THE HIDDEN COST OF LIQUEFIED NATURAL GAS IN QATAR

Industrial Pollution and Its Impact on the Environment and Public Health



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Abstract

This study examines the environmental and health costs of Qatar's liquefied natural gas (LNG) industry and questions how its benefits and burdens are distributed. While the industry's success is measured by production and export volumes, understanding its local costs depends on what is measured and publicly disclosed about air and coastal water pollution, together with the availability of data on workers' and residents' health. Focusing on Ras Laffan and the surrounding areas, the study investigates the extent to which these costs are incorporated into industrial expansion decisions and examines the responsibilities of the state and operating companies for preventing harm and addressing its consequences.

Chapter One analyses pollution sources throughout the LNG production chain, from extraction and processing to liquefaction, storage and shipping. It examines emissions from flaring, venting and leaks, alongside the effects of cooling water and industrial discharges on the marine environment. It also considers the cumulative impacts of neighbouring facilities and the extent to which the gas industry's contribution to the environmental burden on coastal areas can be identified.

Chapter Two examines the exposure of workers and nearby residents to industrial pollutants, considering how exposure varies with working conditions, residential location and wind direction. It reviews the available evidence on the respiratory and cardiovascular effects of the pollutants concerned and assesses whether monitoring data and health records are sufficient to estimate the industry's contribution to this health

burden. It then discusses who bears the costs of treatment, absence from work and lost income, as well as the availability of periodic medical examinations, healthcare and compensation for workers exposed to pollution.

Chapter Three examines the Qatari authorities' responsibility for regulating the industry, focusing on the independence of regulatory bodies, public access to emissions data and inspection findings, and the handling of violations and incidents. It also scrutinises the criteria for permitting new expansions and the extent to which they account for the cumulative impacts of existing projects. The study concludes with proposals for independent monitoring, public disclosure of facility-level measurements, the integration of health impact assessments into permitting decisions, and requirements that parties found responsible for harm bear the costs of remediation and compensation.

Introduction

Qatar's liquefied natural gas (LNG) industry raises fundamental questions about the value the ruling regime assigns to human life in its economic calculations. When production and export targets are precisely defined, while local health and environmental costs remain difficult to trace in published data, this disparity reveals a failure in both priorities and accountability. The revenues flowing into the treasury carry a corresponding duty to protect those who work in industrial facilities and live nearby. Treating that protection as a secondary concern reduces people to their role in sustaining production and leaves their safety dependent on decisions they lack sufficient information to scrutinise.

These hidden costs arise before a gas shipment leaves port and extend across extraction, processing, liquefaction, storage and shipping. Each stage generates emissions and discharges whose effects vary according to the substances released, their quantities, the timing of their release and the areas they reach. In Ras Laffan and its surroundings, the proximity of industrial facilities makes it essential to examine their combined burden. Confining assessments to individual project boundaries obscures cumulative pressures on air, water and coastal habitats, allowing successive expansions to proceed without their combined consequences becoming clear to the public. The Qatari authorities bear responsibility for the decisions that allow this burden to accumulate and for requiring operators to identify and reduce it.

That responsibility becomes more pressing when human exposure is considered. Behind operational indicators are workers spending hours near emission sources,

families seeking to understand what reaches their residential areas, and individuals whose ability to work and support their dependants suffers when illness occurs. Assessing these burdens requires data linking pollution to the location and duration of exposure and to health records, while distinguishing industrial contributions from other sources. Gaps in this information weaken the capacity to detect harm early and make it harder to secure protection and redress.

The concentration of information needed to assess risks in the hands of operators and public authorities, coupled with inadequate public access, reveals an imbalance between those exercising power and those affected by their decisions. Residents bear the consequences of expansion, yet their ability to examine those consequences depends on what they are permitted to know. A worker seeking to establish a connection between illness and employment may be required to produce evidence whose underlying measurements and records are controlled by more powerful parties. Inadequate public access to information thus becomes an obstacle to accountability, reinforcing the Qatari regime's responsibility to ensure access to information, independent expertise and effective remedies.

Approving further expansion therefore makes the authorities accountable for the additional burden they accept and for the adequacy of the conditions they impose to prevent harm. Holding them accountable requires scrutiny of regulatory independence, public access to monitoring and inspection findings, the competent authorities' ability to restrict operations when necessary, and the allocation of remediation and compensation costs when harm is established. Increasing production without providing evidence open

to scrutiny that residents and workers are protected demonstrates disregard for their rights to safety and information. Qatar's management of its gas resources must be judged by how effectively it safeguards people and their environment, and by the extent to which decision-makers and operators are held responsible for the consequences of their actions.

Chapter One — Sources of Industrial Pollution and Their Environmental Impacts

1. Pollution Sources Throughout the Production Chain

Tracing Qatar's liquefied natural gas (LNG) production chain **[1]**, from the North Field platforms to the Ras Laffan loading berths, reveals a flaw in how the industry presents its environmental costs. The operator describes in detail where gas is extracted and how it is processed, liquefied and shipped, while reporting emissions and discharges as aggregate figures across its operations. Readers can therefore follow the gas all the way to the carrier, yet cannot use those figures to determine what each facility releases into the air and sea. This constitutes a substantial disclosure gap, because identifying the location, timing and source of emissions is essential to holding operators and regulators accountable.

The strongest scientific support for this criticism comes from the 2023 study by Rey-Pommier and colleagues [2], published in *Atmospheric Chemistry and Physics*. The researchers explained that the latest official reporting they relied on for Qatar's sectoral distribution of nitrogen oxide emissions was published in 2011 and described emissions from 2007. To address this gap, they used *Sentinel-5P* satellite data covering 2019–2022. Their maps identified emission hotspots near gas-fired power stations in northeastern Qatar, around Ras Laffan. They also noted that emissions from different sectors overlap there at spatial scales too small for the satellite instrument to distinguish. These findings place a specific

responsibility on the Qatari authorities. Satellite observations reveal where emissions are concentrated, while determining the respective contributions of liquefaction units, power stations and other facilities requires the publication of detailed, source-specific local measurements.

The operator's own figures also demonstrate that highlighting the success of an individual project provides only a partial picture of the industry's performance. Offshore sources requiring monitoring include fuel combustion on platforms, flaring, venting and equipment leaks, alongside drilling waste and produced water. Onshore, QatarEnergy LNG's report **[3]** recorded an increase in the quantity of hydrocarbons flared within its reporting boundary, from approximately 176,000 tonnes in 2023 to 194,000 tonnes in 2024. Volatile organic compound emissions also rose from 1,303 to 1,598 tonnes over the same period. Meanwhile, the company states that recovering boil-off gas at the berths helped reduce flaring during carrier loading by more than 90%. That achievement concerns the loading stage, whereas the aggregate figures show that flaring increased across the operations covered by the report between the two years. The disclosure gap lies in the company's presentation of improvements in a particular operation alongside aggregate tables that do not identify which facilities experienced increased flaring or explain the reasons for those increases.

The same problem arises along the coast. A study **[4]** published in 2015 on chlorine and chlorination by-products in Ras Laffan's cooling water used local seawater samples and field measurements to improve modelling of residual chlorine and chlorination by-product dispersion near discharge outlets. An

engineering study **[5]** in 2016 likewise used field measurements and remote sensing data to validate a model of water dispersion near an outfall. These studies demonstrate that assessing discharges requires knowledge of what enters the sea, where it spreads and how its effects interact with those of neighbouring outlets. Publishing water-use volumes or recycling rates therefore leaves essential environmental questions unanswered, including the temperature of discharged water, the concentrations of residual substances it contains, and how these measurements vary in the waters surrounding the outfalls.

The Qatari authorities' responsibility is further underscored by the fact that Ras Laffan Industrial City's own environmental regulations require cumulative impact assessments of emissions from existing facilities and future projects, covering normal operations, start-up, shutdown and operational disturbances. Whenever an expansion is announced, the public has a right to access the assessment findings and understand both the existing burden and the additional pressure new facilities will create. Asking residents and workers to accept assurances about the safety of expansion on the basis of general indicators, while verification requires detailed monitoring and assessment results, amounts to demanding their trust in a decision without providing sufficient evidence for them to scrutinise it.

2. Air Pollution During Routine Operations and Industrial Incidents

A stable annual emissions total can conceal sharp increases in pollutant concentrations in the air surrounding a facility over just a few hours. In an industrial area such as Ras Laffan, this distinction matters when assessing the exposure of workers and nearby residents. Exposure associated with routine operations may persist over months or years, while a sudden shutdown or the restart of a unit can increase concentrations over a shorter period. Whether these elevated concentrations reach workplaces and residential areas depends on their timing and duration, as well as the prevailing wind direction.

QatarEnergy's 2023 report **[6]** documents how operational disruptions can exacerbate emissions. Sulphur dioxide emissions increased by approximately 15% compared with the previous year across the operations covered by the report. The company attributed part of this increase to intensified flaring at two stations affected by prolonged equipment failures. It also identified unplanned flaring in its offshore operations as the principal cause of increased volatile organic compound emissions that year. These figures demonstrate how equipment failures and unplanned flaring can increase the annual air pollution burden.

Comparing Qatari standards with World Health Organization guidelines reveals a substantial gap in the level of health protection. The WHO recommends an annual mean nitrogen dioxide concentration no higher than 10 micrograms per cubic metre (μg/m³) and a 24-hour mean guideline value of 25 μg/m³**,** assessed

according to the methodology set out in its guidelines **[7]**. By comparison, Qatar's Second National Communication **[8]** reported national standards of 100 μg/m³ annually and 150 μg/m³ over 24 hours. The Qatari values are therefore ten times the WHO annual guideline and six times its daily guideline. This difference allows elevated pollution levels to fall within the national standard despite exceeding the concentrations recommended by the WHO to protect health.

Measurements from Doha illustrate this gap. In its June 2026 update, the WHO database **[9]** recorded annual mean nitrogen dioxide concentrations of 29 μg/m³ in 2017, 47 in 2018, 42 in 2019, 28 in 2020 and 30 in 2021. This series is based on a single roadside monitoring station in a residential and commercial area. Over the five years, the recorded concentrations ranged from 2.8 to 4.7 times the WHO annual guideline, while remaining below the Qatari annual limit reported in the National Communication. This distinction has direct health implications. A systematic review informing the WHO guidelines found an association between higher 24-hour mean nitrogen dioxide concentrations and increased emergency department visits and hospital admissions for asthma exacerbations. The annual measurements establish the extent of exceedance at the monitoring location, while determining the number of days with elevated exposure requires daily data.

One weakness in Qatar's environmental disclosure is that the available documents on Ras Laffan identify the pollutants covered by the monitoring network but do not provide a basis for tracking daily and annual nitrogen dioxide concentrations in the ambient air of Al Khor and Al Dhakhira. Consequently, it is not possible to

determine how many days concentrations exceeded the WHO guideline or whether exposure over a full year exceeded its recommendations. This information gap prevents a reliable assessment of the health burden on residents and the contribution of LNG facilities to that burden.

The disclosure problem becomes more consequential when considering benzene, which the International Agency for Research on Cancer classifies as carcinogenic to humans**.** A field campaign **[10]** covering 15 locations in Doha, conducted between late February and the end of March 2016, recorded a mean benzene concentration of 1.5 μg/m³, while the mean combined concentration of benzene, toluene, ethylbenzene and xylenes was 15.3 μg/m³. These figures demonstrate the limitations of aggregate volatile organic compound measurements for assessing exposure to an individual carcinogen. In residential neighbourhoods surrounding Ras Laffan, the absence of a published, long-term benzene concentration series in the available sources leaves residents and researchers without the local monitoring evidence needed to estimate cancer risk associated with prolonged exposure.

2. Environmental Costs Along the Coast and at Sea

Ras Laffan illustrates the environmental burden placed on Qatar's coast by concentrating gas facilities, cooling systems, desalination plants and shipping activities within a single marine area. In 2024, QatarEnergy LNG **[11]** reported using approximately 6.46 billion cubic

metres of seawater in once-through cooling systems across the operations covered by its report. This figure demonstrates the scale of the industry's reliance on the sea to cool its equipment. The thermal burden on coastal waters depends on the volume of water returned, its temperature, the duration of discharge and the ability of currents to disperse it. Where discharges from different facilities converge near the port, outfall location and water renewal become decisive factors in determining the exposure of nearby habitats.

Researchers from the University of Ottawa in Canada and Qatar University previously conducted a field study **[12]** documenting the mixing of wastewater from a desalination plant with cooling water from other facilities before the combined discharge entered the sea within the port. The team used field measurements and remote sensing data to validate a model of warm-water dispersion. Under the modelled conditions, lateral confinement of the outfall reduced minimum dilution by approximately 50% at the end of the near-field zone. This finding highlights the risks of concentrating discharges within a confined area, where nearby habitats can be exposed simultaneously to heat from cooling water, salinity from desalination discharges and residual chlorine. The environmental concern lies in the combined thermal, saline and chemical stresses within the same marine area. Repeated exposure to these pressures can stress sensitive organisms and affect seagrass habitats that provide shelter and food for juvenile fish.

Chapter Two — The Health Costs of Industrial Pollution and the Distribution of Their Burden

1. Health Impacts and the Limits of Available Evidence

Assessing the health costs of Qatar's liquefied natural gas (LNG) industry reveals serious shortcomings in estimating the burden on workers and residents. Studies identify nitrogen oxide emission hotspots in the industrial area, while health records document hospital admissions for respiratory and circulatory diseases. Yet the published sources that could be verified do not link these two types of data in a way that allows the health burden on residents of Al Khor and Al Dhakhira to be estimated. Consequently, the effects of industrial activity on residents' health remain unquantified, despite medical evidence demonstrating the serious health consequences of exposure to the pollutants concerned.

The nature of the health risk varies by pollutant and duration of exposure. A systematic review **[13]** informing the World Health Organization's guidelines concluded that higher 24-hour mean nitrogen dioxide concentrations are associated with increased emergency department visits and hospital admissions for asthma exacerbations. For fine particulate matter ($PM_{2.5}$), the evidence supports a causal relationship between exposure and adverse cardiovascular effects over both the short and long term. The health burdens that the WHO attributes to outdoor air pollution include ischaemic heart disease, stroke and chronic obstructive pulmonary disease. Assessing impacts near industrial

facilities therefore requires consideration of both acute episodes of illness and the burden accumulating over years.

In Qatar, warning signs warranting investigation emerged years ago. A study **[14]** published by epidemiology and biostatistics researcher Bener and colleagues compared daily air pollutant measurements with admission records from Hamad General Hospital. It found an association between higher pollution levels and increased admissions for respiratory and cardiovascular diseases. The shortcomings become clearer when examining Qatar's published hospital admission data. For 2023, the *Health in the State of Qatar* report recorded 15,227 admissions for respiratory diseases and 13,724 for circulatory diseases in Hamad Medical Corporation's data. These totals indicate the scale of the burden managed by hospitals, but the report does not show where patients live or how admissions are distributed geographically. The data therefore leave a central question for residents of Al Khor and Al Dhakhira unanswered. Do asthma exacerbations or hospital admissions for heart disease increase on days when pollutant concentrations rise as air arrives from the direction of Ras Laffan?

2. The Health Bill

Illness entails financial burdens whose distribution among workers, their families and public healthcare facilities raises questions about the extent to which operators in Qatar's liquefied natural gas (LNG) sector bear responsibility when a work-related connection is

established. The operator or insurer may cover part of the treatment costs, and care may be provided at public expense, while workers may lose part of their wages during their absence. The losses extend to their families, who pay for medicines and transport and may lose additional income if a family member takes time off work to provide care. The longer treatment continues, or the more difficult a worker's return to employment becomes, the heavier this burden weighs on a household already in need of a stable income.

This exposes the limitations of the safety indicators published by operating companies in Qatar. Counts of recorded injuries and illnesses show how many cases entered company records, while leaving the distribution of their costs unaccounted for. Holding operators accountable requires disclosure of the amounts they actually paid for treatment and compensation when a work-related connection was established, the costs borne by public healthcare facilities, and the expenses and income losses that remained with workers and their families.

Data from Hamad General Hospital illustrate the potential cost of a single case. A study based on records from 2002 estimated the average cost of an asthma hospitalisation at US$1,544 per case, with an average stay of 6.4 days. This estimate applies to the asthma cases studied during that period. Estimating the present-day cost of industrial pollution requires first identifying the cases attributable to industrial exposure, then calculating their current treatment costs, lost working days, wages actually lost and household expenditure. Compensation payments must also be accounted for to establish the share borne by companies and the losses remaining with workers and their families.

This accounting is particularly important for contractors' workers. In 2024, they performed approximately 48.9 million of the 59.5 million working hours covered by QatarEnergy LNG's report, representing more than four-fifths of the total. In the same report, the company disclosed 17 cases of work-related ill health across the operations covered. However, the aggregate figure does not identify how many cases involved contractors' workers, how many were associated with pollutant exposure, or how treatment and compensation costs were distributed. These figures therefore do not allow readers to determine whether exposed workers received periodic medical examinations appropriate to their duties, continued care after diagnosis, or compensation when occupational harm was established.

Responsibility for payment depends on the legal framework governing the worker's employment. Where Qatar's Labour Law applies, Article 105 requires periodic medical examinations for workers exposed to occupational diseases. Article 109 makes the employer responsible for treatment costs in the event of a recognised occupational injury, in accordance with the decision of the competent medical authority. The worker receives full wages throughout treatment or for six months, whichever is shorter, followed by half wages if treatment continues, until recovery or the establishment of permanent disability. Article 110 provides for compensation for work-related death or disability resulting from an occupational injury, subject to its conditions. However, Article **3**, as amended in 2026, excludes certain categories of petroleum-sector workers, including employees of companies established by QatarEnergy or in which it holds an ownership interest. Assessing protection therefore requires identifying the provisions applicable to operators' employees and

contractors' workers, and tracing the examinations, treatment, wages and compensation each group actually received.

In its analysis of Qatar's 2020 data **[15]**, the International Labour Organization highlighted differences between institutions in the classification of occupational injuries and deaths, as well as the need to investigate potentially work-related cases so that compensation reaches those entitled to it. The financial consequences of this problem arise when an illness associated with occupational exposure is treated as an ordinary illness. Workers, their families or public healthcare facilities may then bear expenses that, once the occupational connection is recognised, would fall to another party under the applicable framework. The health bill associated with Qatar's gas industry remains incomplete as long as disclosures fail to show how much companies paid, how much workers lost in wages, and how much families and public healthcare facilities ultimately bore.

Chapter Three — Oversight, Transparency and Accountability for Harm Caused by the Gas Industry

1. Regulatory Independence and the Capacity to Enforce Compliance

Environmental oversight of Qatar's gas industry raises an institutional concern about the relationship between driving industrial expansion and controlling its impacts. QatarEnergy manages Ras Laffan Industrial City, which hosts gas-processing facilities and LNG expansion projects, while the city's regulations provide powers to monitor compliance and impose penalties on facilities that breach environmental requirements. This arrangement combines an interest in increasing production with responsibility for controlling some of its environmental consequences within the same industrial framework. It creates risks of conflicts of interest and makes the independence of regulatory decisions a matter requiring scrutiny. The practical value of that independence depends on the competent authority's ability to impose costly conditions, restrict operations or shut down a pollution source, even when such decisions conflict with production and export targets.

Permitting and oversight responsibilities also fall within the Ministry of Environment and Climate Change. The Environmental Assessment and Permits Department reviews permit applications, while the Environmental Monitoring and Inspection Department conducts routine and unannounced inspections, verifies the accuracy of facility records and follows up on corrective action plans in coordination with the relevant bodies. Assessing this

allocation of responsibilities requires examining how disagreements between the environmental authority and the operator are resolved, and which body has the final say when a violation persists. Holding the Qatari authorities accountable also requires them to demonstrate what the exercise of these powers has produced specifically at gas facilities, including substantiated violations, corrective action orders and enforcement measures.

The legal framework provides a specific basis for holding non-compliant facilities accountable. Article 16 of the Environmental Protection Law requires project owners to maintain a record of their activities' environmental impacts and permits verification through sampling and testing. When a violation is identified, the article provides for corrective action to be required. If the violation is not rectified within sixty days, it allows measures to halt the offending activity and claims for appropriate compensation to remedy the resulting damage. The length of time a violation continues after the facility has been notified therefore becomes an important measure of regulatory performance, alongside the action taken once the deadline expires.

Ras Laffan's published environmental regulations contain provisions that warrant scrutiny. The annex governing penalties for environmental non-compliance sets minimum penalties of QAR 250 per day for each minor violation and QAR 5,000 per day for each major violation, in addition to corrective and enforcement costs. It also provides for the possibility of shutting down all or part of the source of the violation, depending on its severity. The deterrent effect of these penalties must be assessed against the scale of the harm, the economic benefit gained by delaying compliance, and the amounts

actually imposed and collected. Continuing operations while postponing expenditure on pollution control provides a financial benefit to the operator, a possibility the regulations themselves recognise among the factors used to determine penalties.

The central gap in the sources reviewed remains the absence of a detailed record allowing enforcement cases at gas facilities to be traced from the establishment of a violation through the implementation of penalties and verification that its causes have been addressed. This gap limits the ability to assess the rigour and independence of oversight in practice. The Qatari authorities bear responsibility for providing evidence open to scrutiny of how they exercise their powers, including the date and duration of each violation, the body that established it, the penalty imposed and collected, and the findings of follow-up inspections. As long as these facts remain unavailable for verification, the effectiveness of oversight remains a claim that is difficult to test, while workers and residents remain unable to establish how the authorities respond to violations affecting their health and environment.

2. Denying Residents Access to Information on Risks

Residents' right to know about the risks surrounding them depends on clear and timely access to environmental information. In areas affected by industrial activity in Qatar, residents and workers need information explaining local air and water quality, the significance of recorded measurements, and the

circumstances requiring precautions. Reliance on general indicators or technical reports that are difficult to understand limits their ability to use this information to protect themselves and pursue pollution-related complaints. The authorities and operators are responsible for explaining published findings in accessible language and disclosing monitoring interruptions, coverage limitations and the reasons for missing data. Incomplete or delayed information leaves residents with a misleading picture of their surroundings, particularly when results are presented without explaining what they cover and what they fail to capture. Information should also be available in formats and languages that reflect the diversity of the workforce, with historical records readily accessible so that changes can be tracked and events verified.

Timely notification is particularly important during industrial incidents. The discharge and spill notification form annexed to Ras Laffan's environmental regulations includes the incident's start and end times, the substance involved and its quantity, wind direction and speed, preliminary analytical results, and measures taken to limit the impact. Notifications are directed to the competent authorities. Holding those authorities accountable requires examining how essential information reaches residents at risk, how long this takes, and whether the instructions provided are clear. Delayed warnings deprive residents of the opportunity to reduce exposure during the hours when that information is most urgently needed.

The right to information extends to understanding what happened after an incident, including investigation findings, corrections to initial information and measures taken to prevent recurrence. Residents should be able to

report unusual odours or suspected discharges and receive a reference number and a reasoned response explaining how their report was handled. Without a clear complaints procedure, their observations become reports whose outcomes are difficult to trace, weakening their ability to verify whether the relevant bodies have responded.

The seriousness of inadequate access to information lies in the resulting imbalance in the ability to establish harm. Operators and public authorities hold operational records, incident reports and monitoring data, while affected individuals have only their accounts of what they observed or experienced. Lack of access to these records makes it harder to examine complaints and obtain independent expertise to assess their connection to industrial activity. The Qatari authorities therefore bear responsibility for preserving relevant information and making it readily accessible, enabling residents and workers to document and pursue their claims on a verifiable basis.

1. Accountability for Expansion Before Approval

Authorising the expansion of the liquefied natural gas (LNG) industry makes the Qatari authorities responsible for the additional environmental and health burdens they permit within an existing industrial area. Each new unit enters an environment already affected by overlapping facility emissions, discharges and associated transport and shipping activities. Expansion decisions should therefore rest on an assessment of the existing

burden, the expected increase, and the populations and areas that will bear it. Granting approval without making that assessment and its supporting evidence publicly available prevents the public from scrutinising the basis for allowing further pressure on their environment and health. This responsibility is directly grounded in the environmental regulations, which require modelling of the cumulative impacts of project emissions alongside existing sources, with permitted and future sources incorporated into specified scenarios under the city's master plan. The requirements also cover emissions during start-up, shutdown and operational failures, as well as additional flaring during abnormal conditions. Authorities and operators must therefore demonstrate how these requirements have been applied to each expansion, which assumptions were used, and what findings justified accepting the additional burden.

Scrutiny of permitting decisions also requires verifying that assessments cover residential areas, workers' accommodation and workplaces beyond the project boundary. A narrowly defined study area, or operational assumptions that fail to account for potential disruptions, understates the estimated burden on paper. Modelling boundaries and underlying data should therefore undergo independent review, with gaps and uncertainties explained and their implications for the decision made explicit. The permitting authority bears responsibility for requiring further evidence whenever the available information is insufficient to assess the consequences of expansion.

Health impact assessment should also be an explicit permitting requirement, linking anticipated changes in air and water quality to exposure patterns among residents and workers. This should include identifying

the most exposed groups, exposure durations, the potential for short-term peaks, and the combined effects of relevant pollutants. The decision must explain how the assessment findings influenced the project's scale, design and operating conditions, and identify the circumstances requiring production reductions or the suspension of particular units. An assessment that produces no enforceable conditions leaves health protection dependent on the operator's assurances.

Accountability for expansion also requires addressing how its consequences will be financed from the outset. Permit conditions should specify the costs the operator must bear for establishing and operating monitoring systems, independently verifying their results, funding incident response and pollution remediation, and providing compensation when its responsibility for harm is established. Monitoring independence can be safeguarded by placing the selection of monitoring providers, their methodology and the publication of findings under a body independent of the company, while requiring the operator to provide funding through clear, auditable arrangements. Financial guarantees proportionate to the assessed risks should also be considered, ensuring that resources for remediation and redress are available when needed and that responsibility is allocated when several facilities contribute to the harm.

The specific demands are therefore to make every new permit conditional on an updated, publicly accessible cumulative impact assessment, incorporate an independent health impact assessment into the grounds for approval, and require facilities to publish monitoring results by source, location and time. These measures should be accompanied by independent verification of

measurements, publicly defined conditions for modifying or suspending operations, and financial guarantees for remediation and compensation. The Qatari authorities remain responsible for explaining their acceptance of any additional burden and demonstrating that permit conditions protect affected people and enable them to pursue their rights.

Recommendations

1. **Ensure independent environmental oversight.** Separate inspection and enforcement decisions from the interests of operators and bodies promoting expansion. Empower the regulator to impose penalties and suspend polluting activities, and publish inspection findings, corrective actions and their implementation status.
2. **Require detailed facility-level disclosure.** Publish emissions and discharge data by facility, pollutant, monitoring location and time. Make environmental impact assessments and their annexes publicly accessible, and establish early warning systems for residents and workers when incidents require health precautions.
3. **Subject expansions to independent cumulative impact assessments.** Make approval of new projects conditional on a published assessment of the combined environmental and health burdens of existing and planned facilities. Defer approval when evidence is insufficient to assess risks or proposed mitigation measures are inadequate.
4. **Establish an independent occupational and public health monitoring programme.** Link exposure measurements with health data while protecting privacy. Provide risk-appropriate periodic medical examinations for workers, including contractors' personnel, and monitor surrounding residential areas to assess health burdens and their sources.
5. **Require verifiable reductions in air and marine pollution.** Require operators to implement time-bound plans to reduce leaks, venting, flaring,

and thermal and chemical discharges. Independently verify implementation and tighten operating conditions when violations recur.

6. **Make responsible parties bear the costs of harm and ensure redress.** Require operators to fund monitoring and remediation and provide financial guarantees proportionate to the risks. Facilitate complaints and access to independent expertise, and ensure treatment and compensation for substantiated harm and losses without making workers and families bear the costs of pursuing their rights.

Conclusion

The costs of the liquefied natural gas (LNG) industry are measured by its effects on people and their environment, and by the burdens that may fall on families, healthcare facilities and future generations. Workers' health, the safety of the air residents breathe, and the sea's capacity to sustain life are rights that should govern production and expansion decisions. Any economic calculation that overlooks these dimensions presents an incomplete picture of returns and leaves part of the industry's costs outside the accounts of those who benefit from it. The authorities bear direct responsibility for the conditions under which resources are exploited and facilities expanded. A permit determines the additional environmental pressure deemed acceptable, the protections required for workers and residents, and the obligations imposed on operators. This responsibility requires subjecting production objectives to independent environmental and health scrutiny, making the grounds for decisions publicly accessible, and accepting their amendment or suspension when protecting people requires it.

Information gaps reveal an imbalance that undermines affected people's ability to defend their rights. When the data needed to assess exposure and trace incidents remain beyond public reach, residents struggle to document their concerns, researchers to estimate burdens, and those harmed to substantiate their claims. This imbalance becomes more acute when individuals must prove the harm they have suffered while companies and public authorities hold most of the tools and records needed to investigate it. Access to information is therefore a prerequisite for accountability and redress,

and a responsibility that begins before harm occurs and continues afterwards.

Justice also requires identifying who bears the actual costs of pollution, illness and loss of earning capacity. Making workers and their families pay for substantiated harm, or leaving public facilities to address it without holding the responsible party to account, transfers the costs of industrial activity to society. Accountability must extend to the implementation of preventive measures, timely responses, funding for remediation and guaranteed compensation, while ensuring that affected people can access independent expertise and effective remedies.

Protecting health and the environment remains a test of how wealth and power are managed in Qatar. Responsibility is measured by what regulators can enforce, what the public can verify, and the protection and redress available to those harmed. The Qatari authorities and operators must provide accessible evidence, open to scrutiny, that they fulfil these obligations and bear the consequences of failing to do so. Wealth extracted from beneath the ground carries a duty to safeguard the lives of those working above it, the rights of those living near industrial facilities, and the environment that future generations will inherit.

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THE HIDDEN COST OF LIQUEFIED NATURAL GAS IN QATAR

Industrial Pollution and Its Impact on the Environment and Public Health

This book examines the environmental and health costs of Qatar's liquefied natural gas (LNG) industry and questions how its benefits and burdens are distributed. While the industry's success is often measured by production and export volumes, the study investigates what is publicly known—and what remains undisclosed—about air and coastal water pollution, the health of workers and nearby residents, and the long-term impact on Qatar's environment.

Focusing on Ras Laffan and surrounding areas, it traces pollution throughout the LNG production chain, from extraction and processing to liquefaction, storage and shipping. It analyses exposure to industrial pollutants, the associated respiratory and cardiovascular risks, and the adequacy of health monitoring, compensation and care for affected workers and communities.

The book also scrutinises the regulatory framework, the independence of oversight bodies, access to emissions data, and how the cumulative impact of multiple projects is addressed in permitting decisions. It concludes with practical recommendations for independent monitoring, full disclosure of facility-level data, and stronger accountability to ensure that economic gains do not continue to come at the expense of people's health and Qatar's natural environment.

KEY ISSUES EXPLORED

SOURCES OF POLLUTION
Emissions, flaring, venting and industrial discharges across the LNG production chain.

HEALTH IMPACTS
Exposure risks for workers and nearby residents, and the adequacy of healthcare and compensation.

REGULATION AND OVERSIGHT
The effectiveness and independence of regulatory bodies, data transparency and enforcement.

THE ENVIRONMENTAL BURDEN
Cumulative impacts on air quality, coastal waters and marine life, with a focus on Ras Laffan and surrounding areas.



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