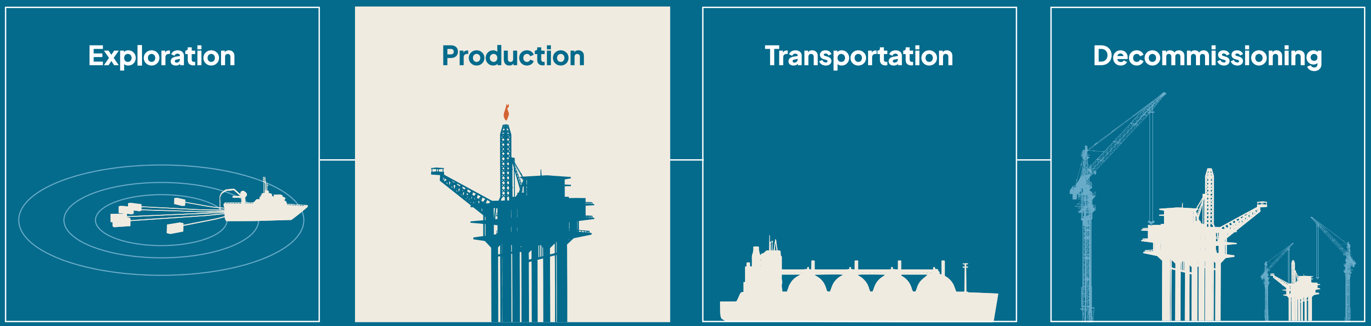
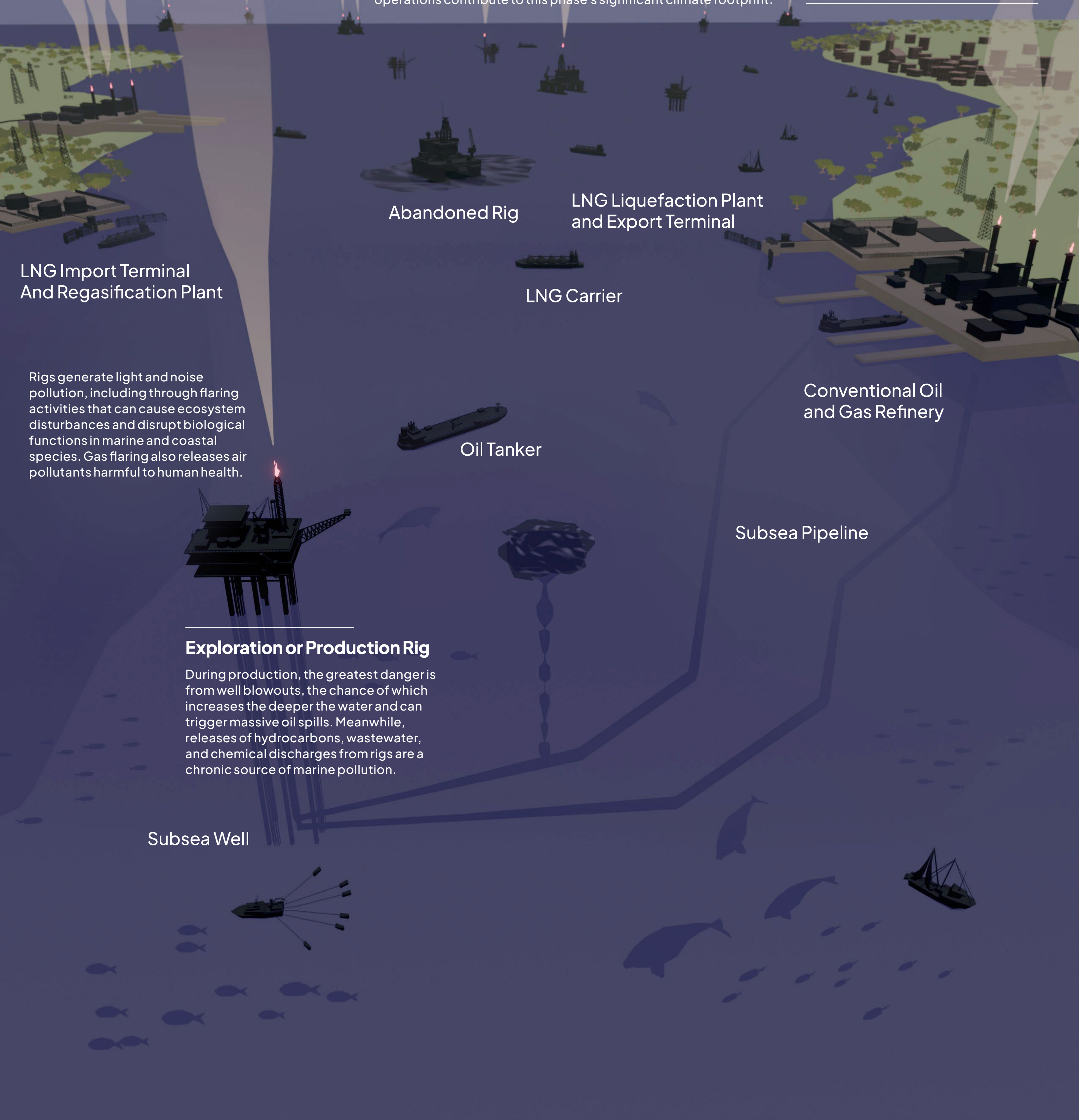


Production

Greenhouse gas emissions stemming from gas flaring, methane leaks from infrastructure, and the energy needed to power operations contribute to this phase's significant climate footprint.

Onshore Fracking Fields

The extraction of fossil gas that is converted to LNG and transported across oceans occurs both onshore and offshore.



Rigs generate light and noise pollution, including through flaring activities that can cause ecosystem disturbances and disrupt biological functions in marine and coastal species. Gas flaring also releases air pollutants harmful to human health.

Exploration or Production Rig

During production, the greatest danger is from well blowouts, the chance of which increases the deeper the water and can trigger massive oil spills. Meanwhile, releases of hydrocarbons, wastewater, and chemical discharges from rigs are a chronic source of marine pollution.

Offshore oil and gas activity poses myriad threats to the environment and human rights across its life cycle, from exploration and production to transportation and decommissioning. *Offshore, Off-Limits* examines many of the relevant risks and impacts at each of these phases. This brief in the series focuses on the risks and impacts associated with offshore oil and gas production.

Key Takeaways

- Offshore oil and gas production platforms have outsized yet largely underreported climate footprints due to emissions from gas flaring, methane leaks from offshore infrastructure, and the massive amounts of energy needed to power production operations.
- The greatest danger associated with offshore oil and gas production is the significant potential for well blowouts, which can trigger massive and ecologically devastating oil spills, injure and threaten the lives of platform workers, and unleash dangerous air quality impacts.
- The deeper the well, the greater the risk of large-scale disaster from a blowout and spill.
- Blowouts and oil spills can have devastating, long-term repercussions for affected communities' economies, livelihoods, and mental and physical health.
- Certain oil spill practices are largely ineffective and can exacerbate environmental harm, underlining the need to end offshore drilling and its associated risks.

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What Is Offshore Production?

Producing oil and gas in the oceans involves pumping hydrocarbon deposits from deep under the seabed, separating their liquid and gaseous components, and preparing them for transport to end users. Many of the dangers of offshore oil and gas operations with the most potential for large-scale and/or long-term harm are associated with production phase activities.[1] Drilling for and processing oil and gas at sea pose the risk of accidental spills, uncontrolled releases of toxic fluids and planet-warming gases from wells, and routine discharge of wastes into the marine environment. Moreover, the process of extracting oil and gas from subsea wells consumes enormous amounts of energy, leading to significant greenhouse gas (GHG) emissions and poor air quality. The impacts of offshore production pose numerous risks to the health and livelihoods of local communities, marine life, and coastal ecosystems far and wide, as well as to the global climate.

How Is Offshore Production Carried Out?

Installation of Production Infrastructure

The production phase begins with the installation of drilling platforms and pipelines, which are anchored to the seafloor. Based on the water depths where drilling occurs, the production facilities may be fixed, floating, or subsea.[2] Larger, above-water platforms — generally used in deep- and ultra-deepwater — often employ more than a hundred workers to keep them running.[3] The risk of explosions and fires, detailed below, makes these platforms extremely dangerous.

In areas where it is challenging or not economically viable to carry out production activities on above-water platforms, offshore operators will rely on subsea production systems.[4] In those situations, rather than building a production platform for an individual well, operators transport oil, water, and gas for many miles from multiple wells through a network of pipelines to distant processing facilities. Marine oil and gas pipelines are laid by ships, which move down the pipeline route, welding together sections of steel pipe.[5] During this process, cables and anchors are dragged along the seabed, disturbing local biota.[6]


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Recovery

Extracting oil and gas from underground reservoirs involves using pumps, gas valves, and motors to drive the hydrocarbon mixture to the surface. When the pressure in the reservoir drops, operators often resort to enhanced oil recovery (EOR) techniques, such as injecting liquid or gas underground to bring more oil to the surface.[7] The most common EOR technique used offshore involves injecting water produced from the initial oil separation process back into the well — a method known as waterflooding.[8] This produced water constitutes the largest volume of waste associated with offshore oil and gas production activities.[9] It contains a litany of toxic substances, including dispersed hydrocarbons, heavy metals, naturally occurring radioactive materials (NORMs), production chemicals, and dissolved gases.[10]

Processing and Export

Once at the surface, the hydrocarbon (oil and gas) mixture is either received by a floating production, storage, and offloading (FPSO) unit, transported to an FPSO by short infield pipelines, or transported directly onshore for processing via pipeline or tanker.[11] At an onshore refinery, the oil and gas are converted to commodities like diesel, petrol, and residential fuels.

Offshore oil and gas processing facilities account for the highest rate of critical accidents in the petroleum industry.[12] These incidents are very difficult to control because processing facilities use highly flammable, toxic chemicals at extreme temperatures and pressures. The risks associated with the various modes of transporting extracted oil and gas from offshore production sites to onshore facilities are detailed in the Transportation brief.

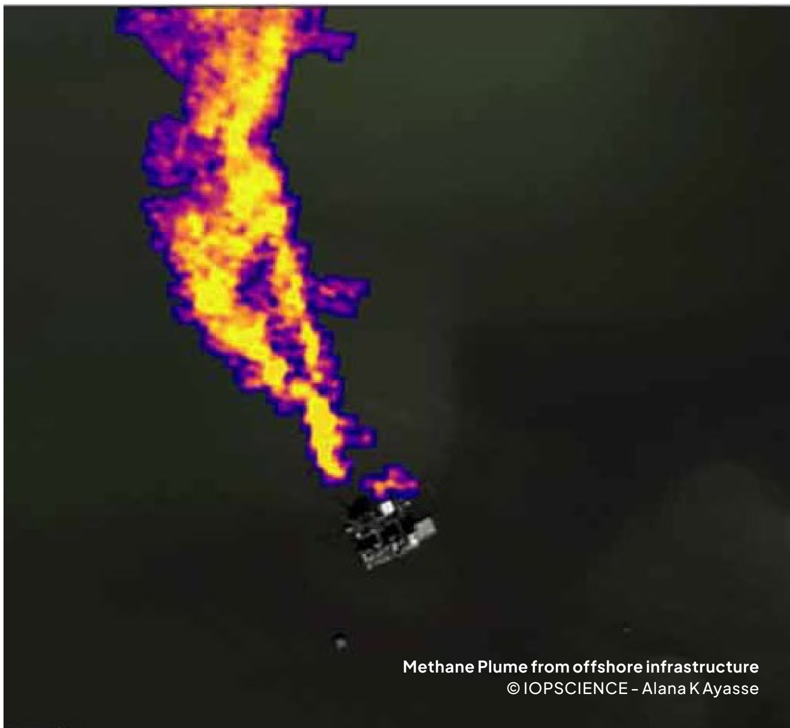
What Are the Risks Posed by Offshore Production?

Oil spills and blowouts resulting from equipment failure, human error when offloading and filling tanks, cleaning operations, and poor handling of wastes and chemicals put oceans — and the ecosystems, communities, and global climate that depend on them — under substantial stress. Gas can also pose hazards during production, from explosions to leakage of planet-warming methane. Hydrocarbon, wastewater, and chemical discharges from producing platforms add to chronic marine pollution, and additional direct physical impacts occur as subsea infrastructure is installed. The following sections detail several of the greatest risks during production: well blowouts, oil spills, contaminated discharges, greenhouse gas emissions, and other forms of air, noise, and light pollution.

Climate Risks

Offshore oil and gas platforms, which account for 30 percent of global oil and gas production,[13] have outsized climate footprints. The process of extracting oil and gas deposits from subsea reserves is energy-intensive. It releases enormous quantities of greenhouse gases, including carbon dioxide (CO_2), methane (CH_4), non-methane volatile organic carbon (VOC), nitrogen oxides (NO_x), and sulfur oxides (SO_x).[14] These emissions are attributable to the combustion of fossil fuels needed to power the operations, as well as leakages from wells and the venting and flaring activities that routinely occur during production.[15] The treatment of produced water on oil and gas platforms, the injection of polymers, and the reinjection of produced water into the reservoir require even more energy, thus increasing the emissions released into the atmosphere.[16]

The high concentrations of GHGs emitted during oil and gas production do not merely contribute to anthropogenic climate change. They also lead to coastal erosion, warming oceans, and other destructive ecological impacts, as well as contribute to the degradation of the marine ecosystem through ocean acidification. This is caused by the deposition of excess quantities of CO_2 into the ocean, which results in mass coral bleaching and other adverse impacts.



Methane Plume from offshore infrastructure
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Existing data likely undercount total emissions from the production phase of offshore oil and gas, in part due to the technological and logistical challenges of monitoring emissions at sea. A study by Carbon Mapper utilizing remote sensing technology revealed that shallow-water platforms in the Gulf of Mexico have more persistent and significantly higher methane loss rates than typical onshore production sites (23 to 66 percent compared to 3.3 to 3.7 percent) and thus disproportionately contribute to climate change.[17] Methane — a by-product of oil and gas production[18] — can trap 86 times more heat than the same amount of CO_2 over a 20-year period and is, therefore, a highly potent greenhouse gas.[19] According to findings from the study, many shallow-water platforms could be super-emitters of methane.[20]

Another pernicious source of emissions during production is gas flaring, the on-site burning of natural gas that is too uneconomical to sell and costly to store and dispose of safely. A common industry practice, gas flaring releases a potent planet-warming mix of methane, CO_2, and black carbon, contributing around 1 percent of anthropogenic CO_2 emissions annually.[21]

Gas flaring emissions from the offshore oil and gas industry have gone largely unreported. An investigation published in 2022 revealed that flaring in dozens of oil fields operated by some of the world's largest fossil fuel companies — British Petroleum (BP), Eni, ExxonMobil, Chevron, and Shell — had emitted 20 million metric tons of CO_2 equivalent in 2021, comparable to the annual GHG emissions of 4.4 million cars.[22] As oil and gas operations move to increasingly remote locations at sea and ever-deeper waters, more emissions from flaring operations may go undetected, with little to no accountability.

Stopping further offshore expansion is critical if we are to avoid the worst impacts of rising global temperatures. The best available science has made clear that it is not possible to limit average global temperature rise of 1.5˚C or above — which is necessary to avoid serious, irreversible harm to oceans, the climate system, and human rights[23] — without steep and rapid reductions in GHG emissions possible only through the phaseout of fossil fuels.[24] Yet according to the UN Environment Programme's 2023 Production Gap Report, governments currently plan to produce far more oil and gas than is consistent with a 1.5˚C pathway — 29 percent and 82 percent higher, respectively.[25] Ongoing and planned offshore projects, if allowed to advance, will drive the world faster to climate catastrophe. From drilling to downstream fossil fuel burning and use, ExxonMobil's oil and gas operations off Guyana's coast are slated to release 125 million metric tons of CO_2 into the atmosphere every year from 2025 to 2040 — roughly equivalent to the climate footprint of 15 large coal-fired power plants. This is on top of the additional tens of millions of tons of GHG emissions it will produce through gas flaring.[26] In the North Sea, licensing new offshore exploration and developing already-licensed oil and gas fields could unleash 10.3 billion metric tons of CO_2, which is 25 times the UK's annual emissions at current levels.[27] Conversely, studies show that globally halting the expansion of offshore drilling and phasing down production from existing subsea wells could cut emissions by 6.3 billion metric tons of CO_2 equivalent per year by 2050, which is around 13 percent of the total emissions reductions needed to keep warming under 1.5˚C.[28]

Stopping new offshore development projects from moving forward while shutting down existing production is thus essential to ensuring a safe climate and livable planet. In light of this reality, legal challenges to new offshore oil and gas projects increasingly highlight the incompatibility of States' climate commitments with the authorization, financing, and support of these projects, given their massive climate impacts. In a decision from January 2024, a court in Norway invalidated the permits for three new oil and gas fields in the North Sea, finding that the Breidablikk, Tyrving, and Yggdrasil fields were approved illegally. In reaching that conclusion, the Oslo District Court cited the Norwegian government's failure to assess the global climate impacts that would stem from the downstream use of the oil and gas produced from the fields and exported for consumption abroad.[29] Similarly, in June 2024, the UK's highest court ruled that planning applications for new oil and gas extraction projects must consider the environmental impact of emissions generated not only from drilling but also from the burning of fossil fuels.[30] The ruling casts doubt on the future of the UK government's plans to develop large offshore oil fields in the North Sea.[31] The Norway and UK cases are just two of a growing list of legal challenges that have leveraged climate arguments to protect oceans — and the planet — from the many dangers posed by the offshore oil and gas industry's expansion.[32]

Environmental and Biodiversity Risks

Well Blowouts

By far, the greatest danger associated with offshore oil and gas production is the significant potential for well blowouts, which can have devastating impacts on rig workers and the environment. A blowout is an uncontrolled release of crude oil, fossil gas, and/or other fluids from a well caused by a sudden surge in pressure.[33] Though offshore facilities are normally equipped with blowout preventers designed to seal off wells and avoid such emergencies, human error and mechanical failings are not uncommon. The 2009 Montara blowout and accompanying oil spill off the coast of Western Australia, discussed below, was reportedly the result of technical failures and a series of human errors.[34] However, blowouts are not unique to the production phase, and they can also occur during exploratory drilling, as was the case when a system failure at BP's Macondo well led to the Deepwater Horizon disaster. However, because the ecological and human rights impacts of blowouts and accompanying oil spills are similar across the four phases, they are discussed, along with lessons drawn from Deepwater Horizon, below.

Blowouts of oil production wells can also generate massive spills capable of inflicting widespread and lasting damage to entire ecosystems, economies, and communities. As discussed below, when drilling takes place in deep ocean waters with uncontrolled currents and volatile conditions, the possibility of a spill, the danger and difficulty stopping it, and the risks to surrounding life and the environment are magnified.


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Methane released by ruptured wells has been observed to contribute to oxygen-depleted hypoxic zones that cannot support marine life. Such "dead zones" were observed in the aftermath of the BP Deepwater Horizon spill, which resulted in "astonishingly high" concentrations of methane in areas of the Gulf of Mexico — in some cases 100,000 times normal levels.[35] While there may be multiple causes or contributing factors to dead zones, including agricultural runoff,[36] some scientists speculate that this phenomenon can occur when the accumulation of methane results in increased populations of microbes that break down the methane but also deplete oxygen levels in the process, driving out other marine life.[37] While more research is needed to establish the relationship between offshore methane emissions and hypoxic marine conditions, there is reason to presume that leaking wells can potentially increase the risk of ocean deoxygenation and the myriad risks it poses to marine life.[38]

The deeper the well, the greater the risk of large-scale disaster in the event of a blowout. According to one study, for every 100 feet (ft) deeper a well is drilled, "the likelihood of a company self-reported incident like a spill or an injury increased by more than 8 percent."[39] Before disaster struck, BP's Deepwater Horizon was in the process of drilling what was one of the deepest offshore oil and gas wells ever drilled, the Tiber well, in water over 4,000 ft deep and with a wellbore 35,000 ft below the seafloor.[40] When the nearby ultra-deepwater exploratory well Macondo blew out, it produced the largest offshore spill in the history of the United States,[41] releasing 3.19 million barrels of crude oil (134 million gallons) across sensitive marine ecosystems and polluting more than 57,500 square miles (m^2) of the Gulf of Mexico.[42] Today, there are ultra-deepwater drilling rigs capable of drilling down to 40,000 ft, which is 11,000 ft deeper than Mount Everest is tall.[43]

Even spills from blowouts in shallower waters are challenging to stop. The 2009 Montara blowout occurred in relatively shallow waters at just over 70 m (238 ft) in the East Timor Sea. Yet, it still took *ten weeks* for personnel to control the spill.[44] In the meantime, the blowout released 80,000 gallons of oil into the sea *every day*, contaminating Indonesian waters as far as 150 nautical miles (240 km away).[45] Such spills' social, economic, and environmental consequences can be devastating.

Oil spills in shallow waters are also especially harmful to sensitive habitats such as coral reefs, mangroves, and seagrass meadows. For instance, three decades after a 1986 oil spill in Bahia de las Minas, Panama, coral reefs still have not returned to their pre-oil spill conditions. This is largely due to several factors, including recurring human-induced perturbations such as chronic oil pollution from frequent ship traffic in the area and the activities of local refineries, as well as climate change.[46] Currents can also bring contaminants from deep-water installations to shallower waters, such as what was experienced in the Chandeleur Islands, Louisiana, in the aftermath of the Deepwater Horizon disaster.[47]

Oil Spills

Where there is oil production, there are oil spills. Despite improved safety regulations in some countries and technological advancements in recent decades, offshore spill incidents during production and other phases have increased over the last thirty years.[48] Spills vary in size, severity, frequency, and duration, but they are always harmful to the environment. Spills can stem from transport vessels, pipelines, refineries, and storage facilities, but the risk of larger and, therefore, more severe oil spills is higher from drilling as the potential amount of oil that could be released is far greater.[49]

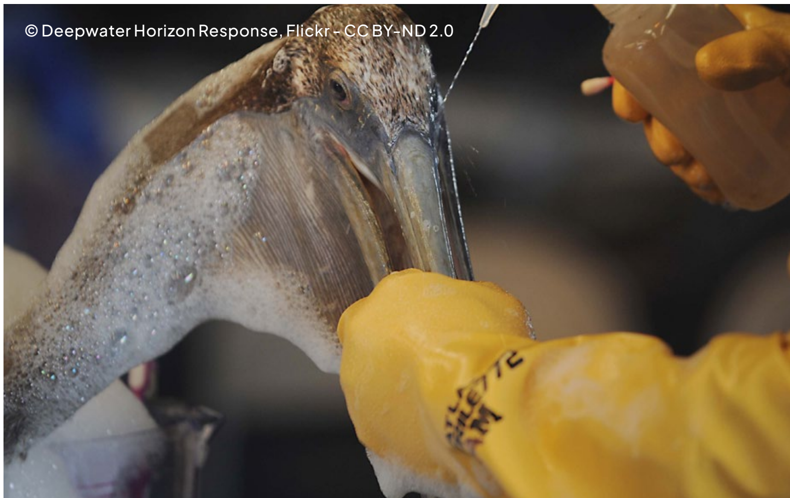
The aggregate environmental consequences of even routine, smaller-scale oil spills should not be minimized. Leaked oil, whatever its source, can enter marine and coastal ecosystems in a number of ways, each presenting grave risks to health and life:

- **Surface slicks** endanger wildlife on the sea surface — such as sea birds, dolphins, sea turtles, and whales.[50] Wind and currents can cause slicks to spread further and contaminate an increasingly larger geographic area.[51]

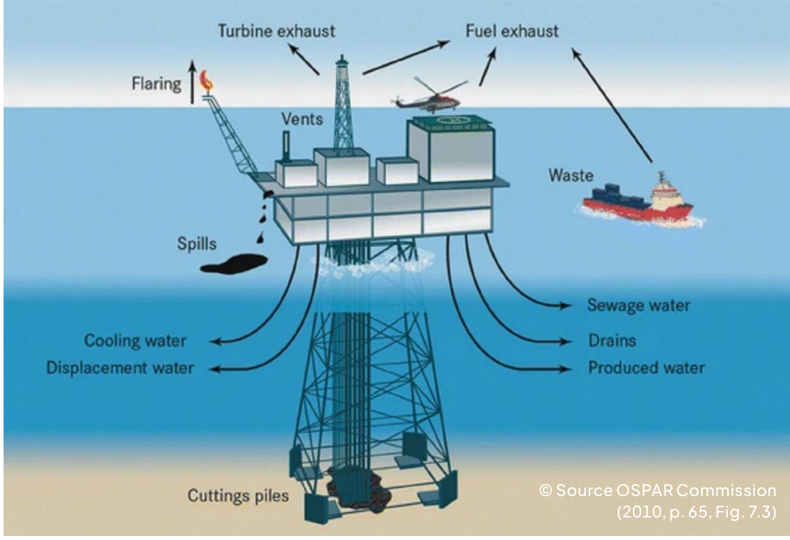
- **Dissolved oil** can harm plankton and larval stages of fish and invertebrates that live in the upper water column. In fish and invertebrates specifically, the toxic components of oil can damage organs, gills, and reproductive systems,[52] endangering marine food webs and, for local human populations, their food security and livelihoods.

- **Shoreline oiling** not only creates an eyesore and a mess that is difficult to clean up and financially devastating for tourism,[53] but it can also smother beaches, mangroves, wetlands, estuaries, and other coastal ecosystems that are important habitats for fish and invertebrates during their early developmental stages.[54] Birds and mammals that come into contact with the contaminated shorelines and feed on oiled animals and vegetation face serious health risks.[55]

Some oil spill cleanup practices commonly employed by operators can be largely ineffective and exacerbate environmental harm, underlining



the need to end offshore drilling and its associated risks. Even with the best available technologies — which have undergone little improvement since the 1960s — marine cleanup efforts recover only a small fraction of oil spilled.[56] In the aftermath of the Deepwater Horizon disaster, only about 25 percent of the 200 million gallons of crude oil spilled in the Gulf of Mexico could be recovered by skimming the oil, siphoning it at the wellhead, and burning it.[57] Most of the oil ended up on the bottom of the ocean floor, evaporated into the atmosphere, dissolved into the water, polluted beaches, or remained on or just below the water's surface.[58] Ironically, certain chemicals used in oil spill response plans can actually make oil spills three- to 52 times more toxic, depending on the marine organism.[59] Chemical dispersants also do not actually remove oil from the water; they merely break it down and displace it into the water column, where it remains toxic to marine life.



Operational Contamination

The release of wastewater from offshore oil and gas platforms is a continuous source of contaminants to marine ecosystems.[60] According to known estimates, over 700 million metric tons of produced water is discharged annually into the marine environment worldwide.[61] As noted before, produced water can contain compounds that are hazardous chemicals and known carcinogens, such as polycyclic aromatic hydrocarbons (PAHs). PAHs can lethally affect fish species in several ways, inducing DNA damage, cardiac function defects, embryotoxicity (which interferes with normal growth, homeostasis, and development of a fetus), and oxidative stress, which reduces the ability of a species to detoxify readily.[62] Produced water also contains alkylphenols (AP), endocrine disruptors that can prompt abnormal hormonal changes in fish.[63]

The impacts of discharging contaminated water in surrounding ecosystems are most evident in bottom habitats near the seabed, where organisms can become smothered by oil and other contaminants. Injecting produced water back into the ocean and flooding the well with polymers for EOR can alter the density, biomass, and diversity of various marine organism communities, including corals.[64] This can have damaging effects on the marine food web. Declines in the populations of the most vulnerable benthic species (those that live at the bottom of the sea), particularly smaller crustaceans, have been detected at distances of up to 10 km from production platforms, in part due to the discharge of produced water.[65]

Noise and Light Pollution

The significant light and noise pollution from offshore rigs can cause ecosystem disturbances and harmful behavioral and physiological changes in marine and coastal wildlife. Gas flaring contributes to light pollution that disturbs fish, turtles, birds, and other wildlife,[66] impacting marine food webs on which coastal populations depend. For example, certain species of seabirds, such as storm petrels, can be attracted to offshore production platforms, drilling rigs, and support vessels and become disoriented by their attraction to light sources.[67] This attraction can be lethal due to flames from gas flares, collision with infrastructure,[68] and exposure to oil. Such episodic events are known to cause the death of hundreds or even thousands of birds.[69] The hammering sounds of drills also contribute to noise pollution detectable by various taxa of marine organisms,[70] which in turn can disturb physiological processes, cause behavioral disruptions, affect mating patterns, and lead to tissue damage, physical injury, and even death in a wide range of species.[71]

The Lasting Legacy of a Blowout

An offshore blowout and accompanying spill can leave a legacy of harm and precipitate legal challenges years later when the long-term implications for surrounding ecosystems and communities become evident. Although BP's Deepwater Horizon catastrophe has become synonymous with the dangers of offshore drilling, the 2009 Montara spill — which occurred only one year prior — is considered one of Australia's worst environmental disasters. The blowout occurred off the northern coast of Western Australia at the Montara Wellhead Platform, which was operated by an Australian subsidiary of Thailand's PTT Exploration and Production (PTTEP), spilling an estimated 30,000 barrels into the Timor Sea over 47 days. The resulting slick covered an estimated 90,000 km^2 — an area larger than Tasmania — devastating the fishing grounds and seaweed crops on which thousands depended for income and their way of life.[72]

In 2016, 8 years after the disaster, 15,000 Indonesian seaweed farmers filed a class action suit against PTTEP Australia, claiming negligence under common law and seeking compensation for lost livelihoods and opportunities.[73] Notably, the plaintiffs alleged that not only the oil spill but the toxic chemical dispersants used for cleanup efforts ruined their seaweed crops. In 2021, the Federal Court of Australia found that PTTEP Australia had breached its duty of care to the farmers by failing to properly seal the well, creating a "very high risk of blowout," and ordered the company to pay lead plaintiff Daniel Sanda around $17,500 for lost income.[74] PTTEP appealed the decision and, as of early 2022, Sanda had not received any payments — and thousands of other plaintiffs were still awaiting compensation.[75] Then, in November 2022, PTTEP agreed to pay $127.4 million in compensation in an out-of-court settlement, a significant step forward in the seaweed farmers' long and challenging fight for justice.[76]

Health, Livelihood, and Cultural Risks

Blowouts are extremely dangerous and endanger life and limb. The violent explosions that accompany blowouts can cause immediate and severe damage to offshore infrastructure and inflict life-threatening injuries and death.[77] Blowouts can also result in raging fires fueled by releasing explosive gases that accumulate and form highly flammable and toxic clouds,[78] with deadly and costly results. The 1988 Piper Alpha platform explosion offshore the UK, for instance, killed 167 platform workers, injuring and traumatizing many more.[79] Considered the world's deadliest offshore oil disaster, the incident affected 10 percent of UK oil production and led to financial losses of an estimated GBP 2 billion (the equivalent of $5 billion today).[80] Decades later, in 2010, the catastrophic blowout and resulting fire that destroyed BP's Deepwater Horizon rig in the Gulf of Mexico killed 11 workers and injured 17 others.[81] While serious design flaws and systems failures contributed to the Deepwater Horizon and Piper Alpha disasters, as the Institution for Chemical Engineers acknowledges, "even perfectly engineered 'hardware' can always be operated incorrectly."[82]

Blowouts can also present air quality issues and consequent health implications for on-site personnel and downwind coastal populations.[83] Research by the National Oceanic and Atmospheric Administration (NOAA) revealed that the quantity of air pollutants in the atmospheric plume generated by the Deepwater Horizon blowout was comparable to that of a large city.[84]

Exposure to crude oil from blowout-related spills can be dangerous to human health. People can become exposed to oil-based toxins that remain in the water and/or collect in the tissues of marine life and other species, eventually making their way up the food chain in progressively larger quantities. For instance, chemical components of crude oil (PAHs) — which can persist in the environment and animal tissues for months or even years — have been linked to cancers of the skin, lungs, bladder, and gastrointestinal system.[85]

Oil spills jeopardize coastal livelihoods. The BP Deepwater Horizon disaster demonstrated just how devastating a blowout and oil spill can be for the health of a region dependent on fisheries and tourism. Studies estimated that the accident led to a loss of $8.7 billion and over 20,000 jobs.[86] But such risks are not unique to the Gulf of Mexico. If a similar event were to happen in the Caribbean Sea — which in recent years has become a hotspot for offshore development — the livelihood impacts could be even more severe. The Caribbean is more dependent on tourism for income than any region in the world, with the sector contributing more than $60 billion to the region's gross domestic product (GDP) in 2022.[87] Another economically significant industry, fisheries, employs over 400,000 people in the Caribbean directly and indirectly (per 2019 figures).[88] In fact, according to environmental groups, in Trinidad alone, at least 50,000 fisherfolk would be affected by a large-scale oil spill.[89] In ocean-dependent regions such as the Caribbean, tourism and fisheries rely on healthy coral reefs and coastal areas. An offshore oil spill could jeopardize these sectors. Moreover, the economic hardships associated with oil spills can compound the mental health impacts that such disasters can have on affected communities, causing lasting harm.[90]

On top of climate impacts, emissions from gas flaring can also cause a number of serious health problems. The practice releases harmful pollutants such as particulate matter (PM2.5), ozone, nitrogen dioxide (NO_2), and benzo[a]pyrene (BaP), which have been linked to strokes, cancer, asthma, and heart disease at high concentrations and prolonged exposure.[91] Moreover, black carbon (also called soot) can impede lung function and cause respiratory disease, heart disease, and stroke.[92] In the oil-producing regions of Nigeria, regular gas flaring has resulted in debilitating and deadly diseases among the local populations, including bronchitis, asthma, cancer, and blood disorders.[93] In the US, in 2019 alone, exposure to black carbon from gas flaring caused dozens of premature deaths.[94]

Conclusion

From the dangers of a well blowout or oil spill to massive and underreported emissions from leaks, venting, and flaring, offshore oil and gas production threatens oceans, ecosystems, and the communities and climate that depend on them. Where there is oil production, there are oil spills. The transboundary reach and lasting impacts of spills on marine life, coastal ecosystems, and dependent populations mean that a single project can put many countries at risk. Response measures remain largely ineffective and pose their own environmental risks, including the toxicity of chemical dispersants. Given the outsized climate footprint of offshore operations, which account for nearly one-third of global oil and gas production, stopping offshore expansion and accelerating the phaseout of existing operations is critical to avoiding catastrophic warming. The risks and impacts of other phases of offshore oil and gas activity are explored further in the other briefs in the *Offshore, Off-Limits* series, which can be found on CIEL's website.

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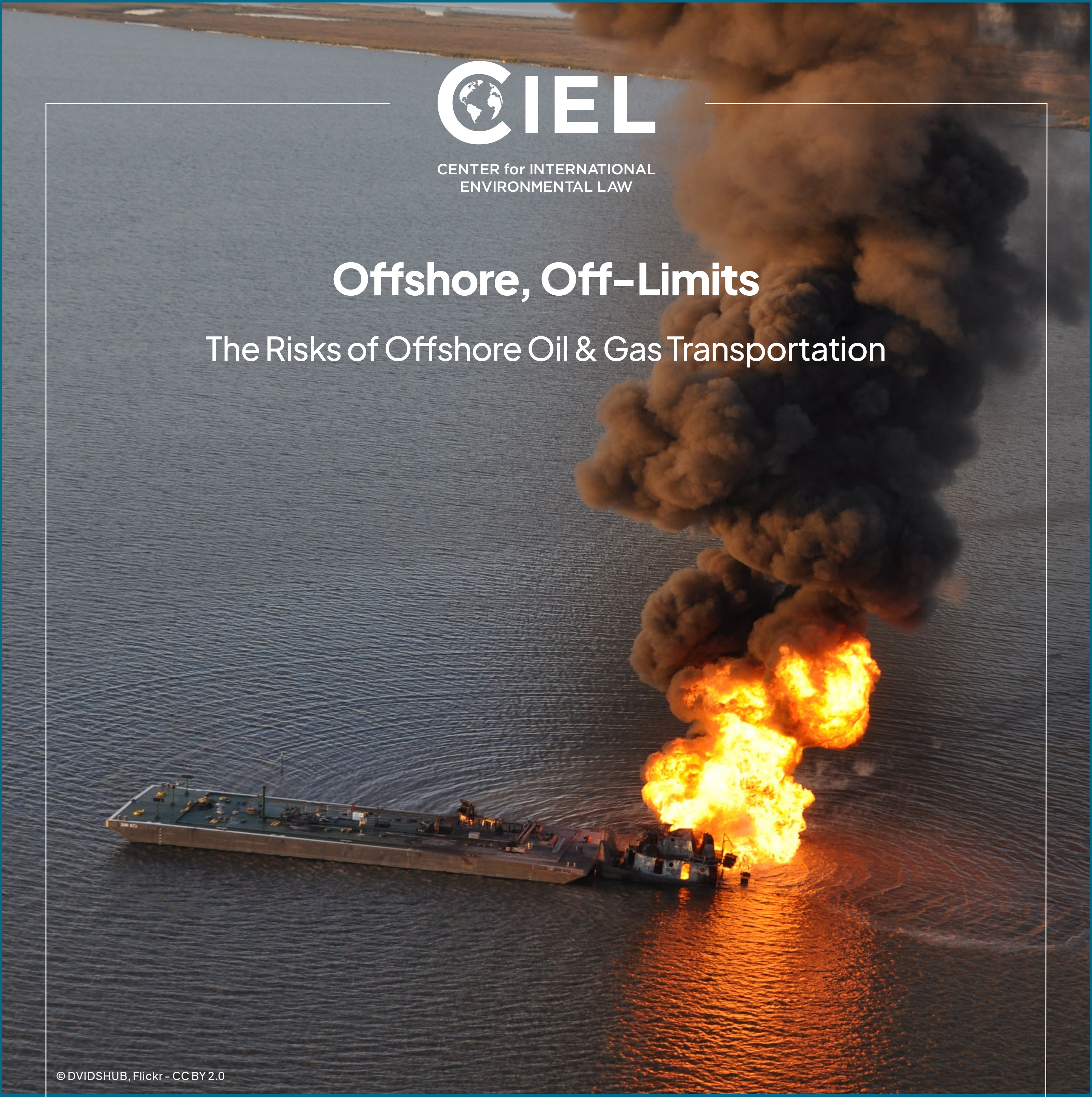
CENTER for INTERNATIONAL ENVIRONMENTAL LAW

Offshore, Off-Limits

The Risks of Offshore Oil & Gas Transportation



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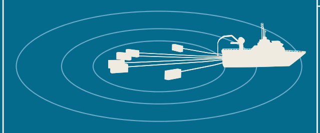

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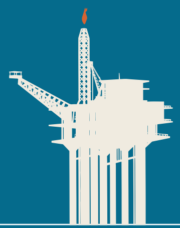

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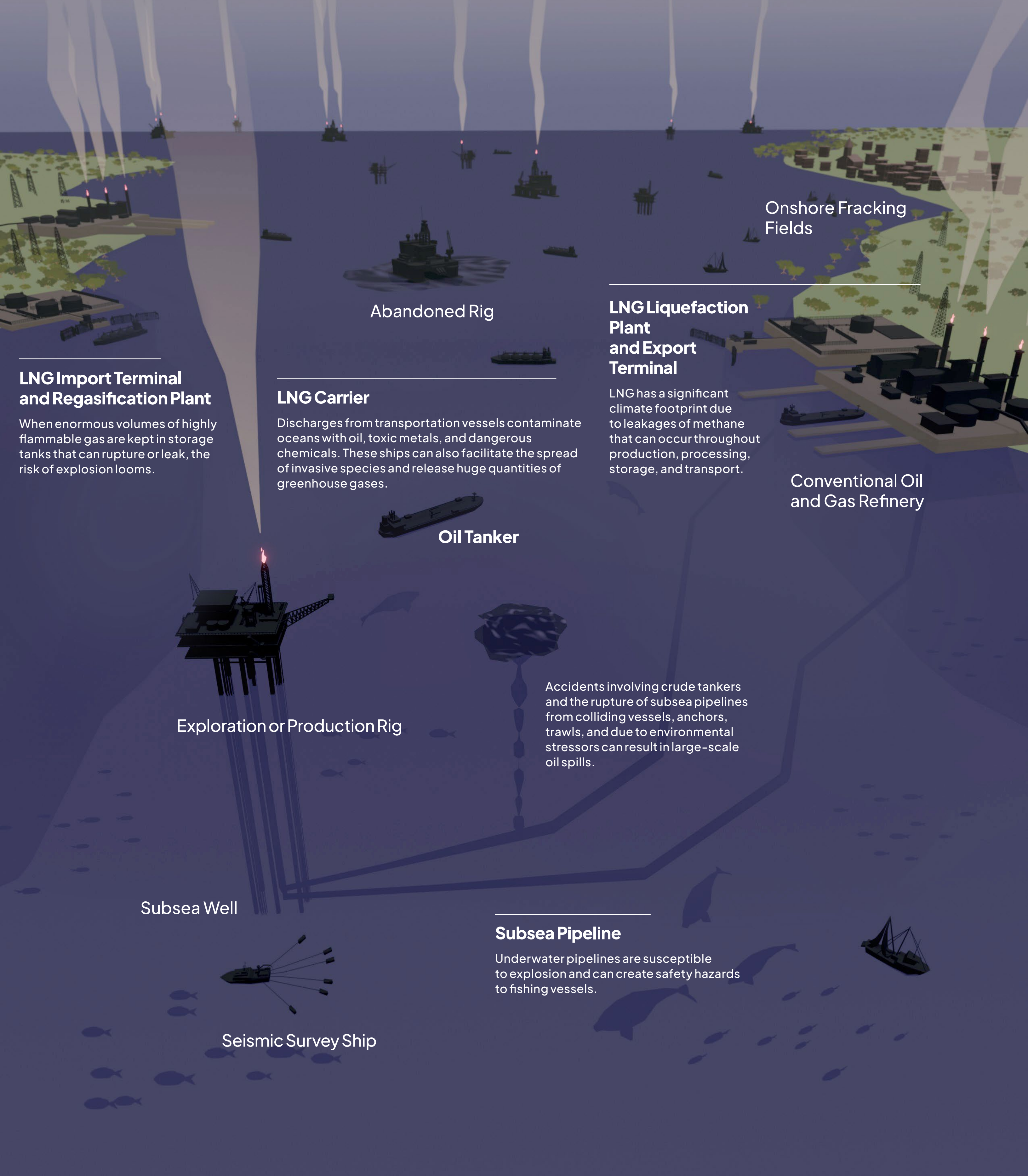


Offshore oil and gas activity poses myriad threats to the environment and human rights across its life cycle, from exploration and production to transportation and decommissioning. *Offshore, Off-Limits* examines many of the relevant risks and impacts at each of these phases. This brief in the series focuses on the risks and impacts associated with the overseas and undersea transportation of oil and gas via pipelines and vessels.

Key Takeaways

- The increasing use of the oceans as highways for the global trade in fossil fuels, especially liquefied natural gas (LNG), only magnifies the sector's climate impacts.
- Transportation-related oil spills can devastate large swathes of ocean and coastlines, and more oil and gas tankers moving between coastal or offshore sites and markets mean a greater risk of accidents.
- Routine harms associated with offshore oil and gas transportation include operational and illegal releases of toxic substances, the facilitation of the spread of invasive species, and the release of significant volumes of greenhouse gas emissions that, in turn, drive the climate crisis.
- Discharges from oil and gas vessels contaminate oceans with oil, toxic metals, and dangerous chemicals, endangering marine ecosystems and human health.
- As accelerating climate change impacts increase the physical risk to oil and gas infrastructure and transport vessels, more offshore transportation- and infrastructure-related disasters are in our future.

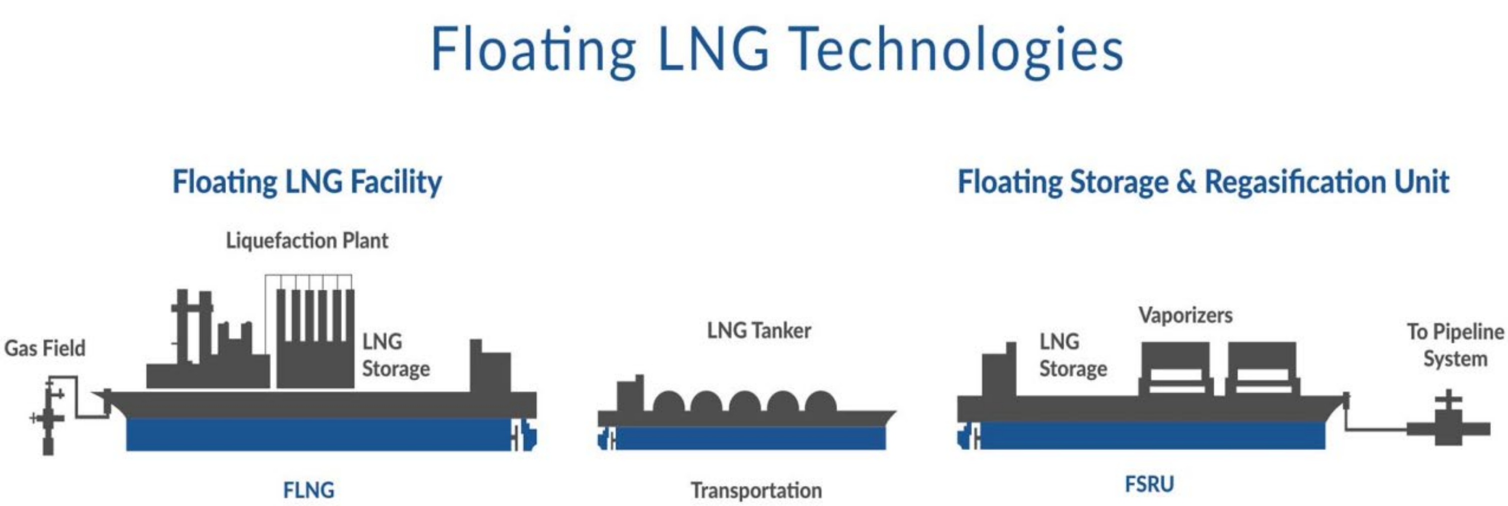
What Is Offshore Oil and Gas Transportation?

After fossil fuels are extracted from subsea fields, they are either processed at offshore facilities or moved via pipelines or tankers to onshore facilities for further processing, refining, and distribution. At present, fully 40 percent of maritime trade consists of shipping fossil fuels and fossil fuel products from one place to another.[1] Transporting massive volumes of crude oil or highly flammable gas over long distances and through fragile marine ecosystems is a massively energy-intensive and inherently hazardous activity. It has become even riskier in recent decades due to increased ship traffic and a rise in the frequency and severity of natural disasters and other climate change impacts that can damage transport infrastructure and result in ecological and human rights catastrophes. Moreover, on top of accidental spills and explosions and operational and illegal discharges, the spread of invasive species via ships and the release of huge quantities of planet-warming greenhouse emissions are among the many routine but harmful impacts of offshore oil and gas transportation on oceans and the wider planet.

How Are Oil and Gas Transported by Sea?

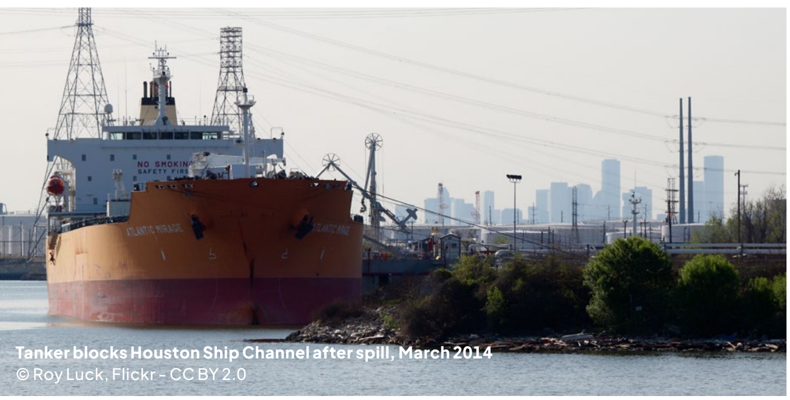
Pipelines

Both crude oil and natural gas can be transported by pipelines on or below the seafloor. Marine oil and gas pipelines are laid either by ships or barges, a process that entails welding together sections of steel pipe as the vessel progresses along the pipeline route.[2] Once in use, pipelines carry the mixture of oil, gas, and water that is extracted from the subsea wells either directly to nearby platforms or to distant facilities for processing and refining. Crude oil and natural gas can be separated out before transport or kept together in a mixture, depending on the type of export pipeline used.[3] These pipelines, particularly those laid out on the seafloor of deeper waters, are subject to immensely high pressures,[4] which can lead them to collapse.[5] As of 2017, there were reportedly over 150,000 km (over 9,300 miles) of undersea oil and gas pipelines around the world,[6] a figure that has likely spiked significantly since more tracts of the ocean have been targeted for new offshore oil and gas operations and infrastructure buildout.



Oil Tankers

Oil tankers are the key conduits for the risky transport of crude oil and related hazardous materials over long and heavily traveled sea routes. They include crude oil carriers — which carry oil from production sites at sea to refineries — and product carriers, which transport fossil fuel products such as gasoline, jet fuel, and diesel. As of 2023, there were approximately 7,500 oil tankers worldwide.[7] Additionally, chemical tankers carry large volumes of liquid chemicals used during the extraction and storage of crude oil — including corrosion inhibitors, thinners, and dispersants — to and from offshore rigs. Barges, which normally are not self-propelled and must be towed by tugboat, are primarily used to transport oil and other fossil fuel products on rivers, canals, coastal waters, and inland waterways.



Tanker blocks Houston Ship Channel after spill, March 2014
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LNG Carriers and Terminals

LNG is one of the fastest-growing forms of fossil fuel production. LNG projects that are already being built or have received financial backing could increase supply by 193 million metric tons per year from 2024 to 2028, a 40 percent rise over five years.[8] Liquefaction means gas can be moved over long distances, not just used within proximity of gas-producing regions. This processing technique has made it possible for gas extracted both onshore and offshore to be transported across the oceans.

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Because liquefaction is primarily designed to enable transoceanic transport, the LNG boom has meant a glut of new coastal infrastructure, including liquefaction and regasification plants, import and export terminals, and seafaring vessels. Gas may be transported through pipelines from onshore or subsea wells to coastal processing plants, where it undergoes the liquefaction process at export terminals to be stored or carried by seafaring vessels. Alternatively, offshore gas may be liquefied on floating liquefied natural gas (FLNG) facilities before being transferred to carriers for export. Wherever liquefaction occurs, the process entails separating out liquid hydrocarbons from the fossil gas — which is comprised primarily of methane and may include ethane, propane, and other gases — and then compressing the gas and cooling it to extremely low temperatures (-260˚F or -161.5˚C) until it enters a liquid state.[9] The LNG is then transported to terminals in specially designed tankers equipped with heavily insulated, temperature-controlled storage tanks that keep the gas in a liquid state, when it is highly flammable and volatile.[10] At the terminal, the LNG is converted back to its gaseous state, a process called regasification, and moved through pipelines to storage and distribution facilities.[11]

Regardless of how natural gas is transported — by pipeline or by ship — the process of liquefying gas is incredibly energy-intensive, costly, and risky for surrounding communities and ecosystems.

What Are the Risks Posed by Offshore Transportation?

Climate Risks

The global transport of oil and gas generates significant greenhouse gas emissions. These stem primarily from the fuel burned for shipping, liquefaction, and compression; leaks of methane from pipelines and vessels, including from crude pipeline accidents;[12] and processing and storage activities upstream and downstream of transportation. Researchers at the Organisation for Economic Co-operation and Development (OECD) estimated that, in 2022, the transport of oil and LNG by tanker accounted for 171.6 million tons of CO_2 emissions globally, which was 20 percent of total shipping emissions that year.[13] As more offshore projects advance, this quantity will likely sharply rise. The overall life cycle greenhouse gas (GHG) emissions produced by offshore oil and gas activity are already likely underestimated due to difficulties in monitoring and gathering data on methane emissions at sea, as discussed in the Production brief.

Contrary to the fossil fuel industry's claims that gas is a "clean" bridge fuel, the production and transport of LNG results in 10 times the carbon emissions of pipeline gas.[14] LNG's massive climate footprint is attributable to the huge amounts of energy needed to liquefy, store, and regasify the fuel for transport, on top of the already energy-intensive process of extracting the gas.[15] The energy-intensive liquefaction process, which involves significantly lowering the temperature of the gas in order to reduce its volume by 600 times, often necessitates dedicated offshore power plants.[16]

LNG also has significant upstream GHG emissions due to releases of methane[17] — the principal component of fossil gas and a highly potent GHG — that occur throughout production, processing, and transportation. LNG storage tanks, by design, release vaporized methane into the atmosphere to maintain incredibly cold conditions, and even with some larger tanks engineered to capture boiled-off gas, leaks occur.[18] Methane is also flared and vented to control the pressure during the regasification of LNG.[19]

The increasing buildout of LNG means that even more methane emissions are likely to occur through offshore transportation activities. Governments worldwide are focusing on accelerating investments in LNG. In the United States alone, as of March 2023, the Department of Energy had authorized eighteen large-scale LNG export projects totaling 450 billion cubic meters per year of capacity.[20] This buildout will see US exports of LNG double by 2027, though in 2024, the Biden administration implemented a temporary pause on pending decisions on LNG exports, which the Trump administration has signaled it plans to reverse.[21] With a deluge of LNG projects slated to come online in 2025,[22] LNG is an extremely dangerous prospect for the climate, especially as some LNG facilities have been found to underreport and miscalculate their emissions.[23]

The climate impacts of offshore oil and gas production and transportation are compounded by the difficulties of underwater detection and monitoring. The oil and gas industry admits that the quantification of subsea emissions is "not technically feasible today," effectively acknowledging that they do not even know how much methane may be leaking from offshore wells and pipelines.[24]

The push for LNG-fueled tankers doesn't solve the problem. On the contrary, recent studies indicate that the most commonly used engine technology on marine vessels emits 70 percent more life-cycle GHGs when it combusts LNG than conventional oil-based fuels.[25] This means that if increasing numbers of ships — not just LNG carriers and conventional oil and gas tankers but other sectors' vessels — start using LNG for fuel, emissions from the shipping sector may increase rather than decrease. LNG is not a solution for decarbonizing the marine transport sector, much less transitioning the world away from fossil fuels.

Environmental and Biodiversity Risks

Air Quality Impacts

On top of releasing enormous quantities of planet-warming methane and other GHGs, the transportation of oil and gas across the oceans emits air pollutants that pose health hazards to those located near or working in ports and terminals — which serve as waypoints for tankers, barges, and other vessels delivering oil and gas from offshore production sites. Oil tankers have been linked to leaked toxic hydrocarbon gases and vapors (HGVs), which induce headaches and dizziness and smell foul enough to decrease the quality of life for upwind communities.[26] Hydrogen sulfide has also been detected in the air around ports[27] and can cause irritation to the eyes and respiratory system, weakness, irritability, sleep-related issues, and other health effects.[28] LNG export terminals can emit their own toxic mix of gases and other dangerous substances into the air, including fine particulate matter, sulfur dioxide, nitrogen oxides, carbon monoxide, and volatile organic compounds.[29]

Oil Spills

While blowouts during production have the potential to cause particularly massive oil spills, as detailed in the Production brief, accidents involving tankers, pipelines, and other oil and gas infrastructure during the transportation phase are even more common and can likewise be devastating to large swathes of ocean and coastlines. A widely cited study from 2003 reported that, at the time, 12 percent of the more than 343 million gallons of oil that enter the sea annually could be traced to transportation-related incidents.[30] Such incidents include collisions involving crude tankers carrying massive volumes of oil as well as the rupture of undersea pipelines from colliding vessels, anchors, and trawls. Equipment failure and/or human error can also result in spills near ports and marine terminals during routine operations — such as the offloading of oil from transport barges or tankers.[31] Additionally, as described above, the extreme pressure conditions at the subsea level, which increase the deeper the water, can cause pipelines to collapse and subsequently leak dangerous contaminants.[32]

MT *Princess Empress* oil spill offshore Philippines, March 2023
© Presidential Communications Office, Wikipedia Commons

More oil and gas tankers moving between offshore sites and markets means a greater risk of accidents. In the US, out of nineteen large spills that occurred in the outer continental shelf from 1964 to 2015, thirteen were caused by accidents involving vessels.[33] From 2013 through March 2024, there were 360 reports of vessel spills of oil, liquefied petroleum gas (LPG), LNG, or methane made to the National Response Center — an emergency call center that fields and documents reports of spill incidents for the US.[34] Across the globe, the majority of oil spills that can be traced specifically to oil tankers over the last fifty years occurred in the Atlantic offshore Europe, accounting for 57 percent of all significant tanker accidents and resulting in the release of 1.4 million metric tons of oil.[35] Studies suggest that this is due largely to heavy ship traffic in these waters.[36] Offshore oil and gas buildout in emerging hotspots could, therefore, mean increased vessel-related spills in waters that have thus far remained ecologically sound.

The Exxon Valdez disaster of 1989, which was the largest oil spill in US waters until the Deepwater Horizon spill in 2010, demonstrated the destructive potential of transportation related accidents. The spill occurred when an oil tanker owned by Exxon Shipping Company ran aground in Alaska's Prince William Sound. The collision tore open the ship's hull and ruptured eight of its eleven cargo tanks, causing some 10.8 million gallons of crude oil to spill into the ecologically sensitive inlet and pollute 1,200 miles (1,900 km) of pristine coastline. The impact of the spill on wildlife was catastrophic, resulting in the death of an estimated 250,000 seabirds and countless other marine and coastal species.[37] The disaster has had resounding effects on the fragile ecosystem, local livelihoods, and economies for decades, and lingering oil contamination remains to this day.[38]

Tank Barge DBL 152 spill in Gulf of Mexico, November 2005
© NOAA Images

Repsol oil spill in Peru
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While the oil and gas industry points to recent studies suggesting that transportation related spills have declined in the last few decades — something that can't be said of production-phase spills, which have only increased due to the rise in offshore activity[39] — the threat of large-scale disaster nonetheless remains. Just the last few years have witnessed multiple major tanker and pipeline spills around the globe, including the following examples:

October 2021: Off the coast of Southern California, a damaged pipeline operated by Houston-based Amplify Energy dumped 25,000 gallons of crude oil into the Catalina Channel, creating a toxic oil slick that spanned 8,320 acres and smothered ecologically fragile wetlands and estuaries.[40]

January 2022: Thousands of liters of crude oil leaked into the sea off the eastern coast of Thailand from an underwater pipeline belonging to Chevron-owned Star Petroleum Refining Public Company Limited (SPRC).[41] The spill, which threatened coral reefs, seagrass beds, and local livelihoods[42] and led officials to declare a local beach a disaster zone,[43] pushed hundreds of Thai villagers and small businesses to file a $152.72 million lawsuit against SPRC.[44]

January 2022: A ruptured pipeline caused an offloading oil tanker to spill over 10,000 barrels of oil just south of the Peruvian capital of Lima, contaminating an area the size of Paris and leaving dead fish, seabirds, and marine mammals in its wake.[45] The spill resulted in one of the country's worst ecological disasters in recent memory and has triggered a $4.5 billion lawsuit against Spanish oil firm Repsol SA, the owner of the faulty pipeline.[46]

March 2023: The MT Princess Empress, an oil tanker that was carrying 210,000 gallons (800,000 liters) of oil, sank off the island of Mindoro in the Philippines. The resulting spill contaminated waters, mangroves, coral reefs, and beaches in Oriental Mindoro province and other islands,[47] threatened hundreds of fishing communities,[48] and upended the local tourism economy.[49] The oil eventually drifted into the Verde Island Passage[50] — known globally as the "center of the center of marine shore fish biodiversity" and threatened 21 marine protected areas.[51]

November 2023: A pipeline off the coast of Louisiana leaked an estimated 1.1 million gallons of crude oil into the Gulf of Mexico,[52] apparently due to a failed subsea cable that lost pressure. As of early 2024, the exact cause of the system failure is not known,[53] and the long-term impacts of the spill on the local marine environment are yet to be fully understood.

July 2024: A Philippine oil tanker measuring 213 feet, MT Terra Nova, capsized in Manila Bay after encountering monsoon rains and huge waves.[54] The tanker was carrying 1.5 million liters of industrial fuel when it sank in an area popular with fisherfolk, leaving one crewman dead and causing an oil slick over 2 miles long in its immediate wake.[55]

Offshore oil and gas buildout in new geographies, therefore, means that more such disasters are likely in the future in regions unequipped and lacking the experience and infrastructure to respond quickly and effectively.

Climate Change Means More Offshore Disasters in Our Future

Offshore oil and gas activity drives global temperature rise by releasing enormous quantities of greenhouse gases during production and transportation and through the emissions that inevitably follow when the produced oil and gas is used as intended. Climate change, in turn, contributes to the increased frequency and intensity of extreme weather events that can seriously damage offshore and coastal infrastructure and thereby lead to disastrous releases of hydrocarbons and chemicals into the ocean. Hurricanes and storm surges are among the leading causes of oil spills involving ships, barges, tankers, pipelines, platforms, and processing and storage facilities. For instance, Hurricane Katrina — a Category 5 hurricane that hit the Gulf Coast of the US in 2005 and caused over 1,800 fatalities and $100 billion in damage — triggered 81 oil spill events in southwest Louisiana.[56] More recently, the US National Oceanic and Atmospheric Administration (NOAA) reported a total of 55 oil spills in the two weeks after Hurricane Ida,[57] a Category 4 storm that in 2021 ravaged the Gulf Coast and parts of the Caribbean and South America.

While sudden-onset natural disasters may be among the more visible and newsworthy climate impacts, slow-onset environmental changes attributable to global temperature rise also endanger offshore oil and gas infrastructure and heighten the likelihood of disasters at sea and along coastlines. Sea-level rise, for instance, can cause damage to platforms, refineries, and pipelines through flooding and coastal erosion. Increased precipitation can significantly weaken structures and lead to unforeseen shutdowns of oil processing, storage, and transportation facilities,[58] whereas drought can increase the likelihood of flooding. Heavy rainfall, moreover, can increase the risk of mold growth, leading to further structural issues as well as electrical damage.[59]

Because existing offshore production sites generally are not built to withstand the effects of rising sea levels and other climate change-driven phenomena, the likelihood of future oil spills and other catastrophes is all but guaranteed. In the Niger Delta, for instance, a troubling 72 percent of hydrocarbon production sites are vulnerable to changing rainfall patterns, flooding, and drought.[60] According to the Intergovernmental Panel on Climate Change (IPCC), based on projections for sea-level rise, “almost all port and harbour facilities in the Caribbean will suffer inundation in the future,”[61] which could spell disaster for coastal processing and storage facilities. In the US, governmental audits have revealed that the more than 4,000 oil and gas platforms located in the country’s outer continental shelf “were not designed to accommodate a permanent increase in sea level.”[62] In Rhode Island, Shell’s reported failure to prepare its oil terminal in Providence for near-term climate change impacts triggered a lawsuit brought forward by the Conservation Law Foundation alleging violations of the Clear Water Act. While the lawsuit, which was settled in 2023, concerned a riverfront terminal, it offers guidance for similar challenges that could be brought against offshore facilities as concerns over the escalating impacts of climate change mount.[63]

New offshore oil and gas projects, therefore, don’t only drive climate change but, in doing so, also elevate the likelihood and frequency of catastrophic marine and coastal contamination. In light of this growing risk, plans by governments and companies to expand oil and gas infrastructure along coasts and oceans must be subject to increased scrutiny and accountability.

Water Contamination

Bilge dumping is a pervasive source of marine pollution across the shipping industry, including among oil and gas vessels. Bilge water is composed of the many hazardous substances that collect at the bottom of a vessel, including oil, toxic metals such as lead and arsenic, cleaning solvents, and dangerous chemicals like benzene. While bilge dumping is barred by international law under the 1973 International Convention for the Prevention of Pollution from Ships, as modified by the Protocol of 1978 — or “MARPOL 73/78” — that hasn’t stopped ships from bypassing the costs of treating wastewater by illegally releasing enormous quantities of bilge into oceans every year. In fact, a recent investigation revealed that there may be up to 3,000 cases of bilge dumping by commercial vessels every year in European waters alone — a scale significantly higher than what companies have publicly owned up to.[64] The offshore oil and gas industry is a major contributor. One study indicated that accidental spills, as well as operational discharges of cargo oil occurring during transportation of petroleum products, accounted for the release of 160,000 metric tons of oil into oceans worldwide every year, the equivalent of four Exxon Valdez oil spills every year.[65]

When it enters oceans, bilge water can pose many of the same harms to marine life associated with oil spills, on top of the independent risks presented by its other toxic components. And while large-scale spills may garner the most attention, the impact of smaller-scale releases of oil in marine environments must not be underestimated. The ecological and socioeconomic impacts of both large-scale and small-scale oil spills are discussed in the Production brief.

Ecosystem Disturbances

Whether via pipelines or seafaring vessels, the transportation of oil and gas from coastal and offshore production facilities to global markets — and accompanying infrastructure — can cause a range of ecosystem disturbances. Early on, during the process of laying pipelines on the seafloor, cables and anchors are dragged along the seabed, disturbing local biota.[66] Operational and accidental discharges of oil and other contaminants from vessels also threaten lasting harm to marine and coastal ecosystems, as described above and in the Production brief.

Oil and gas tankers and other carriers can also facilitate the spread of invasive species, which have been identified as one of the four greatest threats to the world’s oceans.[67] Untreated ballast water released at a ship’s destination can introduce thousands of harmful aquatic or marine microbes, plants, and animals from different ecosystems into new ecosystems, causing irreparable damage to biodiversity as introduced species multiply to outcompete native ones.[68] This can wreak havoc on food webs, which in turn is incredibly detrimental to the economies and health of local communities that rely on intact ecosystems for fishing and other activities.[69] Although shipowners are now required to install ballast water management systems under international law, chemicals used in this process can create high concentrations of byproducts that are more toxic than the chemical disinfection itself.[70] These chemicals can be harmful to the very native species they are trying to protect, thereby also putting the health of people who rely on the impacted marine ecosystem for protein at risk.

LNG terminals also threaten a range of adverse ecological impacts. The regasification of LNG requires huge inputs of seawater to serve as a heat medium to drastically increase the temperature of the gas. This cooled seawater — which will have undergone chlorination — is then released back into the ocean, where it can be toxic to invertebrates and fishes.[71] The discharge of processed seawater also results in the disruption and resuspension of coastal sediment, which often contains harmful contaminants like mercury, which then enters the marine food web.[72]

Health and Livelihood Risks

When enormous volumes of highly flammable gas are kept in storage tanks that can rupture or leak, the risk of explosion looms. LNG, in particular, presents a significant fire and explosion hazard, particularly during the liquefaction process, which occurs under extreme temperature and high-pressure conditions in which the severity of accidents is particularly high.[73] Spilled LNG in water can explode, while on land, it can create odorless clouds that can freeze skin and asphyxiate. Ignited LNG vapors can lead to intense, unquenchable fires, like vapor cloud explosions (VCEs) or jet fires.[74] LNG fires burn hot enough to cause second-degree burns on exposed skin up to a mile away.[75]

The gas industry and regulators have long downplayed the risk of LNG explosions and dismissed them as low-frequency events.[76] However, an independent expert study revealed that the magnitude of LNG explosions could be 15 to 20 times greater than what industry models project,[77] and when they do happen, LNG explosions are capable of mass destruction and high death counts.[78]

For instance, a 2004 explosion at the Skikda LNG terminal in Algeria — an early pioneer in the LNG industry — left thirty dead and another 70 injured, at the time fueling protests against the then-proposed buildout of LNG facilities in the US.[79] However, in spite of resistance from frontline communities and environmental organizations, the US has since become one of the world's biggest LNG exporters and, in 2022, it experienced an explosion at one of its own major facilities, the Freeport LNG terminal in Texas. While the explosion did not result in any deaths, its destructive potential and highly disruptive effects on domestic and international gas supply chains and prices underscore the risks intrinsic to increased reliance on the LNG industry.

Underwater pipelines are also susceptible to explosions. In 2021, a gas leak from an underwater pipeline that connected to a platform at the Ku-Maloob-Zaap oil field, operated by Pemex, Mexico's state-owned oil company, caused a fire on the ocean surface west of the Yucatan Peninsula.[80] Then, in 2023, two people died, and six people were injured in another fire on a Pemex oil platform in the Gulf of Mexico.[81] Reports stated that a tangle of pipelines were engulfed in flames and, according to Pemex, oil production was "impacted in a substantial way" due to the fire.[82] In 2022, explosions at the Nord Stream pipelines in the Baltic Sea caused extensive pollution, affecting sediment, seawater, and a vital fish spawning area, for over a month.[83] Shipping was restricted near the leak due to safety concerns,[84] and the incident was estimated to contribute to 32 percent of Denmark's annual GHG emissions, equivalent to around 14 million tons of CO_2.[85]

Undersea pipelines can also create safety hazards to fisherfolk and their vessels. Pipelines either laid on the seabed or buried underneath — and subsequently exposed by the weather and other environmental factors — can entangle fishing equipment and vessels, risking life and property.[86]

Conclusion

Transportation-related oil spills, air pollution from vessel traffic, methane leaks and releases from pipelines and LNG facilities, and chemical discharges all add to existing strains on the oceans and threaten the biodiversity, climate, and communities that depend on them. With the rapid expansion of LNG production, the oceans are increasingly treated as the highways for the global trade in planet-warming energy. The mounting impacts of climate change, from extreme weather events to sea-level rise, mean more offshore transport- and infrastructure-related disasters are in our future and underline the need for a rapid fossil fuel phaseout. The risks and impacts of other phases of offshore oil and gas activity are explored further in the other briefs in the *Offshore, Off-Limits* series, which can be found on CIEL's website.

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CENTER for INTERNATIONAL ENVIRONMENTAL LAW

Offshore, Off-Limits

The Risks of Improper Decommissioning of Offshore Oil and Gas

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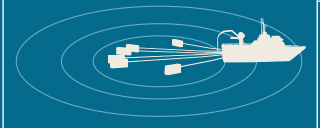
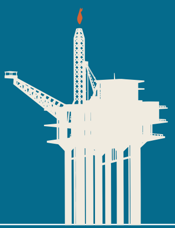
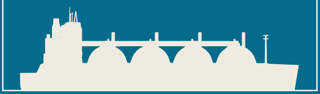
Exploration



Production

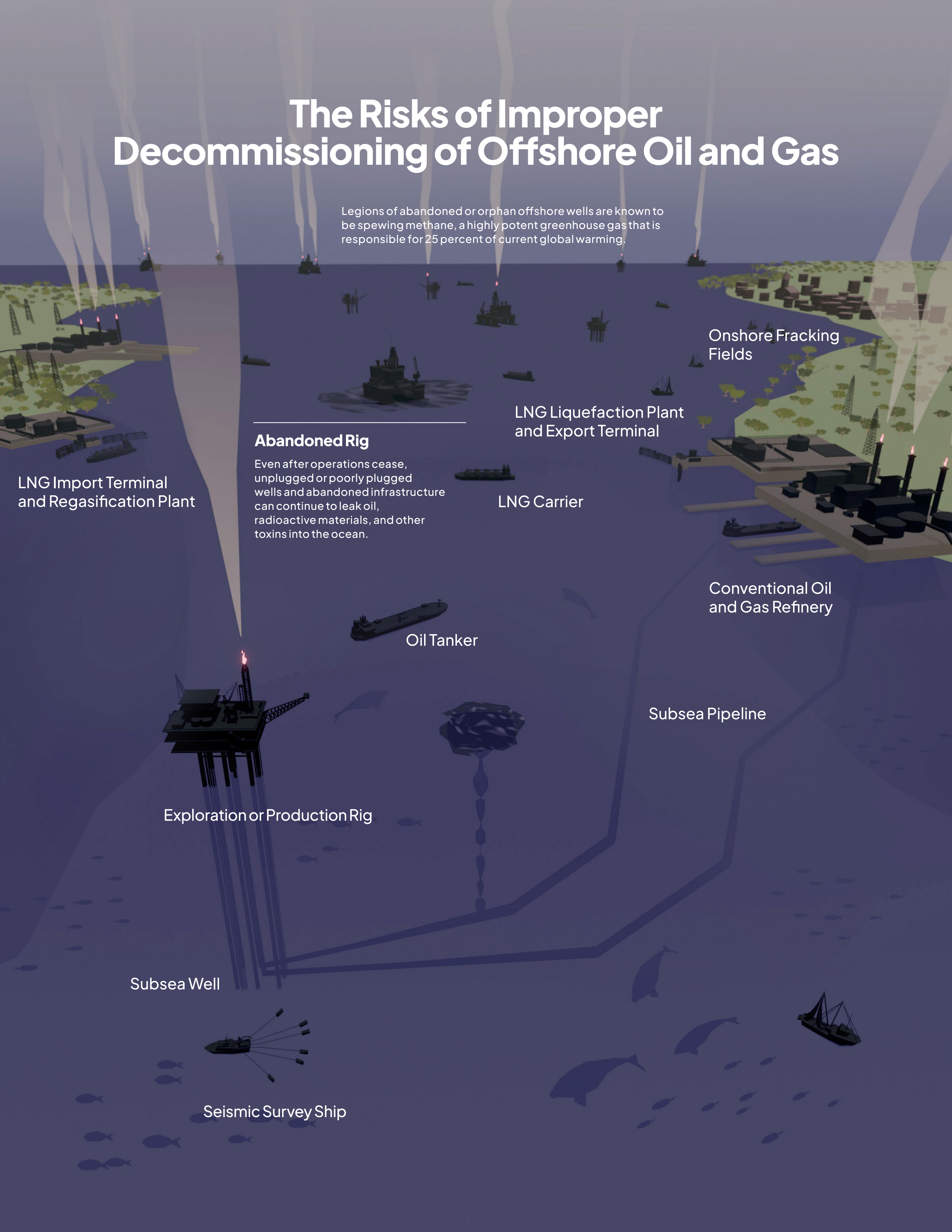


Transportation



Decommissioning

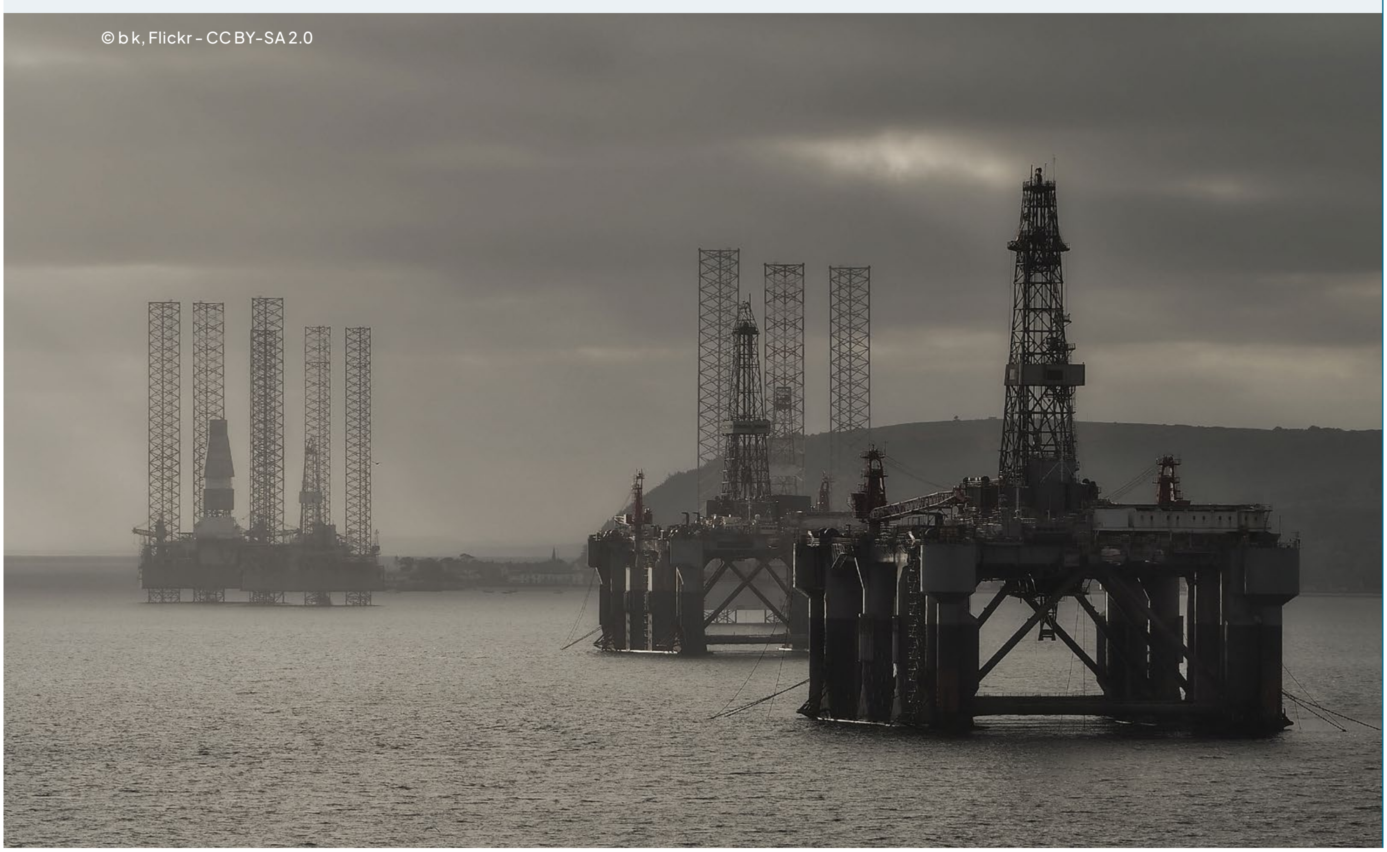
The Risks of Improper Decommissioning of Offshore Oil and Gas



Offshore oil and gas activity poses myriad threats to the environment and human rights across its life cycle, from exploration and production to transport and decommissioning. *Offshore, Off-Limits* examines many of the relevant risks and impacts at each of these phases. This brief in the series focuses on the risks and impacts associated with the decommissioning phase of offshore oil and gas projects, after operations have ceased when closure and cleanup should occur.

Key Takeaways

- Abandoned wells and improperly decommissioned offshore platforms are proliferating in the world's oceans, leaking enormous amounts of planet-warming gases into the atmosphere and toxic contaminants into the marine environment.
- From impacts on fisheries and tourism to contaminants in the food chain, offshore oil and gas facilities left in oceans can threaten the health, livelihoods, and cultures of nearby coastal populations long after operations cease.
- Oil and gas companies often avoid paying decommissioning costs through legal, tax, and contractual loopholes, shifting the burden to host governments and the public.
- There is a need for better accountability for both offshore operators and the government agencies tasked with their oversight to ensure that decommissioning liabilities are enforced.



What Is Offshore Decommissioning?

Decommissioning is the final stage of offshore oil and gas operations, which entails plugging and sealing the oil or gas well to permanently close it off and removing and disposing of associated equipment and infrastructure.[1] It should occur when an oil or gas well stops producing, which can be after several decades or much sooner, for instance, if a well is deemed commercially unviable during exploratory drilling. In principle, the process is complete when the host ecosystem and seafloor have been returned to their original, preexisting state. In practice, however, operators very often abandon wells without properly closing down and cleaning up production sites, leaving aesthetic eyesores, environmental hazards, and significant financial burdens in their wake.

How Are Offshore Oil and Gas Projects Decommissioned?

Proper decommissioning is a necessary, albeit costly and complex, process that requires years of planning. Closure of offshore oil and gas production sites typically involves the following steps:

Plugging Wells and Severing Well Casings

What the fossil fuel industry refers to as a "plug and abandonment" operation foremost involves cleaning out the well and installing a series of barriers to help keep potentially harmful fluids and gases from leaking into the environment.[2] This process often entails cutting and recovering the well casing — typically a steel pipe that lines the well — to prevent it from becoming a conduit for migrating fluids as it corrodes over time.[3] The well casing can be severed using chemicals, explosives, or cutters and is then recovered using cranes and other machinery.[4] The decommissioned well is ultimately capped with a surface plug to prevent leaks.[5] Operators carry out subsea plugging and casing recovery activities using semisubmersible rigs or floating vessels.[6]

Removing Platforms, Pipelines, and Other Offshore Structures

After the wells have been permanently plugged and sealed, operators should ideally remove all the infrastructure and equipment at the production site, including the rigs and platforms, wellheads, moorings, pipelines, artificial islands, and power cables.[7] Before the platform can be dismantled, workers must clean out any holding tanks, processing equipment, and piping, disposing of any residual oil or gas.[8] The platform must then be removed from its foundation, which may entail severing moorings that extend below the seafloor.[9]

Disposing of Platforms and Other Equipment

Complete rig or platform removal entails transporting all existing infrastructure and equipment from an offshore production site to onshore facilities where they can be recycled or disposed of, such as scrapyards.[10] However, some operators fail to decommission sites or only do so partially. Operators sometimes deliberately dump dismantled structures and other waste in deep waters, a practice that can harm the marine environment, as discussed below. In some jurisdictions, regulators may allow offshore platforms to remain in place or be relocated to the seafloor to serve as artificial reefs, the ecological benefits of which are dubious.[11]

Cleaning Up the Project Site

Following rig removal, proper site cleanup involves clearing the seafloor of all debris and obstructions, which may require the use of trawl nets and vessels as well as deep-sea divers.[12] Trash recovered from the seafloor should be towed to shore for proper disposal.[13]

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What Are the Risks Associated with the Decommissioning Phase?

Responsible closure and cleanup of offshore oil and gas operations is necessary to avert further harm from an already destructive industry and constitutes a critical step in a just and equitable transition away from fossil fuels. Failure to properly close down and clean up offshore operations leaves a lasting legacy of harm long after drilling ends. While the process of shutting down oil and gas production sites can be disruptive to the environment, it is far preferable to allowing the proliferation of aging, leaking wells and infrastructure in the world's oceans. The best way to avoid the impacts and costs associated with decommissioning offshore oil and gas operations — and the damage of failing to do so properly — is not to commence them in the first place.

Environmental and Biodiversity Risks

Equipment and wastes left at sea may release toxic or radioactive contaminants, whether over time or as a result of sudden accidents when oil and gas companies abandon offshore operations without decommissioning the project sites. Abandoned offshore infrastructure poses a host of risks. Over time, oil and gas pipelines left on the seafloor become more susceptible to damage from erosion, mudslides, corrosion, and fishing trawlers, and, when ruptured, may leak oil, gas, and other harmful compounds into the ocean.[14] Heavy currents during hurricanes and other extreme weather events, which are occurring with increasing frequency and severity due to climate change, are capable of moving pipelines over significant distances.[15] The displaced pipeline segments may, in turn, damage subsea habitats or the infrastructure at other oil and gas production sites, elevating the risk of noxious leaks.[16] Likewise, discarded drill cuttings have the potential to release heavy metals — including mercury[17] — and naturally occurring radioactive materials for years after operations have ceased.[18] Like old pipelines, ecotoxic cuttings can be dispersed by mudslides, ocean currents, and other physical disturbances.

Oil and gas leaks from abandoned wells can expose marine life to toxic substances. Beyond methane, unplugged or poorly plugged wells can also leak oil as well as other contaminants, such as benzene, nitrogen oxides, and carbon dioxide (CO_2). Benzene, a known carcinogen, has an acute toxic effect on marine life when dissolved in water, and in the long term, it can shorten lifespans, cause reproductive problems, lower fertility, and affect physiology and behavior.[19] Nitrogen pollution can cause algal blooms that clog the gills of fish and invertebrates, smother coral, and block sunlight from reaching underwater vegetation.[20] When it enters oceans, nitrogen can boost the growth of harmful phytoplankton species whose biotoxins accumulate in the tissues of the fish that eat them and can lead to death and illness among the marine mammals and birds that feed on the contaminated fish.[21] Finally, CO_2 emissions drive both ocean acidification and anthropogenic climate change.

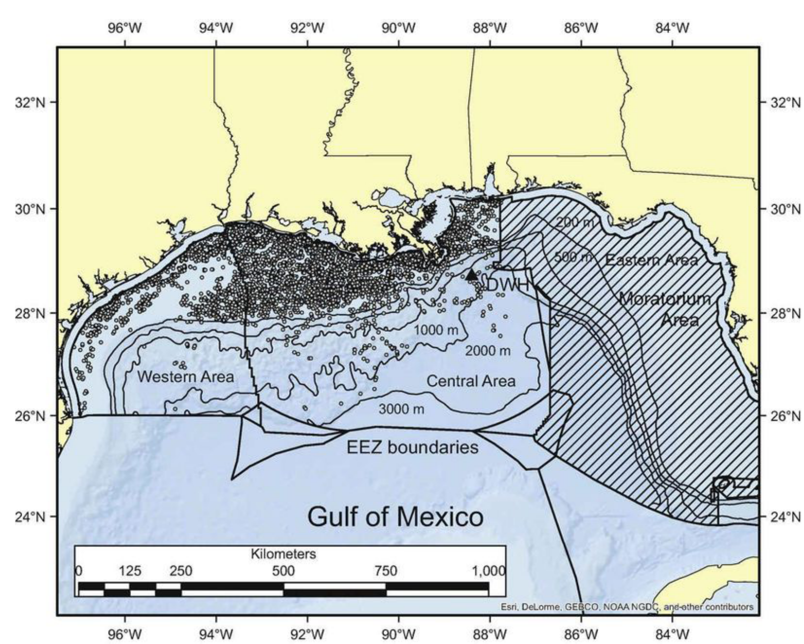
Regulators and operators should take steps to address and minimize the adverse environmental impacts associated with certain cleanup practices. For instance, decommissioning activities can lead to increased noise levels and ship traffic due to the presence of large vessels on-site and the transport of materials to and from port.[22] Likewise, the use of explosives to break down moorings and other infrastructure creates shockwaves and acoustic energy, disturbances that can destroy coral reefs and kill or harm wildlife, including fish, sea turtles, and marine mammals.[23]

Poor site cleanup practices can pose risks to water quality, with far-reaching implications for marine ecosystems. Sources of pollution include accidental spills or discharges from surface vessels as well as fluids released during the cleaning and disassembly of platforms, pipelines, and other machinery containing oil and harmful chemicals.[24] The process of dredging the seabed surrounding rigs to remove drill cuttings — which contain mineral deposits typically coated with hydrocarbons and toxic drilling mud and other waste — can stir up materials that may have been contaminated during drilling and subsequently buried through sedimentation.[25] These newly exposed toxins can then enter the water column and benthic environment, traveling via ocean currents over long distances and harming zooplankton, invertebrates, and fish.[26] Some industry practices around decommissioning, therefore, need significant improvement.

Climate Risks

The offshore oil and gas industry's most damaging environmental legacy is the legions of unplugged or poorly plugged wells littering the seafloor, a shocking percentage of which are largely unaccounted for. Unplugged or poorly plugged wells release planet-warming greenhouse gases and other toxins harmful to the marine environment. Even in jurisdictions that require operators to plug wells before their abandonment, the lack of capacity for sustained monitoring of decommissioned sites — as well an absence of strong laws mandating that operators assume that duty — almost guarantees that shoddy work and equipment failures will go unnoticed. This is only likely to get worse, with the number of improperly plugged or orphan wells and deserted facilities expected to increase drastically around the world.[27] Decades-old production sites offshore the Asia-Pacific, Latin America, and West Africa are nearing the end of their economic lives — including in jurisdictions where decommissioning is new and thus largely unregulated.[28]

In the Gulf of Mexico alone, more than 32,000 out of 55,000 permanently or temporarily abandoned wells have been ignored for decades and may be leaking, not to mention the more than 1,000 rigs and platforms that have long been sitting idle.[29] Yet, alarmingly, a 2021 research plan prepared by the Bureau of Ocean Energy Management (BOEM) indicates that the US federal agency specifically tasked with managing the development of offshore energy and mineral resources "in an environmentally and economically responsible way" was and may still be unaware of which abandoned oil and gas wells in the Gulf of Mexico are leaking.[30] Given the significant threat they pose to the climate, the lack of knowledge about leaking wells is particularly troubling.

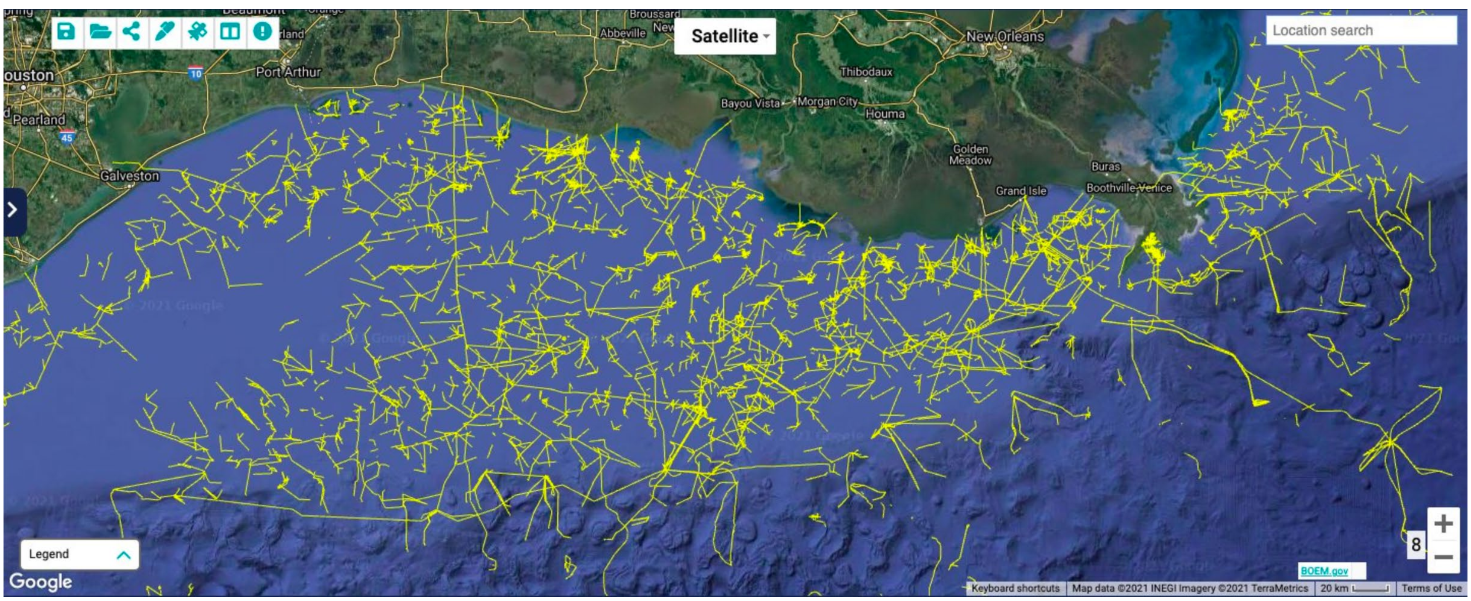


© Murawski, S.A., Hollander, D.J., Gilbert, S., Gracia, A. (2020)
Deepwater Oil and Gas Production in the Gulf of Mexico and Related Global Trends

Leaks from post-production wells exacerbate climate change. Leaking offshore wells constitute a pernicious threat to marine ecosystems as well as to the global climate — one that persists long after production sites have been shut down. When oil and gas wells are left unplugged or when plugs fail — which becomes all the more likely over time as environmental factors contribute to declining well integrity[31] — they can release harmful gases into the ocean and atmosphere, including enormous quantities of methane.[32] A study in the North Sea, for instance, revealed that one-third of the region's abandoned offshore wells could be releasing between 3,000 and 17,000 tons of methane into the ocean every year,[33] roughly equivalent to the annual CO_2 emissions of 16,000 to 91,500 gas-powered cars.[34]

Methane leaks from offshore wells can be so massive that they can even be detected from space. In June 2022, scientists using satellite data discovered that an oil and gas platform offshore southern Mexico had spewed some 40,000 metric tons of methane over a 17-day period in December 2021.[35] Methane is a highly potent greenhouse gas, second only to CO_2 in driving climate change during the industrial era.[36] In fact, methane is 86 times more effective at trapping heat than CO_2 over a 20-year period and is responsible for 25 percent of current global warming.[37]

The vast network of offshore pipelines, many of which are aging, also risks leaks. In the US, lax federal regulators have permitted 97 percent of inactive offshore pipelines to remain in place since the 1960s. In spite of clear rules requiring cleanup, there are currently 18,000 miles (29,000 km) of abandoned pipelines on the Gulf of Mexico's seafloor.[38] Out of the 8,600 miles of active pipelines in the Gulf, over 44 percent were installed prior to 2000[39] and are already aging — which, according to documentation by the Bureau of Safety and Environmental Enforcement, can increase the risk of leakage incidents due to corrosion.[40]



Oil and gas pipelines in the Gulf of Mexico officially designated "Abandoned" or "Out of Service."
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Rigs-to-Reefs: Ecological Havens or Greenwashing Harbors?

Recent years have witnessed the growing popularity of "rigs-to-reefs" (RtR), an alternative to complete platform removal that involves converting decommissioned offshore oil and gas platforms into artificial reefs. In the US, the RtR program under the Bureau of Safety and Environmental Enforcement (BSEE) permits the operator to either:

1. "Top" the platform by severing it 85 feet below the surface while leaving the remaining structure in place
2. Detach the platform from the seabed and then topple it in place
3. Tow the platform to another location more ideal for reefing[41]

Outside of the US, artificial reefs have been created from inactive platforms offshore Brunei, Malaysia, Senegal, and Thailand, among other places.[42] Unsurprisingly, the fossil fuel industry is a big proponent of RtR programs, which can save oil and gas companies millions of dollars in decommissioning costs.

Among environmentalists, marine scientists, and ocean campaigners, however, the practice remains controversial. On the one hand, some groups have advocated that old platforms be left in the ocean, arguing that removing them could do more harm than good.[43] On the other hand, many remain skeptical that leaving gargantuan unnatural structures under the sea could be beneficial to the environment and point to "substantial unpredictability and uncertainty regarding the effectiveness of artificial reefs, considering the variability and complexity of global marine ecosystems."[44] Moreover, the practice could cause future harm. Studies show that artificial reefs have the potential to damage marine environments by harboring and facilitating the spread of invasive species, creating adverse changes in natural food-web dynamics and ecological community structure, and releasing contaminants as rigs corrode.[45]

Given the debate around the long-term efficacy and safety of artificial reefs, as well as the diversity of marine ecosystems, two things are clear. First, RtR programs cannot follow a "one-size-fits-all" approach across regions that ignores unique ecological conditions and corresponding risks specific to a particular site. Second, the fossil fuel industry must not use RtR programs to shirk responsibility for proper closure and cleanup while simultaneously greenwashing the environmental, climate, and health impacts of their offshore operations or minimizing the numerous impacts and risks they pose across their phases, as detailed in this series of briefs.

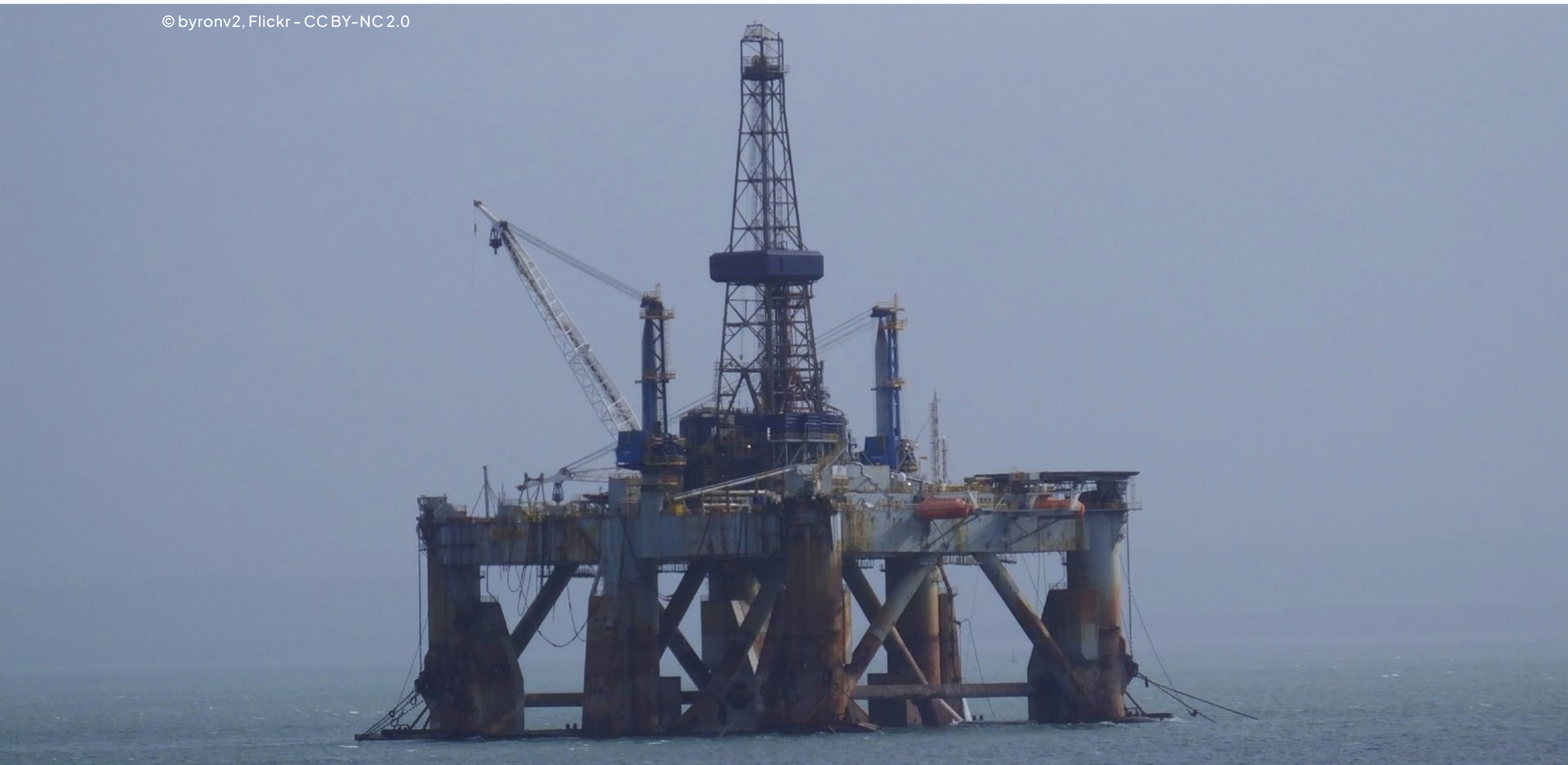
Health, Livelihood, and Cultural Risks

From impacts on fisheries and tourism to contaminants in the food chain, offshore oil and gas facilities can threaten the health and livelihoods of nearby coastal populations long after operation ceases. On the one hand, when offshore projects are simply abandoned without closure and cleanup, pipelines and other infrastructure and trash left on the seafloor present navigational and trawling hazards to commercial and subsistence fishermen alike.[46] On the other hand, poor industry practices around the dismantling and recovery of offshore infrastructure can cause substantial habitat destruction, fish die-off, and overall ecological imbalance. In either case, the impacts can jeopardize the physical and economic integrity of fishing communities dependent on those resources.

Communities adjacent to operations are also at heightened risk of consuming seafood that contains heavy metals, hydrocarbon particles, and the many other harmful compounds dispersed into the marine environment during the breakdown and cleanup of production sites and released by leaking wells. These toxins collect in the tissues of fish and other marine life and eventually make their way up the food chain in progressively larger quantities, meaning that humans are exposed to harmful doses. Especially dangerous particulates include chemical components of crude oil called polycyclic aromatic hydrocarbons (PAH), which can persist in the environment and animal tissues for months or even years and have been linked to cancers of the skin, lung, bladder, and gastrointestinal system.[47]

Abandoned offshore rigs and platforms also create huge eyesores that can negatively affect local tourism by making coastal towns less attractive to visitors. In fact, according to an analysis of communities on the Gulf of Mexico, counties in the region that did not house offshore infrastructure like pipelines and refineries brought in 50 percent more tourism dollars per capita compared to localities with such infrastructure.[48]

Leaks from abandoned or improperly plugged wells can damage coastal areas and the cultural, as well as livelihood, resources located there. Some Indigenous communities in the US, for example, have voiced concerns that abandoned wells have the potential to leak oil that will contaminate coastal areas, including archaeological sites.[49]



Financial Risks

The high costs of proper closure and cleanup pose significant burdens to governments and the public in affected areas when companies default on their decommissioning duties.

The Cost and Complexity of Decommissioning Obligations

Shutting down offshore oil and gas facilities is consistently and significantly more expensive than closing onshore ones — and the bill only increases the deeper the water. While the cost of plugging a conventional onshore well can range between $20,000 and $50,000,[50] plugging an offshore well can cost around $150,000 per shallow water well and at least $21 million for a subsea well in deep water, according to estimates by the BSEE.[51] The process of removing and disposing of equipment and infrastructure at offshore sites is likewise pricey. The BSEE projects that removing fixed platforms in shallow water could cost anywhere between $85,000 and $4.6 million, while extracting a floating rig and associated equipment in deep water could cost $30 million or more.[52] Thus, per lease, decommissioning can cost tens of millions of dollars in shallow water and hundreds of millions of dollars in deep water.[53] It also costs considerably more to decommission offshore infrastructure damaged by hurricanes — which are increasingly frequent and severe due to climate change — than intact facilities.[54]

Those bills may come due sooner than anticipated. The risk of decommissioning default may increase if wells underperform, prices drop, or mandated climate action accelerates, leading to earlier-than-expected production halts and abandoned wells. A 2021 forecast by the financial analysis firm IHS Markit estimated that, globally, offshore decommissioning could cost nearly $100 billion between 2021 and 2030,[55] what has been referred to as a "decade for decommissioning."[56] In the Gulf of Mexico's Outer Continental Shelf (OCS), production levels are declining, and decommissioning costs are rising due to more expensive deepwater development. As a consequence, the financial pressure on operators may intensify if revenues available for decommissioning drop.[57]

Decommissioning costs may be higher than anticipated if assets are decommissioned earlier than expected. Costs can change significantly over the lifespan of a project, and their unpredictability is compounded by the diverse funding structures employed by different jurisdictions to address these expenses. In Mexico, for example, companies are required to contribute to a designated fund for decommissioning active projects based on estimates of future production, remaining reserves, and initial decommissioning costs.[58] But because these contributions are made gradually, there's a chance that there won't be enough money in the fund to properly decommission a site if it happens before the planned end of its operating life. In other countries such as Australia and Norway, decommissioning is funded gradually as it becomes necessary.[59] However, this "pay-as-you-go" approach can be risky if the responsible party relies solely on income from the project, especially since decommissioning costs typically arise when the offshore asset is at the end of its life and not generating much profit.

Corporate Strategies to Avoid Decommissioning Costs

While most countries with significant offshore oil and gas resources require private companies to cover decommissioning costs, companies often avoid paying by transferring ownership of their oil and gas assets.[60] Bad-faith corporate tactics and opportunism have contributed to the rise in orphan wells, abandoned rigs, and disused platforms in the world's oceans. Corporations that sidestep decommissioning obligations leave the public in host countries to shoulder heavy financial burdens.

Larger companies can sell their aging assets to smaller firms, known as "wildcat" operators, with the aim of extracting maximum profit from depleted wells before they become non-productive.[61] Such has become common practice in Nigeria, where large multinationals like ExxonMobil and Shell reportedly routinely offload their oil and gas assets to inexperienced and under-resourced local companies, leaving them to inherit the decommissioning obligations and associated costs and liabilities, although they lack the means to cover them.[62]

Wildcat operators may declare bankruptcy and thereby shirk closure and cleanup costs, shifting them to the public rather than foot the bill when the time for decommissioning inevitably arrives.[63] In 2016, Australian energy giant Woodside transferred its aging assets in the Timor Sea to the newly incorporated group Northern Oil and Gas Australia, which subsequently collapsed into insolvency in 2019, passing the outstanding cleanup costs to Australian taxpayers.[64] Two decades after purchasing an offshore California rig from Mobil in 1997, Colorado-based oil company Venoco declared bankruptcy following a burst pipeline, leaving the state to deal with the mess.[65]

Regulatory, Tax, and Legal Loopholes

Tax credits or exemptions for decommissioning costs may enable oil and gas companies to transfer the heavy economic toll of oil and gas production to the public.[66] In the UK, for instance, dismantling the numerous inactive rigs in the North Sea is expected to cost around £40 billion,[67] only half of which will be borne by oil companies, the rest falling to the public purse through tax relief.[68] Such massive costs can be especially burdensome for lower-income countries already struggling with massive debt.

Contractual loopholes may also facilitate oil and gas operators' avoidance of decommissioning costs. For instance, in 2016, the local subsidiary of fossil fuel giant ExxonMobil, together with its joint operators Hess and China National Offshore Oil Corporation, entered into a production-sharing agreement with the Guyanese government concerning the consortium's deepwater drilling operations offshore Guyana.[69] Despite the significant looming expense of closing down these ultra-deep offshore operations, the agreement permits the consortium to deduct the estimated future costs of decommissioning as current operating expenses, thereby reducing the amount of "profit oil" it must share with Guyana. The agreement does not require ExxonMobil to demonstrate that it has reserved those decommissioning funds for future use, only to promise to pay when the time comes to close operations down, which in effect passes the decommissioning bill onto the government up-front.[70] An independent report by the Institute for Energy Economics and Financial Analysis (IEEFA) estimates that Guyana will ultimately pay Exxon and its partners GY$666.1 billion ($3.2 billion) out of its oil profits for decommissioning costs.[71]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Without adequate management and regulation of decommissioning, legal loopholes can be exploited by oil and gas companies, increasing default risk. Smaller subsidiary companies often receive financial assurances from their parent companies to cover the costs of decommissioning.[72] However, these parent companies are not always legally bound to fulfill these financial commitments for decommissioning, and it is not within their financial interests to do so.[73] As a result, when the time comes to decommission, if the subsidiary companies lack sufficient funds, they may default on their obligations, leaving the financial burden of decommissioning to the public.[74]

In the Gulf of Mexico's OCS, the ability of companies to obtain financial assurance waivers from BOEM has increased the risk that the government will have to pay the costs of decommissioning in the event of default. Typically, a company involved in offshore activity in the OCS that has potential future decommissioning costs is required to post a bond that serves as a financial guarantee that the company will fulfill its cleanup obligations.[75] However, as reported by Carbon Tracker, in 2022, only 10 percent of estimated decommissioning costs for the OCS were secured by bonds.[76] This is due in part to BOEM's financial assurance program, which allows companies that do not have investment-grade credit ratings to use third-party guarantees in lieu of posting a bond when obtaining leases for offshore development. Under this scenario, if these lessees became financially insolvent and filed for bankruptcy — as was the case between 2009 and 2020 for 30 companies whose unbonded offshore decommissioning liability totaled approximately $7.5 billion[77] — the public would be left to foot the massive bills. A new rule under the Biden administration requiring these less creditworthy companies to secure supplemental was expected to help ensure that some funds are available to cover decommissioning costs in the event these companies go bankrupt, lessening the burden borne by taxpayers.[78] However, the future of the rule under the new Trump administration is uncertain. In any case, because decommissioning deadlines routinely go unenforced — as a recent investigation into the US Government Accountability Office revealed[79] — there is a need for better accountability for both offshore operators and the government agencies tasked with their oversight.

Conclusion

Closing down and cleaning up offshore oil and gas operations is a complex, lengthy, and costly process that is all too often not done properly or not done at all. With the proliferation of orphaned and abandoned wells in the world's oceans, operators are leaving eyesores, environmental hazards, and financial burdens in their wake. Methane leaks from offshore wells constitute a significant and growing source of planet-warming emissions. Decommissioning, including plugging and sealing wells and disposing of associated infrastructure, is all the more difficult and costly in deeper waters and too often goes unmonitored. Legal, regulatory, and contractual loopholes facilitate industry avoidance of costs, leaving the public to foot the bill and suffer the consequences of the lasting harms that remain after an offshore oil or gas project is shuttered. The best way to avoid the pernicious impacts and significant costs of decommissioning offshore oil and gas operations is to not begin them in the first place. The risks posed by other phases of offshore oil and gas activity are explored further in the other briefs in the *Offshore, Off-Limits* series, which can be found on CIEL's website.

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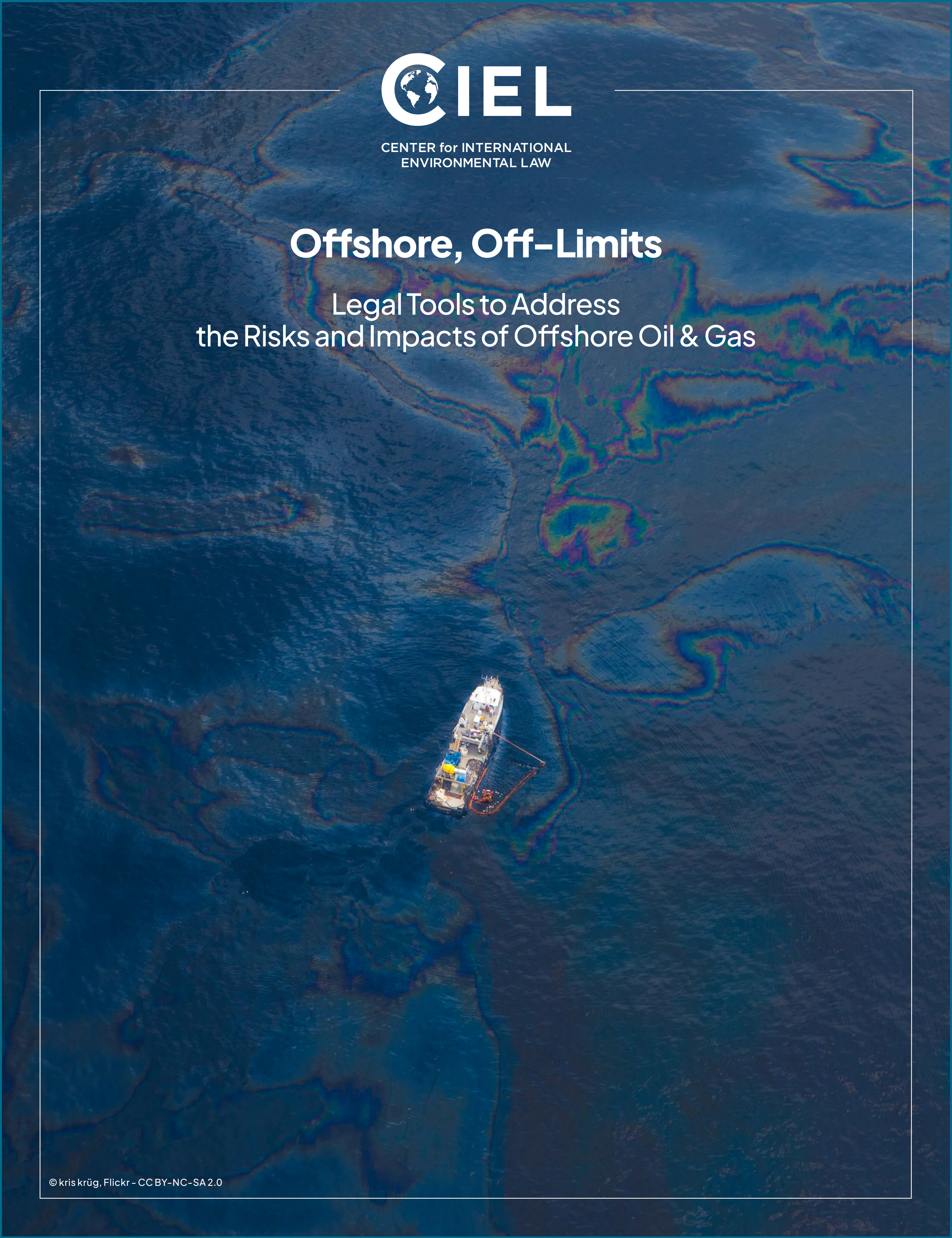
Offshore, Off-Limits

Legal Tools to Address the Risks and Impacts of Offshore Oil & Gas



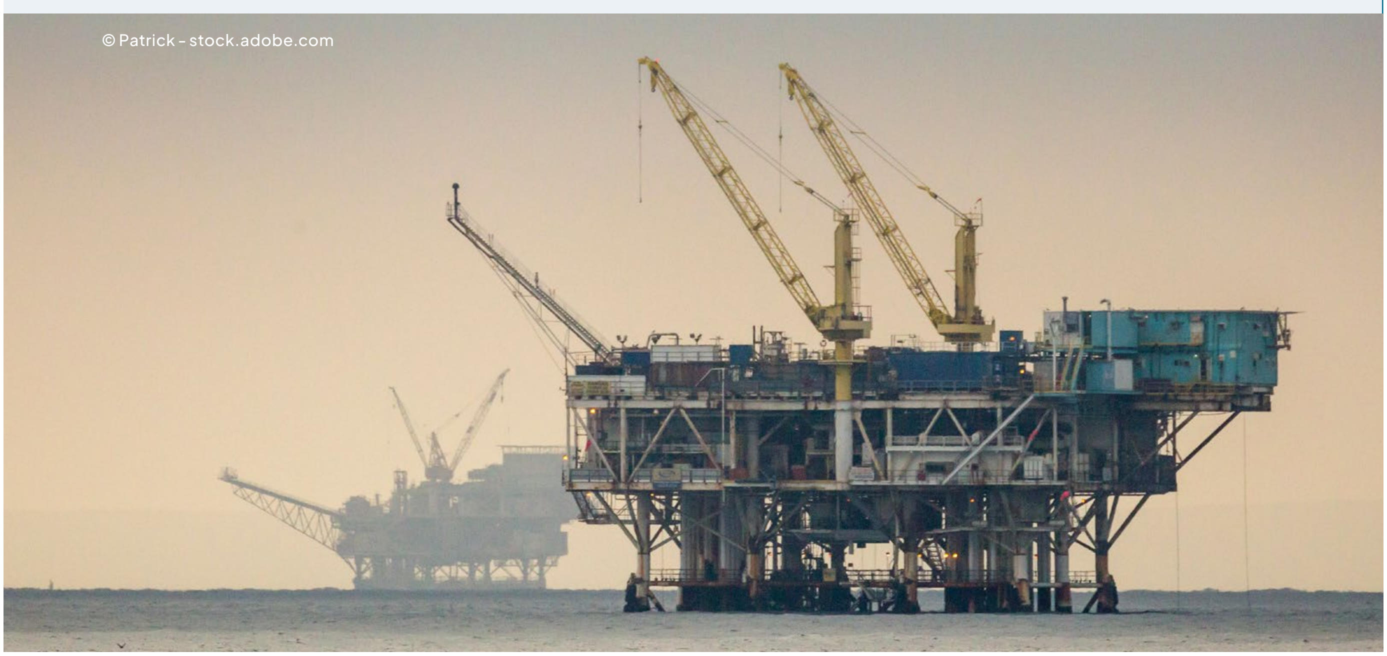
Major oil and gas projects are being developed on the coastlines and at sea on almost every continent, presenting common challenges and risks at every stage, from exploration and production to transportation and decommissioning. These shared challenges offer a unique opportunity to build movements on a regional basis, connect people working on these issues across the world, and equip affected communities with the expertise, analysis, and arguments needed to respond. Individuals, communities, and organizations can influence decision-making relating to offshore activity at many points, be that at the planning and permitting stage, while an activity is underway, or after operations have ceased. This brief discusses various legal obligations and principles relevant to the prevention, mitigation, or remediation of the risks and impacts of oil and gas activities on coastlines and at sea, as well as some of the international instruments and tools that enshrine them.

Domestic law provides a first line of defense against the risks and impacts of offshore oil and gas activity. In some countries and subnational jurisdictions, governments have prohibited new offshore oil and gas exploration and production in their waters or made commitments to phase out fossil fuel activities by a particular date.[1] Whether through agency decisions, executive orders, or legislation, such temporary or permanent bans have been enacted in several places, including Costa Rica,[2] the eastern Gulf of Mexico,[3] and New South Wales, Australia, among others.[4] Even where no such restrictions have been imposed, laws may operate to make offshore oil and gas activity impermissible in certain areas or under certain conditions, provide legal grounds to challenge licenses, or require operators to close down and clean up their sites.

Community protest against exploration activities offshore South Africa's Wild Coast

Where not prohibited, offshore fossil fuel development typically occurs in a country's territorial waters or, if further off the coast, within its exclusive economic zone (EEZ), falling under the jurisdiction of domestic legal and regulatory frameworks. Subnational and national laws and regulations pertaining to hazardous or industrial activities on coastlines and at sea, environmental impact assessment and management, and emergency response plans and operations — among others — will restrict the conditions for obtaining permits for offshore activity and impose requirements to which approved operations must adhere. In many countries, species protection, fisheries management, and biodiversity conservation frameworks limit offshore activity in certain areas or constrain the conduct of operations. Failure to comply with procedural or substantive requirements under those laws, or the failure of those laws to reflect international standards and obligations binding on the State concerned, can give rise to claims under administrative or constitutional law. Properly invoked, those laws can be leveraged to compel governments and companies to assess, consider, and disclose the risks associated with offshore activity before it is authorized or undertaken and across its phases. They can also ensure avenues for redress and accountability for adverse impacts that materialize.

International law, regulations, and principles developed to protect oceans, the environment, and human rights can be relevant in resisting offshore oil and gas expansion, accelerating its phaseout, and preventing, mitigating, and remediating its adverse impacts. These international instruments and tools, many of which are binding on States, provide standards against which to assess the adequacy of domestic regimes or evaluate decisions relating to offshore activity proposed or undertaken by States and private actors. In that sense, even where it is not directly enforceable by non-State actors, international law can inform domestic legal challenges to, and court interpretations of, the lawfulness of offshore oil and gas activity and the responsibility of operators for any resultant harms. The sections that follow provide an overview of international law and standards relevant to three categories: information and participation, prevention and protection, and responsibility and remedy.



Rights to Participation, Information, and Consultation

First and foremost, decisions about offshore activity must adhere to relevant transparency and participation requirements. Members of the public — and particularly those most directly or immediately impacted by an offshore oil and gas activity — have a right to be informed about and take part in the decision-making process around proposed oil and gas activities on coastlines and at sea. Understanding the fundamental rights at issue and the corresponding international obligations, standards, and principles to which impact assessment and public disclosure, consultation, and consent processes should adhere can strengthen community efforts to influence decisions about whether, where, and how oil and gas activities are conducted on coastlines and at sea.

Participation in Environmental Decision-Making

The right to participate in public affairs is codified in key international human rights treaties binding on virtually all States, such as the International Covenant on Civil and Political Rights (ICCPR), as well as widely ratified regional agreements like the American Convention on Human Rights.[5] Numerous international instruments enshrine the public's right to participate, specifically in the context of decision-making around environmental matters. Recognizing that "[e]nvironmental issues are best handled with the participation of all concerned citizens," the 1992 Rio Declaration provides that individuals shall have the opportunity to participate in environmental decision-making processes at the national level.[6] According to the Rio Declaration, States should pay particular attention to ensuring the participation of Indigenous Peoples and women in these processes, given their vital role in environmental management.[7] The Regional Agreement on Access to Information, Public Participation and Justice in Environmental Matters in Latin America and the Caribbean, commonly known as the Escazú Agreement, obligates States Parties to guarantee public participation in environmental decision-making "from the early stages so that due consideration can be given to the observations of the public, thus contributing to the process."[8] The parallel treaty in Europe — the United Nations Economic Commission for Europe Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters, also known as the Aarhus Convention — requires the frameworks for public participation during the "preparation of plans and programmes" relating to the environment to be "transparent and fair."[9]

The right to participate in environmental decision-making is inherently linked to the right of access to environmental information, under which States are duty-bound under multiple instruments to generate, disclose, and disseminate.[10] The right of access to information "is an enabler of participation and a prerequisite that ensures the openness and transparency of, and accountability for, States' decisions,"[11] including those relating to proposed offshore oil and gas development.

The Legal Duty to Undertake EIAs

Environmental impact assessments (EIAs) are a core means of conveying information about the environmental risks of a proposed activity to the public before the activity is undertaken. EIAs are a required component of due diligence obligations whenever a proposed activity may have significant environmental effects, as they provide States and the public with a mechanism for identifying and incorporating relevant environmental information into decision-making processes. EIA processes frequently provide the most relevant avenue through which interested members of the public can challenge proposed oil and gas activities.

The requirement to conduct EIAs and the content thereof is enshrined in numerous domestic instruments across the world. Many coastal countries where offshore oil and gas activities are undertaken or proposed have environmental management statutes or other regulations that detail procedural and substantive requirements for the conduct of EIAs. These include the circumstances in which such assessments are required, how the intensity of the assessment varies with the degree of risk, and their timing, publication, dissemination, and consultation. Moreover, domestic regulatory and legal frameworks set out the right of members of the public to challenge the adequacy of an EIA or the conclusions drawn from it. While it is beyond the scope of this brief to analyze the myriad statutory and regulatory regimes applicable to EIAs for offshore activity in different countries, the following overview of international law and standards on EIAs can inform efforts to obtain information and influence decisions about offshore oil and gas operations across jurisdictions.

Under customary and treaty-based international environmental law, States must enact and implement adequate EIA regulatory frameworks. States have an obligation to conduct, or require private actors to conduct, EIAs in certain circumstances, including where a proposed activity risks causing significant adverse effects on the environment or transboundary harm,[12] as do offshore oil and gas activities. Indeed, the duty to carry out EIAs has been reaffirmed, elaborated, and operationalized by a wide range of legal instruments and authoritative sources of international environmental law.[13] According to the International Law Commission, the obligation of States to conduct EIAs for proposed activities under their jurisdiction or control requires States to "put in place the necessary legislative, regulatory and other measures" for an EIA to be conducted when it is "likely" proposed activities will cause "significant adverse impact."[14] Furthermore, "[p]rocedural safeguards such as notification and consultations are also key to such an assessment."[15] Importantly, impact assessments should inform States' analyses of whether "execution of the project is compatible with its international obligations."[16]

The Scope and Content of Required EIAs

A number of international agreements and frameworks elaborate on the required scope and content of EIAs, including for activities in and on oceans. Similarly, EU directives relating to strategic environmental assessments and EIAs contain similar provisions.[17] As the Inter-American Court clarified, EIAs must evaluate "the cumulative impact of existing and proposed projects" to accurately analyze not just the direct and immediate effects of a proposed activity but the compound impact of the activity in light of other existing and future activities in the affected area.[18] The UN Convention on the Law of the Sea (UNCLOS) expressly requires EIAs for planned activities likely to cause substantial pollution or significant and harmful changes to the marine environment.[19] In a 2024 Advisory Opinion clarifying the obligations of States in the context of the climate emergency, the International Tribunal for the Law of the Sea (ITLOS) explains that the duty extends to any planned public or private activity that may cause such harm "through anthropogenic GHG emissions," including through the cumulative effects of the activity and other GHG sources.[20] While not exclusive to sea-based activities, the ILC's Draft Guidelines on the Protection of the Atmosphere and the Kiev Protocol to the Convention on Environmental Impact Assessment in a Transboundary Context (Espoo Convention) likewise note the need for States to undertake EIAs for proposed activities that may have an adverse effect on the climate.[21] Such requirements unquestionably apply to offshore oil and gas development, which has an outsized climate impact, both through the GHG emissions generated during production and transportation and the significant quantities released when the extracted oil and gas are inevitably consumed as intended.

A human rights-based approach to impact assessments requires a holistic analysis that looks beyond direct and immediate environmental impacts. Regional human rights bodies within the African and Inter-American human rights systems have emphasized the need for States to carry out impact assessments that address the environmental as well as the social, cultural, and spiritual effects of a proposed activity on local communities prior to authorizing the activity.[22] A proper assessment, the Inter-American Court explains, serves to ensure that affected communities "are aware of the possible risks, including the environmental and health risks, so that they can evaluate, in full knowledge and voluntarily, whether or not to accept the proposed development or investment plan."[23] Accordingly, an impact assessment should ideally "include the full consideration of all alternatives" to the proposed activity.[24]

Multiple sources of international law emphasize the need for EIAs to duly assess the effects of proposed offshore activity on marine species and ecosystems. The Convention on Biological Diversity (CBD) requires States to institute domestic procedures requiring EIAs for any project "likely to have significant adverse effects on biological diversity with a view to avoiding or minimizing such effects and, where appropriate, allow for public participation in such procedures."[25] In the context of oceans-based activities specifically, the CBD Voluntary Guidelines for the Consideration of Biodiversity in EIAs and Strategic Environmental Assessments (SEAs) in Marine and Coastal Areas offers several recommendations. These include, among others, making EIAs mandatory for activities taking place in ecologically or biologically significant marine areas and vulnerable marine ecosystems and for activities "resulting in emissions, effluents, and/or other means of chemical, radiation, thermal or noise emissions in areas providing key ecosystem services."[26]

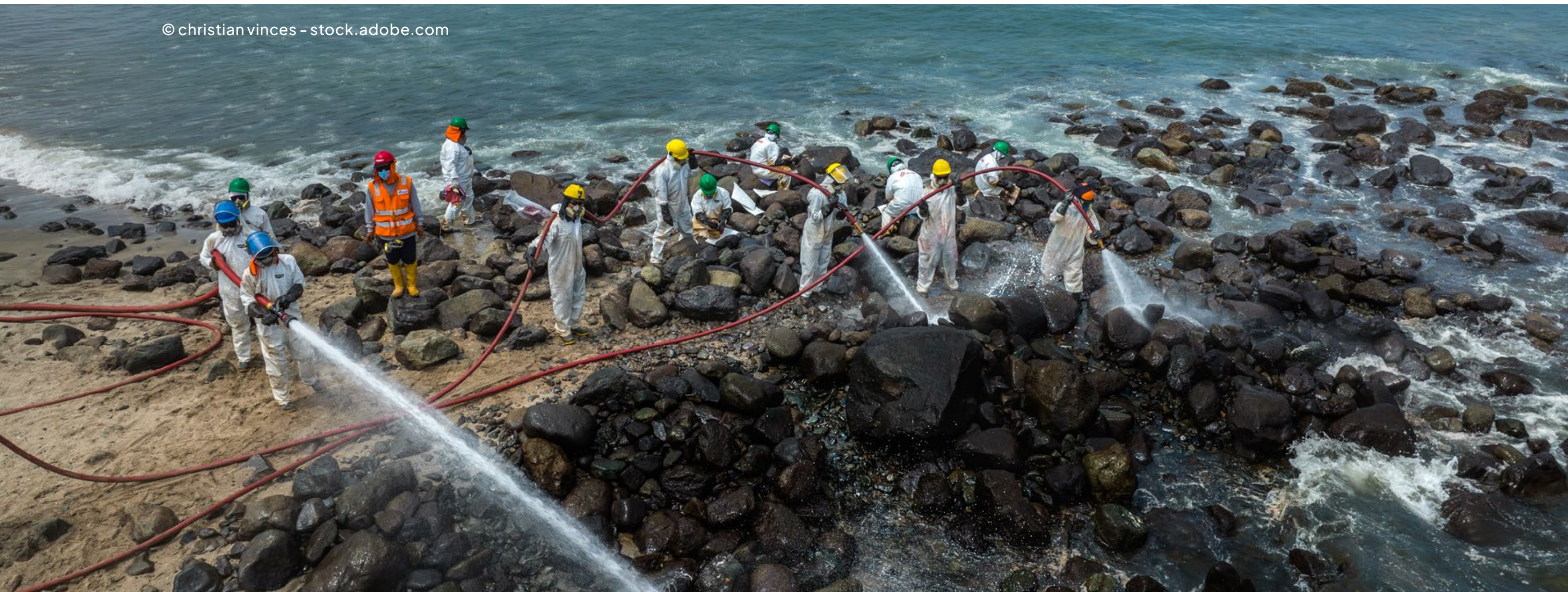
Under certain regional laws and frameworks, States may also be mandated to consider the direct and indirect impacts of a proposed activity on marine species or habitats that have been afforded special protection. Such instruments include, for instance, the Protocol for Specially Protected Areas and Wildlife (SPAW) Protocol[27] — which is an instrument under the Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region (Cartagena Convention) — and OSPAR Recommendation 2010/5,[28] which offers guidance to Parties to the Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR Convention).[29] As recognized by the UN Special Rapporteur on the Right to Food, assessing the biodiversity impacts of a proposed offshore oil and gas project is essential to understanding how it may infringe on the rights of local fisherfolk, whose livelihoods depend on the integrity of marine ecosystems.[30]

Informed Consultation and Consent

Access to environmental information and the conduct of EIAs are crucial to protecting human rights from infringement through environmental harm. International human rights authorities, including human rights treaty bodies and UN Special Procedures, have observed that impact assessments should be independent, comprehensive, and participatory.[31] Furthermore, consistent with the human rights to participation, consultation, and consent, an EIA should be "conducted in a transparent manner, with the provision of adequate information to affected communities" and "undertaken prior to the launch of any project, rather than as a means to validate a project that has already commenced."[32]

States must guarantee that complete, objective information on the risks and impacts of a proposed activity is compiled and disseminated in order to uphold rights to consultation and consent. States are duty-bound to ensure that Indigenous Peoples, local communities, and other members of the public are consulted on decisions affecting their rights under a number of instruments, among them the Escazú Agreement,[33] the Aarhus Convention,[34] the Indigenous and Tribal Peoples Convention, 1989 (International Labour Organization Convention [ILO] No. 169),[35] and the UN Declaration on the Rights of Indigenous Peoples.[36] Further, international law firmly establishes the right of Indigenous Peoples to free, prior, and informed consent (FPIC) with respect to decisions that may affect their lands, territories, and resources.[37] To comply with FPIC duties, States must ensure that consultations are carried out in coordination with affected Indigenous Peoples through their own representative institutions prior to approving any measures that may affect them, and they must refrain from approving such measures absent their free and informed consent.[38]

Information on environmental risks and impacts must also be accessible. The "informed" requirement of FPIC obligates States to ensure that the affected Indigenous Peoples are provided with timely information regarding all aspects of the proposed activity in an easily accessible and understandable manner.[39] To ensure an inclusive, non-discriminatory process, such information — which necessarily includes any EIAs — should be communicated in the languages of the concerned communities and in a culturally appropriate format, be that oral or written.[40] The disseminated information must also address the nature, objectives, and consequences of the consultation process itself, including the "consequences of giving or withholding consent."[41] In addition, the information disclosed must be sufficiently comprehensive to ensure that the communities concerned are fully apprised of the scope and reach of the proposed project so they may discuss and evaluate all its potential impacts. This would entail, at minimum, a "preliminary assessment of the likely economic, social, cultural and environmental impact, including potential risks."[42]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Challenges to Oil and Gas Approvals on Information and Participation Grounds

A State's decision to approve, finance, or otherwise support an offshore oil and gas activity may be subject to legal challenge if it is made without due regard to the rights of the public and affected communities to informed and meaningful participation. A number of recent lawsuits challenging States' approval of offshore oil and gas activities have centered on defects in the EIA and/or public consultation processes. For instance, in a case led by Greenpeace Nordic and Natur og Ungdom (Nature and Youth) that is currently on appeal — discussed in the Production brief — the Oslo District Court invalidated permits for three new oil and gas fields in the North Sea because they were approved without consideration of the climate impacts stemming from the downstream consumption of the oil and gas produced from the fields.[43] Similarly, the UK Supreme Court held that in assessing planning applications for new oil and gas extraction wells, a local council should have considered the climate impacts from the inevitable and intended use of the produced fossil fuels, not just emissions from drilling the wells.[44]

Furthermore, several challenges to exploration activities have alleged violations of affected communities' rights to information and consultation. For example, as detailed in the Exploration brief, a legal challenge to Woodside's plans to conduct seismic blasting offshore northern Western Australia succeeded on the grounds that the company had not properly consulted the Traditional Custodians of the Burrup Peninsula,[45] as detailed in the Exploration brief. Likewise, the petitioners in the litigation against oil exploration activities off South Africa's Wild Coast, also discussed in the Exploration brief, argued that Shell, Impact Africa, and the South African government had not properly consulted coastal communities whose livelihoods and spiritual and cultural rights were at significant risk of harm.[46] On top of failing to share critical information on how the planned seismic blasting could cause adverse, irreparable damage to local fisheries and ecosystems, the lawsuit alleges that the operators had failed to provide public notice of the exploration right in the languages spoken by the majority of members of the affected communities and through communication channels that were easily accessible. Upholding these arguments, in June 2024, South Africa's Supreme Court of Appeals affirmed the High Court's judgment that the government had improperly granted Shell and Impact Africa the right to carry out seismic surveys unlawfully.[47]

Thus, while existing international law does not comprehensively address or expressly prohibit offshore oil and gas activities, it does enshrine numerous principles that must inform how decision-making processes around proposed oil and gas operations are carried out at the national level.

Duties to Prevent and Protect Against Adverse Human Rights and Environmental Impacts

The obligations to conduct EIAs and ensure public access to information and participation stem from and are central to States' duties under international law to prevent and minimize the risk of foreseeable harm to the environment and human rights. The duty to prevent informs the legal parameters for lawful activity in and on oceans and, when necessary, constrains the conduct of oil and gas operations. States and companies that fail to take adequate measures to ensure that offshore activities under their jurisdiction or control do not cause significant damage to the environment or lead to violations of fundamental human rights can incur responsibility for resulting harm or, at minimum, face legal challenges to the continuation of those activities.

Preventing Human Rights and Environmental Harm

States must take measures to ensure offshore oil and gas activities within their territories or subject to their control do not infringe on human rights. States have a preventive obligation under international human rights law to refrain from causing or contributing to, as well as protect against foreseeable violations of human rights, including those caused by environmental harm and climate change.[48] Pursuant to this obligation, States must take "all appropriate measures" to avert known or foreseeable threats to the realization of human rights posed by offshore oil and gas activity,[49] including the establishment and implementation of legislative and administrative frameworks to minimize threats to the right to life.[50] These measures must aim to effectively prevent harm not only to the environment but also to human health.[51] States are duty-bound to regulate the activities of all actors subject to their jurisdiction and control, including oil and gas companies, ensure "effective protection" against rights violations, and hold actors accountable for violations.[52]

These duties to respect and protect human rights also have extraterritorial application. The duty to respect "requires States parties to refrain from interfering directly or indirectly with the enjoyment of the Covenant rights by persons outside their territories."[53] The duty to protect, in turn, requires States to regulate any actor subject to their jurisdiction to prevent them from violating rights when operating abroad[54] or when undertaking conduct that has the foreseeable effect of infringing rights, regardless of where those infringements occur.[55] Moreover, the duty to protect also extends to protection against conduct that causes pollution as well as climate change and other forms of transboundary environmental harm, as has been widely recognized by international human rights treaty bodies and experts, as well as regional human rights systems.[56]

Because activities conducted in the oceans inherently pose transboundary risks, international laws and principles regarding the prevention of transboundary harm and protection of shared resources should constrain offshore oil and gas activities. The duty to prevent transboundary environmental harm is a central tenet of the law of nations that is, according to the International Court of Justice, "part of the corpus of international law relating to the environment."[57] Starting with the Trail Smelter arbitration,[58] the duty to prevent significant transboundary environmental harm has been reiterated time and again, including in foundational documents setting forth the principles of international environmental law such as the Stockholm Declaration[59] and the Rio Declaration,[60] as well as in multilateral agreements like the CBD,[61] UNCLOS,[62] and the UN Framework Convention on Climate Change (UNFCCC).[63] According to the transboundary harm principle, every State has a duty "not to allow knowingly its territory to be used for acts contrary to the rights of other States"[64] and must do what it can to avoid engaging in or allowing activities in its territory or an area it controls that will cause significant transboundary harm or harm to a shared resource.[65] Thus, while a State has a right to exploit its own resources — such as undersea oil and gas reserves — that right is checked and limited by the duty not to knowingly cause "damage to the environment of other States or of areas beyond the limits of national jurisdiction."[66] Notably, the transboundary harm principle encompasses not just cross-border damage between neighboring States but harm to the global commons and shared resources, including the high seas and the atmosphere.[67] Given the significant and inevitable GHG emissions generated by fossil fuel production across all phases and the consequent impacts on the climate and oceans, pursuing offshore oil and gas activity is arguably incompatible with respecting the transboundary harm principle.

The Adequacy of Assessments and Regulations

States must ensure that offshore oil and gas operations — if permitted at all — are conducted with the utmost vigilance, given their large-scale and lasting impacts on oceans and the communities and ecosystems that depend on them. To satisfy their preventive obligations under international human rights law and adhere to the transboundary harm principle, States must "take all appropriate measures to prevent significant transboundary harm or at any event to minimize the risk thereof."[68] The ICJ has noted that "in the field of environmental protection, vigilance and prevention are required on account of the often irreversible character of damage to the environment and of the limitations inherent in the very mechanism of reparation of this type of damage."[69]

The heightened risks posed by offshore activities trigger heightened obligations. The necessary standard of care — the "due diligence" required — varies with the nature of the risk and the means at a State's disposal. According to ITLOS, what States must do to meet their prevention and protection obligations "may change over time as measures considered sufficiently diligent at a certain moment may become not diligent enough in light, for instance, of new scientific or technological knowledge."[70] The riskier a given activity, the more stringent the standard of due diligence required.[71] Calibrating the preventive measures required to the degree of risk posed is consistent with the precautionary approach — which obligates States to act with caution in the face of uncertain and potentially harmful consequences of activity — a principle ITLOS considers "an integral part of the general obligation of due diligence."[72]

International Instruments Addressing the Prevention of Marine Pollution

International law has evolved to regulate, control, and prevent the adverse and often extraterritorial impacts of industrial activity in and on oceans. UNCLOS — which has been ratified by 170 parties — is the preeminent legal framework governing marine and maritime activity and contains detailed rules relating to the use and protection of oceans. Under the Convention, States have a general obligation to "protect and preserve the marine environment,"[73] which effectively places limitations on their "sovereign right to exploit their natural resources."[74] The obligation entails both "the positive obligation to take active measures to protect and preserve the marine environment, and ... the negative obligation not to degrade the marine environment."[75] It requires States to take all measures necessary to "prevent, reduce, and control pollution of the marine environment from any source,"[76] including seabed activities,[77] offshore installations and structures (which encompasses pipelines and rigs),[78] vessels,[79] dumping activities,[80] and from or through the atmosphere.[81] UNCLOS specifies that States "shall adopt laws and regulations to prevent, reduce and control pollution" from seabed activities, dumping, and other sources that "shall be no less effective than international rules, standards and recommended practices and procedures."[82]

A number of legal and regulatory frameworks concerning oceans provide specific guidance on the types of pollution States must prevent and regulate. Under UNCLOS, pollution encompasses not only toxic and noxious substances from vessels and offshore infrastructure but also the release of energy into the marine environment — including light, noise, and heat.[83] Other authorities, such as the European Union[84] and the International Union for Conservation of Nature (IUCN),[85] have likewise recognized that noise from seismic blasting and other offshore oil and gas activity constitutes pollution. The growing international consensus around the need to regulate ocean noise similarly to other types of environmental pollutants is demonstrated by resolutions adopted by the European Parliament,[86] International Whaling Commission (IWC),[87] UN,[88] and Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and Contiguous Atlantic Area (ACCOBAMS),[89] among others.

GHG emissions are a form of marine pollution that States have a legal obligation to prevent, reduce, and control. In addition to ocean noise, anthropogenic GHG emissions also fall within UNCLOS's definition of "pollution of the marine environment" since they introduce "substances" (i.e., CO_2) and "heat" into the marine environment and cause "deleterious effects"[90] — such as ocean warming, sea level rise, and ocean acidification. As ITLOS clarified in its climate advisory opinion, States thus have a duty to take all measures necessary to "prevent, reduce, and control" pollution from GHG emissions, whether stemming from land-based sources, vessels, or aircraft.[91]

Select Instruments Governing the Prevention and Mitigation of Operational and Accidental Marine Pollution

- The **UN Convention on the Law of the Sea (UNCLOS)**, a comprehensive treaty governing all uses of the oceans and their resources, requires States to take all necessary measures to reduce, prevent, and control pollution of the marine environment. UNCLOS defines "pollution of the marine environment" as "the introduction by man, directly or indirectly, of substances or energy into the marine environment" (Article 194), which encompasses, inter alia, sound waves, greenhouse gas emissions, noxious discharges, and other matter released into the oceans via seabed activities, vessels, ocean dumping, and atmospheric discharges. As of 2024, UNCLOS has been ratified by 170 parties, which include 166 UN Member States, the European Union, and non-member observer States. Additionally, many provisions of UNCLOS codify and are thus considered to have the status of customary international law, which means that they are binding even on States not party to the regime, such as the United States.

- The International Convention on Oil Pollution Preparedness, Response and Co-operation (OPRC), as of 2024, has 115 Contracting Parties and requires States and operators to formulate emergency plans in the event of an accidental oil spill incident, establish response systems, and immediately report any spills to the nearest coastal State in the case of ships, and, in the case of "offshore units" including rigs, the nearest coastal State with jurisdiction over the unit. The Convention applies to both fixed and floating offshore installations engaged in gas or oil exploration and exploitation activities (Article 2).

- The International Convention for the Prevention of Pollution from Ships ("MARPOL 73/78"), which came into force on October 2, 1983, is the principal international agreement addressing the prevention of pollution of the marine environment by ships from operational or accidental causes. Among other things, MARPOL:
    1. Prohibits ships from releasing bilge water whose oil content exceeds 15 parts per million (ppm) (Annex 1, Regulation 9)
    2. Includes six Annexes concerning pollution by different substances, including oil, air pollution from ships, vessel sewage, and hazardous substances
    3. Provides for the designation of "special areas" of oceans in which vessels are subject to stricter controls around discharges than under generally applicable international standards (Annex 1, Regulation 10)

In addition to its provisions relating to ships, MARPOL 73/78 prohibits installations — including drilling rigs — from releasing oil or oil-based mixtures, garbage, platform drainage, and other discharges generated by engines into the ocean. However, the provisions relating to discharges do not apply to "harmful substances directly arising from the exploration, exploitation and associated offshore processing of seabed mineral resources" (Article 2(3)(b)(ii)), which may encompass drilling muds and fluids, produced water, or hydrocarbon leaks from wells.

- The Protocol Concerning Co-operation and Development in Combating Oil Spills in the Wider Caribbean Region (Oil Spills Protocol) was adopted concurrently with the Cartagena Convention in 1983. It aims to:
    1. Strengthen national and regional preparedness and response capacity of the nations and territories of the region
    2. Facilitate cooperation and mutual assistance in cases of emergency to prevent and control major oil spill incidents

- The Protocol for the Protection of the Mediterranean Sea against Pollution Resulting from the Exploration and Exploitation of the Continental Shelf and the Seabed and its Subsoil of the Barcelona Convention aims to protect the Mediterranean Sea against pollution from all phases of offshore oil and gas activities, respond to pollution incidents, and address liability and compensation when pollution occurs.

- The Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and Contiguous Atlantic Area (ACCOBAMS) is a regional convention whose objective is to reduce threats to and improve scientific understanding of cetaceans in the Mediterranean Sea, Black Sea, and contiguous waters. Given the risks underwater noise pollution poses to cetaceans, the Meeting of the Parties of ACCOBAMS has passed numerous resolutions that call on States Parties to avoid the use of any human-made noise in areas inhabited or used by marine mammals. For instance, Resolution 2.16 (2004), which expressly attributes increases in marine noise levels to oil and gas exploration, urges both Parties and non-Parties to the Agreement to take "special care" and, "if appropriate, avoid any use of man-made noise in the habitat of vulnerable species." Furthermore, it urges Parties to encourage industries conducting activities known to produce underwater sound with the potential to cause adverse impacts on cetaceans, including the oil and gas industry, to exercise "extreme caution when operating in the ACCOBAMS area." According to the resolution, ideally, the most harmful of these activities would not be conducted in the area "until satisfactory guidelines are developed."

International Instruments Addressing the Protection of Marine Biodiversity

International and regional conventions concerning biodiversity and endangered species protection may require States to protect threatened marine life and habitats from offshore oil and gas activity, given the many pollutants and ecological disturbances it generates. Relevant instruments include the CBD, the Convention on Wetlands of International Importance (Ramsar Convention),[92] and the Convention on the Conservation of Migratory Species (CMS),[93] among others. The CBD, for instance, requires Parties to take measures "as far as possible and as appropriate" to "[p]romote the protection of ecosystems, natural habitats and the maintenance of viable populations of species in natural surroundings" and to "regulate and manage" activities that have "significant adverse impacts on the conservation or sustainable use of biological diversity."[94] Such activities necessarily include those that generate significant GHG emissions, light pollution, ocean noise, and toxic effluents, all of which can cause substantial harm to the marine environment. Similarly, the Ramsar Convention — an intergovernmental treaty on the conservation and wise use of wetlands and their resources — could provide a basis to challenge the construction of pipelines and other offshore oil and gas infrastructure that could infringe on and disturb protected wetlands. While the CBD, Ramsar Convention, and CMS are not regulatory regimes that offer enforcement mechanisms for non-compliance, their provisions are reflected to varying degrees in the national laws of contracting States, which may provide for causes of action in the event of violations.[95]

International Instruments Addressing Prevention and Response to Ocean Contamination

Given their transboundary consequences, accidental blowouts and oil spills caused by offshore oil and gas activities require cross-jurisdictional prevention, preparedness, and response, as recognized by multiple agreements and frameworks. A number of legal instruments exist specifically to promote and facilitate States' cooperation and coordination in responding to transboundary environmental catastrophes at sea. The International Convention on Oil Pollution Preparedness, Response, and Co-operation (OPRC), which was drafted within the framework of the International Maritime Organization (IMO) and, as of 2024, has 115 Contracting Parties, applies to both fixed and floating offshore installations engaged in gas or oil exploration and exploitation activities.[96] While OPRC does not set standards or requirements for the design of offshore installations or safety protocols, it requires both States and offshore oil and gas operators to formulate emergency plans in the event of an accidental oil spill incident, establish response systems, and immediately report any spills to the coastal authorities of the nearest State.[97] OPRC obligates States to establish national systems for responding promptly and effectively to oil spills[98] and encourages international and regional coordination and planning.[99] Similarly, the Protocol Concerning Co-operation and Development in Combating Oil Spills in the Wider Caribbean Region (Oil Spills Protocol) of the Cartagena Convention aims to strengthen national and regional preparedness and response capacity in the Caribbean region and facilitate cooperation and mutual assistance both to prevent and control major oil spill incidents.[100]

Select Instruments that Obligate Polluters to Pay for Harm Caused by Offshore Activity

- The International Convention on Civil Liability for Oil Pollution (CLC) imposes strict liability for damage caused by oil pollution from oil-carrying ships on the shipowners. Under the Convention, owners of ships carrying over 2,000 metric tons of oil as cargo are required to maintain insurance or other financial security to cover liability for pollution damage. The Convention does not place a limit on liability when it is proven that damage resulted from the shipowner's "personal act or omission, committed with the intent to cause such damage, or recklessly and with the knowledge that such damage would probably result" (Article V(2)). The 1969 Convention was replaced by the 1992 Protocol, which increased the amount of compensation available for major incidents as well as the scope of the regime.

- The 1992 International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage provides compensation to States and persons who suffer pollution damage if they are unable to obtain compensation from the shipowner or if the compensation due isn't enough to cover the damage suffered. The Fund is supplementary to compensation provided through the CLC, though liability under the Fund is limited to damage from pollution occurring in the territories, territorial seas, and EEZs of the 120 Member States. The 2003 Protocol to the Convention establishes an International Oil Pollution Compensation Supplementary Fund, to which only 32 States are party. The Supplementary Fund effectively increases five-fold the maximum amount of potential compensation available to victims.

- The 2001 International Convention on Civil Liability for Bunker Oil Pollution Damage seeks to provide compensation for damage caused by contamination resulting from the escape or discharge of bunker (fuel) oil from ships. The Convention, which was modeled after the CLC, requires vessel owners to maintain insurance coverage or other financial security to cover liability for pollution damage. Under the Convention, claims for compensation are permitted to be brought directly against an insurer (Article 7).

Other legal instruments also establish standards relating to accidental and operational pollution from offshore infrastructure and vessels, applicable to rigs, oil and gas tankers, and LNG carriers. For instance, the International Convention for the Prevention of Pollution from Ships (MARPOL 73/78 or MARPOL Convention) — which has 161 Contracting States and applies to "fixed and floating platforms"[101] — prohibits installations from releasing oil or oil-based mixtures, garbage, platform drainage, and other discharges generated by engines into the ocean. Moreover, it requires that drilling rigs and other platforms be equipped with pollution control devices.[102] The Convention also addresses the intentional release of contaminants into oceans by barring ships from discharging dirty water that contains oil concentrations exceeding 15 ppm.[103] A State Party to the Convention enforces MARPOL regulations through the adoption of national laws and designates a law enforcement agency to arrest and detain those who violate the regulations within the maritime borders of the State.[104] Violators may then face civil, criminal liability — or both — in national courts.[105]

When vessel-based spills occur in spite of pollution control devices and regulations, numerous international agreements that address liability and compensation regimes can inform responsive measures: the International Convention on Civil Liability for Oil Pollution Damage,[106] the 1992 International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage and its 1992 and 2003 Protocols,[107] and the 2001 International Convention on Civil Liability for Bunker Oil Pollution Damage.[108] Additionally, regional instruments such as the Oil Spills Protocol of the Cartagena Convention offer frameworks to facilitate interstate cooperation and assistance in cases of emergency to prevent and control major oil spill incidents.[109]

Despite an abundance of legal and regulatory frameworks specifically designed to prevent and mitigate the harms to oceans, gaps in protection remain. For example, in spite of existing regulations under the MARPOL Convention relating to bilge dumping, vessels often circumvent the costs associated with equipment used to treat wastewater and illegally dump oily bilge into oceans, with harmful results. Enforcement is not the only concern; carve-outs from regulations leave some threats unaddressed. The MARPOL Convention explicitly omits from its coverage "harmful substances directly arising from the exploration, exploitation and associated offshore processing of seabed mineral resources,"[110] including drilling muds and fluids, produced water, and well leaks. Likewise, the 1972 London Dumping Convention and its 1996 Protocol, which set out important standards applicable to the decommissioning of offshore oil and gas facilities, expressly do not apply to wastes directly stemming from exploration, exploitation, and the associated offshore processing of seabed mineral resources.[111]

The persistent regulatory gaps at the international level underscore the primary importance of domestic laws in comprehensively addressing the risks and impacts posed by the offshore oil and gas industry, ensuring that those laws meet and exceed international standards, and enforcing compliance through monitoring and accountability when harms materialize.

Polluter Pays Principle and the Right to Remedy

Under international law, States and corporations have duties to ensure that oil and gas infrastructure is properly shut down and that polluters pay — not only for routine closure and cleanup but for damages caused by operations and their toxic legacy. As primary duty-bearers, States have duties to respect human rights and protect against foreseeable harm arising from the conduct of private parties, including hazardous offshore activity. Compliance with those duties requires States to ensure access to effective remedy when violations of human rights arise.[112] In the context of offshore oil and gas development, States have a duty to prevent operators from improperly decommissioning or abandoning offshore sites and to compel operators to redress resulting environmental and health hazards when they arise.

Several multilateral treaties oblige States to ensure the proper decommissioning of offshore oil and gas wells and the platforms to which they are attached in a manner that protects ecosystems and reduces hazards to the public.[113] UNCLOS, for example, requires States to ensure that disused and abandoned offshore installations or structures are removed in accordance with "generally accepted international standards" and that any such removal "shall also have due regard to fishing, the protection of the marine environment and the rights and duties of the other States."[114] Whereas the 1996 Protocol of the 1972 Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (London Convention) allows Parties to dispose of vessels and offshore platforms at sea in certain circumstances and with formal permits, such dumping cannot pose undue risks to human health or the environment and should not be pursued if there are more feasible and environmentally preferable alternatives.[115] Decision 98/3 under the OSPAR Convention, which guides international cooperation on the protection of the marine environment of the North-East Atlantic, prohibits the dumping and leaving, wholly or partly in place, of disused offshore installations within the OSPAR Maritime Area.[116] Some regional instruments, like the Offshore Protocol of the Convention for the Protection of the Mediterranean Sea Against Pollution (known as the Barcelona Convention), create similar obligations and go a step further by requiring States to ensure that the responsible oil and gas operators carry out and pay for the decommissioning operations.[117]

Select Instruments that Govern the Closure and Cleanup of Offshore Structures

- The UN Convention on the Law of the Sea (UNCLOS), described above, addresses the proper shutdown of oil and gas infrastructure. It requires States to remove disused and abandoned offshore installations or structures with due regard to the "protection of the marine environment" (Article 60(3)). Moreover, it requires States to adopt laws, regulations, and other measures to prevent, reduce, and control pollution of the marine environment by "dumping," which it defines as the "deliberate disposal of wastes or other matter from vessels, aircraft, platforms or other man-made structures at sea" (Article 210).

- The 1958 Geneva Convention on the Continental Shelf defines and delimits the rights of States to explore and exploit the natural resources of the continental shelf. With regard to decommissioning, the Convention requires offshore installations used for the exploration or exploitation of resources on the continental shelf to be "entirely removed" when abandoned or no longer in use (Article 5(5)).

- The Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter 1972 (London Convention) and its 1996 Protocol (London Protocol) promote the effective control of all sources of marine pollution and take practicable steps to prevent pollution of the sea by the dumping of wastes and other matter. Previously, the London Convention prohibited States from deliberately dumping any platforms or other human-made structures, whether totally or partially, including by "abandonment and toppling at site" (Articles 1 (4) and 4(1.1)). The London Protocol, which expanded and effectively replaced the Convention, potentially allows for the dumping of vessels and offshore rigs, but only if such dumping does not pose undue risks to human health or the environment. However, any dumping requires formal permitting and should not be pursued if there are more feasible and environmentally preferable alternatives (Article 3(1), Article 4(1.2), Annex 1–2).

- The OSPAR Decision 98/3 on the Disposal of Disused Offshore Installations is under the framework of the Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR Convention), which coordinates the activities of 15 Governments and the European Union to protect the marine environment of the North-East Atlantic from the offshore industry as well as land-based sources of marine pollution. Passed in 1998, Decision 98/3 prohibits the dumping and leaving, wholly or partly in place, of disused offshore installations within the OSPAR Maritime Area, which encompasses the North-East Atlantic and adjacent seas.

- The Protocol for the Protection of the Mediterranean Sea against Pollution Resulting from the Exploration and Exploitation of the Continental Shelf and the Seabed and its Subsoil of the Barcelona Convention, referenced above, requires States to ensure that the responsible oil and gas operators carry out the decommissioning operations (Article 20).

The polluter pays principle requires that the operator of offshore oil and gas infrastructure should pay for closure and cleanup when the time comes. In its canonical form in the Rio Declaration, the principle states that polluters should "internalize" the costs of their pollution to the environment and society.[118] States, in turn, are expected to adopt measures to ensure that polluters bear the costs of pollution control and prevention. The UN Working Group on Business and Human Rights has linked restitution measures with the polluter pays principle, noting that "if an enterprise caused pollution, it should be required to restore the environment as part of the 'polluter pays' principle."[119]

Requiring oil and gas operators to adequately decommission their operations and cover the costs of remediating associated pollution is also consistent with the right to remedy, guaranteed under international human rights law.[120] When rights are violated, as they are when foreseeable risks of harm from environmental contamination materialize due to the insufficiency of preventive measures, the right to remedy entitles victims to reparation in the form of restitution, compensation, rehabilitation, satisfaction, and guarantees of non-repetition.[121] Ensuring that the actors responsible for pollution pay not only furthers reparatory aims but also serves as a deterrent to future violations, helping to guarantee non-recurrence.[122]

While the implementation of regulations and standards around decommissioning occurs at the domestic level, the quality and application of domestic laws vary widely. As detailed in the Decommissioning brief, structural weaknesses in regulatory regimes all too often let private oil and gas companies dodge responsibility for their damages. As a result, the public pays for these costs through taxes and long-term impacts on public health and the environment.

However, some States are taking steps to hold oil and gas companies accountable. For instance, in 2021, Australia passed a law that makes former owners of oil and gas fields legally responsible for the costs of dismantling facilities if later owners fail.[123] Then, in April 2022, the Australian parliament passed legislation that slaps a levy on oil and gas producers to cover the costs of cleaning up an abandoned oil field in the Timor Sea.[124] Additionally, as discussed in the Decommissioning brief, in the US, a rule recently passed by the Bureau of Ocean Energy Management that increases the financial assurance requirements for offshore oil and gas operators aims to help ensure that American taxpayers are not bearing the brunt of the decommissioning costs for offshore platforms.[125] These and other examples demonstrate that the days of allowing fossil fuel companies to externalize the costs of their polluting offshore operations are numbered.

Conclusion

International and domestic laws that restrict the types of activities that can be conducted in and on oceans and the manner in which they are carried out apply to the oil and gas sector. These laws and the norms and principles they enshrine can be leveraged at different stages of decision-making to:

1. Prevent risks and impacts from oil and gas activities on coastlines and at sea, including by prohibiting those activities and/or phasing them out
2. Challenge States and corporations authorizing, supporting, or engaging in those activities
3. Hold these parties accountable when oil and gas activities violate legal duties and result in harm

International instruments may impose binding obligations on States and/or inform domestic law and industry practice through minimum standards and legal principles against which the permissibility of proposed activities and the adequacy of safeguards can be assessed. The growing number of lawsuits opposing oil and gas operations and holding polluters accountable continue to clarify and strengthen the legal regime applicable to industrial activities on coastlines and offshore. Together, international and domestic frameworks provide a crucial and growing set of legal tools for protecting people and the environment from the threats posed by oil and gas.

Endnotes

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7. Rio Declaration, prin. 20, 22.
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9. Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters, art. 7, *opened for signature* June 25, 1998, 2161 UNTS 447, 38 ILM 517 (1999) [hereinafter Aarhus Convention].
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11. UN Office of the High Commissioner for Human Rights (OHCHR), *Guidelines for States on the Effective Implementation of the Right to Participate in Public Affairs* (Geneva: OHCHR, 2018), https://www.ohchr.org/sites/default/files/2021-12/GuidelinesRightParticipatePublicAffairs_web.pdf.
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13. Examples include: Rio Declaration, prin. 17; Convention on Environmental Impact Assessment in a Transboundary Context, art. 2(2), *adopted* February 25, 1991, *entered into force* September 10, 1997, 1989 UNTS 309; 30 ILM 800 (1991) [hereinafter Espoo Convention]; Convention on Biological Diversity, art. 14, *opened for signature* June 5, 1992, *entered into force* December 29, 1993, 1760 UNTS 79, 143; 31 ILM 818 (1992) [hereinafter CBD]; United Nations Framework Convention on Climate Change, art. 4(f), *adopted* May 9, 1992, *entered into force* March 21, 1994, 1771 UNTS 107, 165; S. Treaty Doc No. 102–38 (1992), UN Doc. A/AC.237.18 (Part II)/Add. 1; 31 ILM 849)1992) [hereinafter UNFCCC]; United Nations Convention on the Law of the Sea, *adopted and opened for signature* December 10, 1982, *entered into force* November 16, 1994, 1833 UNTS 397; 21 ILM 1261 (1982), arts. 204, 205, 206 [hereinafter UNCLOS].
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60. Rio Declaration, prin. 2.

61. CBD, art. 3.

62. UNCLOS, art. 194 ("States shall take all measures necessary to ensure that activities under their jurisdiction or control are so conducted as not to cause damage by pollution to other States and their environment, and that pollution arising from incidents or activities under their jurisdiction or control does not spread beyond the areas where they exercise sovereign rights in accordance with this Convention.").

63. UNFCCC, pmbl.

64. Corfu Channel Case (UK v. Alb.), Judgment, 1949 ICJ Rep. 4, 22 (April 9, 1949).

65. Dispute over the Status and Use of the Waters of the Silala (Chile v. Bol.), Judgment, 2002 ICJ Rep. 614, para. 99 (December 1, 2002); Costa Rica v. Nicar. paras. 104, 118; Pulp Mills para. 101; Gabčíkovo-Nagymaros Project, (Hung./Slovak.), Judgment, 1997 ICJ Rep. 7, para. 53 (September 25 [hereinafter Gabčíkovo-Nagymaros Project Judgment]; Nuclear Weapons Advisory Opinion, para. 29.

66. Stockholm Declaration, prin. 21; Rio Declaration, prin. 2.

67. ILC, Draft Articles on Prevention of Transboundary Harm from Hazardous Activities with Commentaries, *Yearbook of the International Law Commission*, 2001, vol. II, part II, A/CN.4/SER.A/2001/Add.1 (Part 2), art. 2(c) & corresponding commentary; Advisory Opinion OC-23/17, para. 96 (identifying climate change as transboundary harm: "Many environmental problems involve transboundary damage or harm. 'One country's pollution can become another country's human and environmental rights problem, particularly where the polluting media, like air and water, are capable of easily crossing boundaries.' The prevention and regulation of transboundary environmental pollution has resulted in much of international environmental law, through bilateral, regional or multilateral agreements that deal with global environmental problems such as ozone depletion and climate change."); UNEP Division of Environmental Law and Conventions, "IEG of the Global Commons," accessed July 17, 2024, archived at https://cil.nus.edu.sg/wp-content/uploads/2015/12/Ses4-7.-UNEP-Division-of-Environmental-Law-and-Conventions-Global-Commons.pdf ("The 'Global Commons' refers to resource domains or areas that lie outside of the political reach of any one nation State. Thus international law identifies four global commons namely: the High Seas; the Atmosphere; Antarctica; and, Outer Space."); IUCN, *World Conservation Strategy: Living Resource Conservation for Sustainable Development* (IUCN, 1980), 58, https://portals.iucn.org/library/efiles/documents/WCS-004.pdf.

68. ILC, Draft Articles on Prevention of Transboundary Harm from Hazardous Activities with Commentaries, art. 3. See also: Costa Rica v. Nicar. para. 104; Pulp Mills para. 101 (stating that a State "is thus obliged to use all the means at its disposal in order to avoid activities which take place in its territory, or in any area under its jurisdiction, causing significant damage to the environment of another State.").

69. Gabčíkovo-Nagymaros Project Judgment, para. 140.

70. ITLOS Seabed Chamber Advisory Opinion, para. 117.

71. ITLOS Seabed Chamber Advisory Opinion, para. 117; ITLOS Climate Change Advisory Opinion, para. 239.

72. ITLOS Seabed Chamber Advisory Opinion, para. 131.

73. UNCLOS, art. 192.

74. UNCLOS, art. 193.

75. South China Sea Arbitration (Phil. v. China), PCA Case No. 2013-19, Arbitral Award, ICGJ 495 (PCA 2016) (July 12, 2016), para. 941 (Arbitral Tribunal constituted under Annex VII of UNCLOS, 2016).

76. UNCLOS, art. 194(1) (emphasis added).

77. UNCLOS, art. 208 (1).

78. UNCLOS, art. 208 (1).

79. UNCLOS, art. 211.

80. UNCLOS, arts. 210(1), 210(2).

81. UNCLOS, art. 212.

82. UNCLOS, arts. 208(3), 209(2), 210(6).

83. UNCLOS, art. 1(1)(4) (defining "pollution of the marine environment" as "the introduction by man, directly or indirectly, of substances or *energy* into the marine environment") (emphasis added).

84. Directive 2008/56/EC, of the European Parliament and of the Council of June 17, 2008 on Establishing a Framework for Community Action in the Field of Marine Environmental Policy (Marine Strategy Framework Directive) 2008 OJ (L 164/19) art. 3(8) (explaining that "pollution" means "the direct or indirect introduction into the marine environment, as a result of human activity, of substances or energy, including human-induced marine underwater noise…").

85. International Union for Conservation of Nature (IUCN) World Conservation Congress, Resolution 3.068, Undersea Noise Pollution, IUCN Doc. No. WCC 2004 RES 068 (2004), 79–81, https://portals.iucn.org/library/node/44354.

86. Resolution on the Environmental Effects of High-intensity Active Naval Sonars, *adopted* October 28, 2004, Eur. Parl. Doc. 2005 OJ (C 174 E/186) (adopting UNCLOS's interpretation that underwater noise constitutes a form of marine pollution).

87. International Whaling Commission (IWC), Resolution 2018-4 on Anthropogenic Underwater Noise, IWC Doc. No. 2018-4 (2018), https://crm.iwc.int/data/node/8639.

88. UNGA, Resolution 61/222, Oceans and the Law of the Sea, A/RES/61/222 (March 16, 2007), para. 107, undocs.org/A/RES/61/222.

89. For example: Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and Contiguous Atlantic Area (ACCOBAMS), Resolution 2.16, Assessment and Impact Assessment of Man-Made Noise, ACCOBAMS-MOP2/2004/Res.2.16 (2004); ACCOBAMS, Resolution 3.10, Guidelines to Address the Impact of Anthropogenic Noise on Marine Mammals in the ACCOBAMS Area (2007); ACCOBAMS Resolution 6.17, Anthropogenic Noise (2016).

90. UNCLOS, art. 1(1)(4).

91. ITLOS Climate Change Advisory Opinion, para. 264.

92. Convention on Wetlands of International Importance Especially as Waterfowl Habitat, *adopted* February 2, 1971, 996 UNTS 245.

93. Convention on the Conservation of Migratory Species of Wild Animals, *adopted* June 23, 1979, 1651 UNTS 333 [Bonn Convention].

94. CBD, arts. 7(c), 8(d), 8(l).

95. For example, in 2023, the National Green Tribunal — a judicial body tasked with adjudicating environmental cases in India — fined the government of Kerala INR 10 CR (roughly $1.2 million) for failing to protect Ramsar sites from pollution by illegal waste dumping. G. Krishnakumar, "NGT Slaps ₹10 Crore Penalty on Kerala Government for Failure to Protect Ramsar Sites," *The Hindu*, March 24, 2023, https://www.thehindu.com/sci-tech/energy-and-environment/ngts-principal-bench-slaps-10-cr-penalty-on-govt-for-failure-to-protect-ramsar-sites/article66657114.ece.

96. 1990 International Convention on Oil Pollution Preparedness, Response and Co-operation, *adopted* November 30, 1990, *entered into force* May 13, 1995, 191 UNTS 51; 30 ILM 733 (1990), 733, art. 2(4) [hereinafter OPRC].

97. OPRC, art. 4.

98. OPRC, art. 6(1).

99. OPRC, arts. 7.

100. Protocol Concerning Co-operation in Combating Oil Spills in the Wider Caribbean Region, Convention for The Protection and Development of the Marine Environment of the Wider Caribbean Region, *adopted* March 24, 1983, *entered into force* October 1, 1986) 1506 UNTS 224, 22 ILM 240 [hereinafter Oil Spills Protocol of the Cartagena Convention].

101. Protocol of 1978 relating to the International Convention for the Prevention of Pollution from Ships, art. 2(4), 1340 UNTS 61, 1341 UNTS 3) [hereinafter MARPOL 73/18].

102. MARPOL 73/18, Annex I (Requirements for the Prevention of Pollution by Oil), Regulation 39 (Special requirements for fixed or floating platforms).

103. MARPOL 73/18, Annex I, Regulation 15 (2.3).

104. MARPOL 73/18, art. 6; Maritime Industry Authority (Philippines), *Frequently Asked Questions on MARPOL 73/78 Convention*, 14, https://marina.gov.ph/wp-content/uploads/2020/10/MARPOL-73_78.pdf.

105. For instance, when a violation occurs in Singapore, owners and operators may be subject to civil penalties even if unaware of the crew's actions, whereas individual crewmembers who knowingly violate the convention may face criminal liability in addition to fines. Maritime & Port Authority of Singapore, "Violations of MARPOL," https://www.mpa.gov.sg/staticfile/Cwp/assets/SRS/Issue24/case-studies/violations-of-MARPOL.html.

106. International Convention on Civil Liability for Oil Pollution Damage, *adopted* November 29, 1969, 973 UNTS 3, 9 ILM 45 (1970); Protocol of 1992 to amend the International Convention on Civil Liability for Oil Pollution Damage, 1969, *adopted* November 27, 1992, 1956 UNTS 285.

107. International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage, *adopted* December 18, 1971, 1110 UNTS 57, 11 ILM 284 (1972) (amended by Protocol of Nov. 27, 1992) (requiring the payment of compensation to States and persons that are harmed by oil pollution damage States if they are unable to obtain compensation from the owner of the polluting ship or if compensation from the owner is not sufficient to cover the damage); Protocol of 2003 to the International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage, 1992, *opened for signature* May 16, 2003 (providing a third tier of compensation by establishing an International Oil Pollution Compensation Supplementary Fund, whose membership is optional and is open to any State which is a Member of 1992 Fund).

108. International Convention on Civil Liability for Bunker Oil Pollution Damage, *adopted* March 23, 2001, IMO Doc. LEG/CONF.12/19 (2001), 40 ILM 1493 (2001).

109. Oil Spills Protocol of the Cartagena Convention, pmbl., arts. 3, 4, 5, 6.

110. MARPOL 73/18, art. 2(3)(b)(ii).

111. 1996 Protocol to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, art. 1(4.3), *opened for signature* November 7, 1997, *entered into force* March 24, 2006, 36 ILM 7 [hereinafter London Protocol].

112. For example: ICCPR, art. 2(3)(b)–(c); Human Rights Committee, General Comment No. 31 [80], The Nature of the General Legal Obligation Imposed on States Parties to the Covenant, 18 Sess., *adopted* March 29, 2004, CCPR/C/21/Rev.1/Add.13, undocs.org/CCPR/C/21/Rev.1/Add.13, paras. 16–18 [hereinafter Human Rights Committee, General Comment No. 31]; Committee on the Rights of the Child, General Comment No. 16 on State obligations regarding the impact of the business sector on children's rights, CRC/C/GC/16 (2013) (April 18, 2013), paras 30, 44, undocs.org/CRC/C/GC/16; CEDAW, General Recommendation No. 28 on the core obligations of States parties under article 2, CEDAW/C/GC/28 (December 16, 2010), undocs.org/CEDAW/C/GC/28, para. 32. An effective remedy includes a right to reparations, which can include compensation, restitution, rehabilitation and measures of satisfaction, guarantees of non-repetition and changes in relevant laws and practices, as well as bringing to justice the perpetrators of human rights violations.

113. Instruments like the 1958 Convention on the Continental Shelf and International Maritime Organisation (IMO) Resolution A.672(16), for instance, create obligations on States to ensure the full or partial removal of offshore oil and gas infrastructure. Convention of the Continental Shelf, *adopted* April 29, 1958, 499 UNTS 311, arts. 5(1)(5)(6)(7); Int'l Maritime Org., Guidelines and Standards for the Removal of Offshore Installations and Structures on the Continental Shelf and in the Exclusive Economic Zone, *adopted* October 19, 1989, IMO Res. A.672(16) (setting forth non-binding guidelines).

114. UNCLOS, art. 60(3).

115. London Protocol, art. 2, 3, 4(1.1), Annex 1, Annex 2. Previously, under the London Convention, Parties were prohibited from deliberately disposing of at sea (or "dumping") any platforms or other human-made structures, whether totally or partially, including by "abandonment and toppling at site." Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, arts. 1(4.13), 2, 3(a)(ii), *adopted* December 29, 1972, 1046 UNTS 120; 11 ILM 1294 (1972).

116. 1998 OSPAR Decision 98/3 on the Disposal Of Disused Offshore Installations, *adopted* July 23, 1998. However, exceptions may be permitted if there are "significant reasons why an alternative disposal mentioned below is preferable to reuse or recycling or final disposal on land," such as in the case of "exceptional and unforeseen circumstances resulting from structural damage or deterioration."

117. 1994 Protocol for the Protection of the Mediterranean Sea against Pollution Resulting from Exploration and Exploitation of the Continental Shelf and the Seabed and its Subsoil, art. 20, *adopted* October 14, 1994, 2742 UNTS 77; Convention on the Protection of the Marine Environment of the Baltic Sea Area, Annex VI Reg. 8, *entered into force* May 3, 1980, 1507 UNTS 166 [Helsinki Convention].

118. Rio Declaration, prin. 16.

119. UNGA, Report of the Working Group on the issue of human rights and transnational corporations and other business enterprises, A/72/162 (July 18, 2017), para. 13, undocs.org/A/72/162. The polluter pays principle has been recognized by many other authoritative bodies and experts in international law.

120. Numerous international and regional human rights instruments codify the right to remedy, including the following: UNGA, Resolution 217 (III) A, Universal Declaration of Human Rights, A/RES/217(III) (December 10, 1948), art. 8, undocs.org/A/RES/217(III); ICCPR, art. 2(3); International Convention on the Elimination of All Forms of Racial Discrimination, art. 6, *adopted* December 21, 1965, 660 UNTS 195; Convention on the Rights of the Child, art. 39, *adopted* November 20, 1989, 1577 UNTS 3; American Convention on Human Rights, art. 25; [European] Convention for the Protection of Human Rights and Fundamental Freedoms, art. 13, *entered into force* September 3, 1953, as amended by Protocols Nos. 3, 5, 8, and 11, which *entered into force* September 21, 1970, December 20, 1971, January 1, 1990, and November 1, 1998, respectively, 213 UNTS 221; ETS No. 5. According to the Permanent Court of International Justice, the predecessor of the ICJ, "[it] is a principle of international law, and even a general conception of law, that any breach of an engagement involves an obligation to make reparation." Factory at Chorzów (Ger. v. Pol.), Claim for Indemnity, Judgment, 1927 PCIJ (ser. A) No. 9, para. 29 (July 26, 1927).

121. UNGA, Basic Principles and Guidelines on the Right to a Remedy and Reparation for Victims of Gross Violations of International Human Rights Law and Serious Violations of International Humanitarian Law, A/RES/60/147, (March 21, 2006), Part IX, paras. 18–24, undocs.org/A/RES/60/147 (describing "full and effective reparation," as including restitution, compensation, rehabilitation, satisfaction, and guarantees of non-repetition); Human Rights Committee, General Comment No. 31, para. 16; CESCR, General Comment No. 24, para. 41.

122. For example: UNGA, Resolution 60/147, Basic Principles and Guidelines on the Right to a Remedy and Reparation, A/RES/60/147 (March 21, 2006), para. 15, undocs.org/A/RES/60/147 ("In cases where a person, a legal person, or other entity is found liable for reparation to a victim, such party should provide reparation to the victim or compensate the State if the State has already provided reparation to the victim.").

123. Sonali Paul, "Asia Eyes Australia Blueprint as $100 Bln Oil, Gas Clean-up Looms," Reuters, September 7, 2021, https://www.reuters.com/business/energy/asia-eyes-australia-blueprint-100-bln-oil-gas-clean-up-looms-2021-09-07/.

124. Sonali Paul, "Australia Slaps Tax on Oil Industry to Pay for Field Clean-up," Reuters, April 1, 2022, https://www.reuters.com/business/energy/australia-imposes-levy-oil-industry-pay-abandoned-oil-field-clean-up-2022-03-31/.

125. US Bureau of Ocean Energy Management, *Risk Management and Financial Assurance for OCS Lease and Grant Obligations*, Federal Register 89, FR 31544, April 24, 2023, https://www.federalregister.gov/d/2024-08309; US Department of the Interior, "Interior Department Takes Action to Protect Taxpayers from Offshore Oil and Gas Decommissioning Costs," April 15, 2024, https://www.doi.gov/pressreleases/interior-department-takes-action-protect-taxpayers-offshore-oil-and-gas.

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