

1 Water

Water quality

Groundwater

- There may be a risk of groundwater contamination as a result of:
 - induced connectivity between hydraulically fractured shale formations and overlying or underlying aquifers;
 - surface spills of chemicals, flowback water or produced water into near-surface groundwater;
 - leaky wells as a result of poor design, construction, operation or abandonment practices or as a result of well degradation over the life of the well;
 - reinjection of flowback water, produced water or treatment brines into a groundwater aquifer;
 - induced connectivity between different groundwater systems as a result of seismic activity caused by hydraulic fracturing or reinjection of water; and/or
 - changed groundwater pressure regimes from hydraulic fracturing activities.

Surface water

- There may be a risk of impacts on surface water quality as a result of the following types of incidents:
 - on-site spills, including as a result of extreme weather events such as cyclones and floods;
 - spills that occur during transportation of chemicals to or from the site during the development and production phases;
 - spills of flowback water, produced water or brines produced by water treatment; and/or
 - inputs of sediment from erosion of road and pipeline corridors.

Water supply and distribution (quantity)

- There may be a risk of adverse environmental impacts as a result of reduced water supply due to the large amounts of water being extracted for use in hydraulic fracturing.
- There may be a risk of changes to the timing and/or quantity of surface water flows because of the discharge of produced water, which may be significant particularly in arid to semi-arid landscapes.
- There may be a risk to surface water and groundwater flow processes as the result of possible seismic activity caused by hydraulic fracturing or reinjection of water.
- There may be a risk of surface disturbance affecting surface flow paths and altering infiltration.

Aquatic ecosystems and biodiversity

- There may be a risk of adverse impacts on aquatic ecosystems and biodiversity, including groundwater dependent ecosystems. This may result from changes in the quality and/or quantity of surface and/or groundwater available to them.

Amenity values

- There may be adverse impacts on general amenity values such as in national parks, rangelands and recreational fishing areas. This may result from changes in the quality and/or quantity of water available.

Public health

- There may be adverse impacts on human and livestock health due to changes to water quality, supply and distribution as a result of hydraulic fracturing and the associated activities.

Aboriginal people and their culture

- Natural water bodies are central to traditional land use and many sites of significance to Aboriginal people relate to water. A reduction in either water quantity or quality may impair the traditional use and/or value of the sites.

Economic

- Changes to water quality, supply and distribution may have an adverse impact on industries that may coexist with the onshore unconventional gas industry, such as agriculture, pastoralism, fishing and tourism.

Cumulative risks

- There may be cumulative risks associated with some or all of the risks identified above.

2 Land

Terrestrial ecosystems and biodiversity

- There may be a risk that hydraulic fracturing and the associated activities will have an adverse impact on terrestrial ecosystems and biodiversity in the Northern Territory. Specifically, there may be a risk of:
 - biodiversity loss on a local and regional scale as a result of areas being cleared for roads, pipelines and drill pads or as a result of spills;
 - biodiversity loss and reduced ecosystem function due to habitat loss and fragmentation;
 - adverse impacts on terrestrial ecosystems, including fauna and flora, as a result of changes to water quality and availability;
 - biodiversity loss and ecosystem function due to the spread of weeds;
 - impacts on biodiversity and greenhouse gas emissions due to changed fire regimes;
 - adverse impacts on fauna as a result of increased noise and light from gas operations;
 - loss of biodiversity due to inadequate knowledge of biodiversity assets leading to inappropriate planning of regional development;
 - disruption of surface water flows at the landscape scale by road and pipeline infrastructure;
 - loss of locally important or sensitive sites due to inappropriate location of infrastructure within a development area; and/or
 - increased human activity, roads and pipelines acting as barriers and corridors for faunal movement and the drinking of wastewater.

Soil health

- There may be a risk that the chemicals used in the drilling and hydraulic fracturing process will have an adverse impact on soil health, including as a result of spills of flowback water.
- There may be a risk that there will be compaction of soils underneath production pads or along pipelines.

Aboriginal people and their culture

- The landscape, terrestrial ecosystems, plants and animals are central to traditional cultural values. Adverse impacts to these things may have an adverse impact on Aboriginal cultural values.

Seismic activity

- There may be a risk of seismic activity caused either by the hydraulic fracturing process or the reinjection of wastewater into the ground.

Subsidence

- There may be a risk that the drilling and hydraulic fracturing process causes land subsidence.

Economic

- An adverse impact on terrestrial ecosystems may be a risk to industries that co-exist with the onshore unconventional gas industry, such as agriculture, pastoralism, fishing and tourism.

Amenity values

- The Panel recognises that the Northern Territory has iconic wilderness values as a core part of the Australian outback. There may be a risk that the development of the unconventional gas industry will have an adverse impact on the outback experience (for example, tourism) through infrastructure development (for example, the construction of pipelines and processing plants) and increased traffic, noise and light (from flaring).
- There may be a risk of solastalgia.

Cumulative risks

- There may be cumulative risks associated with some or all of the risks identified above.

3 Air

Public health

- The possible health risks associated with the release of gases from the hydraulic fracturing process are discussed below in '1.4 Public health'.

Climate change

- There may be a risk that greenhouse gases, including hydrocarbons (methane and ethane) and carbon dioxide, will be released during hydraulic fracturing and the associated activities. Emissions may be from sources such as wellheads, pipelines, compression stations and final use. The potential contribution of hydraulic fracturing and the associated activities to the burden of greenhouse gas emissions will be assessed by the Panel.

Amenity values

- There may be a risk that there will be adverse impacts on amenity values, such as in national parks and rangelands, due to gaseous emissions and flaring.

Air contamination

- There may be a risk that soil contaminated by spills of fracking fluids or wastewater becomes airborne as dust, causing harm to the environment and to human health.

Cumulative risks

- There may be cumulative risks associated with some or all of the risks identified above.

4 Public health

Drilling and fracking chemicals

- There may be a risk that chemicals used during the drilling and hydraulic fracturing process are harmful to humans and livestock. Further, there may be a risk that those chemicals come into contact with humans or livestock via groundwater or atmospheric pathways. While the concentrations of potentially harmful chemicals in the water are low, the actual amount of chemicals can be significant and may pose a threat to the water supply if not properly managed.

Hydrocarbons and BTEX

- There may be a risk that hydrocarbons associated with the extracted gas come into contact with humans or livestock via groundwater or atmospheric pathways. This may include

aromatic hydrocarbons such as BTEX, which have featured prominently in some risk assessments relating to flowback water from petroleum and unconventional gas extraction activities in the US. The addition of BTEX in drilling and fracking fluids is prohibited in the Northern Territory.

Radioactive substances

- There may be a risk that naturally occurring radioactive materials from underground come into contact with humans or livestock as a result of the drilling or hydraulic fracturing process.

Mental health and wellbeing

- There may be a risk that the mental health and wellbeing of persons could be affected by an unconventional gas project. These factors could include increased costs of living associated with changing property values, access to social services, business failures, increased traffic, effects on the natural environment and concerns about the amenity of the local area, including solastalgia.

Diesel fumes

- There may be a risk of emissions from plant and equipment, such as diesel fumes from drilling equipment and pumps, and from off-site increases in road traffic.

Physical safety

- There may be a risk that physical safety may be compromised by factors associated with hydraulic fracturing, including road transport accidents.

Aboriginal health

- There may be a risk that as a consequence of the possible impacts described above, the physical and mental health of Aboriginal persons and communities, as a group that is especially vulnerable and disadvantaged, is particularly affected (that is, the 'gap' is increased and not decreased).

Cumulative risks

- There may be cumulative risks associated with some or all of the risks identified above.

5 Aboriginal people and their culture

Land ownership

- There may be a risk that hydraulic fracturing or the associated activities will disrupt traditional practices that connect Aboriginal landowning groups with their country and underpin recognition of their ownership of that land.
- There may be a risk that there is inadequate or inappropriate consultation with Aboriginal landholders in obtaining access to their lands and/or permission to carrying out any onshore unconventional shale gas development.

Benefits

- There may be a risk that the development of the industry will occur without short and long term benefits flowing to local Aboriginal communities.

Culture, values and traditions

- There may be a risk that the above and/or below ground disturbance associated with drilling and hydraulic fracturing of onshore shale gas formations will have an adverse impact on Aboriginal culture, values and the traditions that connect landowning groups with their country and sustain community cohesion.
- There may be a risk that access to and the use of traditional lands will be denied or restricted by the presence of any onshore unconventional shale gas development.
- There may be a risk that sacred sites and cultural landscapes are degraded and damaged both above and below the ground.

Community wellbeing

- The development of the onshore unconventional shale gas industry may have an adverse impact on the wellbeing of Aboriginal communities.
- There may be a risk of solastalgia caused by any onshore unconventional shale gas development.
- There may be a risk that any onshore unconventional shale gas industry causes community division in respect of those who may benefit from any industry and those who will not.

Aquatic and terrestrial ecosystems

- The development of the unconventional gas industry may have an adverse impact on aquatic and terrestrial ecosystems important to Aboriginal culture.

Aboriginal health

- There is a risk of an exacerbated adverse impact on Aboriginal health, taking into account the particular vulnerabilities and disadvantage of that population.

Cumulative risks

- There may be cumulative risks associated with some or all of the risks identified above.

6 Social impacts

Housing and rents

- There may be impacts on local housing, which may decrease or increase rents and house prices as a result of an increased population.

Insurance

- There may be a risk that there will be an increase in insurance costs and liabilities of landowners, occupiers, and traditional owners.

Health services

- There may be impacts on the local health system (hospitals, health services and so on) as a result of an increased population, including that there may be increased health services in remote communities as a result of industry's presence.

Education

- There may be an impact on the local education system as a result of an increased population.

Infrastructure

- There may be an impact on infrastructure, such as roads, as a result of increased traffic.

Livelihoods

- There may be an impact on livelihoods.

Long term benefits

- There may be a risk that the development of the industry will occur without short and long term benefits flowing to the local community.

Community cohesion

- There may be an adverse impact on community cohesion and resilience. That is, there may be a risk of social division being created between those who benefit from the development of any onshore unconventional shale gas industry and those who do not.

Crime

- There may be an increase in crime.

Employment

- They may be an impact on local employment and skill levels.
- There may be negative impact caused by an influx of FIFO employees.

Business

- There may be an impact on local business opportunities.

Amenity

- There may be a risk that the amenity of people will be adversely impacted by hydraulic fracturing and its associated activities.

Social licence to operate

- There may be a risk that no social licence to operate an onshore unconventional shale gas industry exists.

Cumulative risks

- There may be cumulative risks associated with some or all of the risks identified above.

7 Economic impacts

Distribution

- There may be a risk that any economic benefits will not be shared by the regions that are directly affected by the industry and/or will not be shared equitably between the gas companies, the government, and the community.

Property values

- There may be a risk that there will be a decrease or increase in existing property values.

Other industries

- There may be a risk that there will be an adverse impact on other businesses, such as tourism, fishing, agricultural and pastoral businesses.

Energy security

- There may be an impact on the energy security of the Territory.

Employment

- There may be an impact on employment in the Territory.

Net impacts

- There may be a risk that any economic benefits will not outweigh economic detriments.
- There may be an opportunity cost of investing in an onshore unconventional shale gas industry rather than in renewable energy.
- There may be a risk of residents leaving a particular region because of the presence of an onshore unconventional shale gas industry.

Management

- There may be a risk that, if not properly managed, any economic benefits will result in 'boom and bust' economic activity.

Cumulative risks

- There may be cumulative risks associated with some or all of the risks identified above.

8 Land access

Consultation

- There may be a risk that gas companies do not consult adequately with land owners, occupiers, or traditional owners, in gaining access to the land for exploration and extraction purposes.

Consent

- There may be a risk that gas companies enter the land without obtaining the consent of the landowner, occupier, or traditional owners, causing conflict.

Conditions

- There may be a risk that gas companies and landowners, occupiers, and traditional owners, do not negotiate mutually beneficial conditions associated with any agreement permitting access.

Compensation

- There may be a risk that compensation paid for access and/or disturbance to land will not be adequate.
- There may be a risk that if there is an incident in the exploration, extraction or production of any gas, the land may not be properly remediated or the land owners, occupiers, or traditional owners may not be adequately compensated.

Cumulative risks

- There may be cumulative risks associated with some or all of the risks identified above.

9 Regulatory framework

Failure to protect the environment

- There may be a risk that the regulatory framework does not adequately protect the environment (water, land, and air) from risks associated with hydraulic fracturing and its associated activities.
- There may be a risk that the regulatory framework does not ensure adequate, or any, remediation and/or rehabilitation of any environmental damage caused by hydraulic fracturing and its associated activities.
- There may be a risk that the cost of any remediation and/or rehabilitation of environmental damage caused by hydraulic fracturing and its associated activities is not passed on, either in whole or in part, to the entity that caused the harm, but is passed on to the public.

Land access

- There may be a risk the regulatory framework does not appropriately balance the rights of landowners, occupiers, and traditional owners, with those of gas companies.

Public health

- There may be a risk the regulatory framework does not adequately mitigate public health risks associated with the onshore unconventional shale gas industry.

Aboriginal culture and communities

- There may be a risk the regulatory framework does not adequately protect Aboriginal culture, values, traditions and communities from risks associated with the unconventional shale gas industry.

Social impacts

- There may be a risk the regulatory framework does not adequately mitigate the social risks associated with the onshore unconventional shale gas industry.

Economic impacts

- There may be a risk the regulatory framework does not ensure that any economic benefits are appropriately distributed between the gas companies, the Government and the local community.

Compliance and enforcement

- There may be a risk of inadequate monitoring or enforcement of compliance with the regulatory framework. This may arise from, for example, inadequate resourcing of the regulatory agency, inadequate expertise, or inadequate training.
- There may be a risk that sanctions provided for in the regulatory framework are inadequate or are not utilised by the regulator.
- There may be a risk that the cost of complying with the regulatory framework is too high for industry and the industry becomes uneconomic.

Access to justice

- There may be a risk that access to justice by the public is denied or restricted by the regulatory framework.

Complexity

- There may be a risk that the regulatory framework developed is too complex.
- There may be a risk that given its complexity, any regulatory framework that is developed is rushed and inadequate.
- There may be a risk that there is inadequate information about the long term risks associated with hydraulic fracturing and its associated activities to develop a suitably robust regulatory framework.

Regulatory capture

- There may be a risk of 'regulatory capture', whereby the regulatory body becomes inappropriately aligned with industry and becomes reluctant to regulate against the interest of any onshore unconventional shale gas industry.
- There may be a risk of the perception of regulatory capture which may have a tendency to undermine confidence in both the regulatory body and the Government.

Political risks

- There may be a risk that the Government is perceived to be subject to undue influence by the gas industry thereby leading to a loss of public confidence in the Government and the democratic process.
- There may be a risk that, given the short term nature of the political cycle, the long term consequences of any onshore unconventional shale gas industry cannot be appropriately regulated.

Cumulative risks

- There may be cumulative risks associated with some or all of the risks identified above.