



GAS TERMINAL PROJECT

The facts about LNG safety

VIVA
EnergyAustralia

Commitment to Safety

Viva Energy is committed to the safety of the local community, and we will not proceed with the gas terminal unless we are confident that it will be safe.

LNG receiving terminals and LNG shipping have a very safe history of operations around the world.

We recognise that there are questions in the local community given this is a new and unfamiliar operation. We would like to reassure our neighbours that safety is at the core of our planning and design process, and comprehensive safety, hazard and risk assessments are being undertaken to reduce and mitigate any risk from the proposed gas terminal operation.

We are working with State and Federal regulators and agencies to make sure all appropriate safeguards are in place, and that we meet all regulatory and licencing requirements, including for WorkSafe, Energy Safe Victoria and Ports Victoria.



Artist's impression of the FSRU and LNG ship at berth,
as viewed from Geelong Grammar School.

FACT

Converting natural gas to LNG is one of the safest ways to transport energy.

- LNG is stored and transported inside steel double-walled or 'double-hull' containers to keep it cold and to reduce the risk of a leak.
- While LNG is classified as a hazardous material, it is transported and stored as a cold liquid, it is not stored under pressure, and as such it is not flammable or explosive in its liquid form.
- In the unlikely event of a leak, LNG would warm, turn back into natural gas, rise and dissipate without leaving any residue on land or water.
- Even in the event of a major leak, the LNG will turn into natural gas, forming a cold gas vapour cloud before dissipating.



LNG safety

- LNG has safety advantages over other commonly used fuels like propane or petrol because of the physical and chemical properties of natural gas.
- Natural gas has a much higher ignition temperature than gasoline – about 648°C (1,200°F) compared to 315°C (600°F) for petrol – making it more difficult to ignite.
- When natural gas mixes with air, it can become too diluted to burn. If the volume of natural gas in the air is below about five per cent or above about 15 per cent, it will not burn. This is a narrow range of flammability.



FACT

Corio Bay, adjacent to the Geelong Refinery, is a safe and suitable location for a liquefied natural gas import facility.

- Viva Energy's Geelong Refinery has been operating safely since 1954 in an industrial area and Port, and plays an important role in ensuring Victorians have the fuels they need.
- There is a minimum distance of 1.3km from the terminal to residential areas and environmentally sensitive wetlands.
- Refinery Pier is already being safely used to handle 240+ hydrocarbon ships each year.
- No changes are required to the existing deep-sea shipping channel. Only localised dredging will be needed to facilitate safe berthing for around 40 LNG ships a year.
- Ports Victoria has established rules and procedures for the safe navigation of all ships in Corio Bay.
- Large tankers carrying liquefied gas have safely operated in Victorian ports for over 50 years, including in Geelong from 1970–2016.



FACT

The proposed floating storage and regasification unit (FSRU) is a relatively simple operation, which will not have a major environmental or operating footprint.

- The FSRU is basically an LNG ship, with extra facilities on board to re-gasify the LNG and deliver it into the Victorian gas pipeline system.
- LNG is transferred from the ship to the FSRU and stored as a very cold liquid. It is not stored on board the FSRU as a gas.
- LNG is warmed up and re-gasified by circulating seawater through pipes.
- The import operation is far simpler than major gas export hubs elsewhere, such as Gladstone and Darwin. There will be no major onshore LNG production or processing plants or gas storage tanks.
- Modelling shows that the local marine environment won't be adversely affected by the addition of the new terminal.

[View Safety Study Summary](#)



FACT

Viva Energy's LNG terminal will be built to meet or exceed government and industry codes and standards. This will ensure the safety of the public and our employees throughout the life of the facility.

- The LNG terminal operation is subject to federal, state and local standards, codes and safety regulations to ensure its safe design and operation.
- As a designated Major Hazard Facility (MHF) we must apply to WorkSafe Victoria for a license to operate, including submitting a Safety Case showing that the facility will be operated safely. This identifies the hazards and risks, describes how the risks are controlled, and the safety management system in place.
- As part of the approvals process a comprehensive hazard and risk analysis will be completed.

[View Safety Fact Sheet](#)

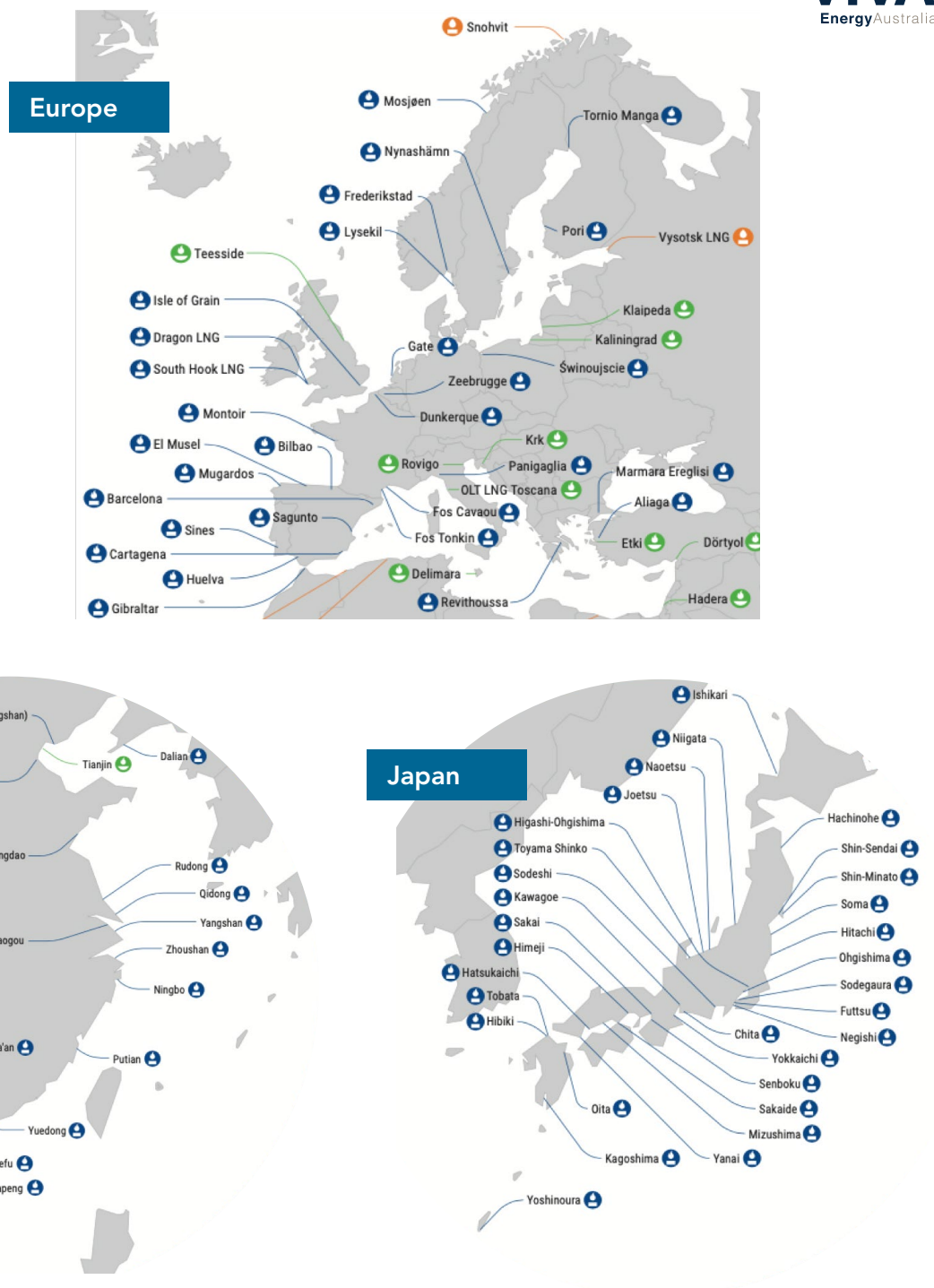


FACT

More than 30 floating storage terminals operate safely around the world, including in close proximity to cities and residential areas.

- Gas receiving terminals have operated for decades near populated areas without a serious accident affecting the public, including:
 - Everett, Massachusetts (1971);
 - Barcelona, Spain (1969);
 - Fezzano, Italy (1969); and
 - Pyongtaek, Korea (1986).
- In the US, the Yankee Gas peak shaving facility in Waterbury, Connecticut, operating since 2008, is located about 150m from a residential area. Golden Pass LNG terminal in Texas, where houses are located around 200m from the facility and 100m from the shipping channel.
- Of the 28 existing LNG terminals in Japan, a seismically active country, most are near major cities such as Tokyo and Osaka.
- Authorities around the world have, time after time, satisfied themselves that LNG terminals represent a safe and acceptable urban activity.

Regasification terminals across Europe, China and Japan



FACT

The safety, hazard and risk assessments carried out to date show that the gas terminal including LNG shipping operations, can be operated safely.

A range of studies, analysis and assessments are being completed by safety and risk experts as part of the project planning and design.

This work is an important part of our application for a licence to operate, and will be ongoing through the design and planning phase of the Project, in conjunction with regulators and agencies like Ports Victoria, Worksafe and ESV.

The studies and reviews are looking at all viable events that could lead to a major incident, and how we can reduce and mitigate risk through terminal design and plans for operations.

Results of assessments so far indicate very low incremental risk to the community from the addition of the terminal operations.

[View Study Summary](#)



FACT

Modelling of safety risk found that even in a major accident at the floating gas terminal, the 'worst case' safety risk is localised to the area around the pier and the terminal operation.

Quantitative Risk Assessment (QRA) is a tool to measure and categorise risk. It provides a consistent method across different industries to support planning and guide regulatory controls. It is often used for Major Hazard Facilities like a refinery – allowing us to assess the cumulative effects of different events.

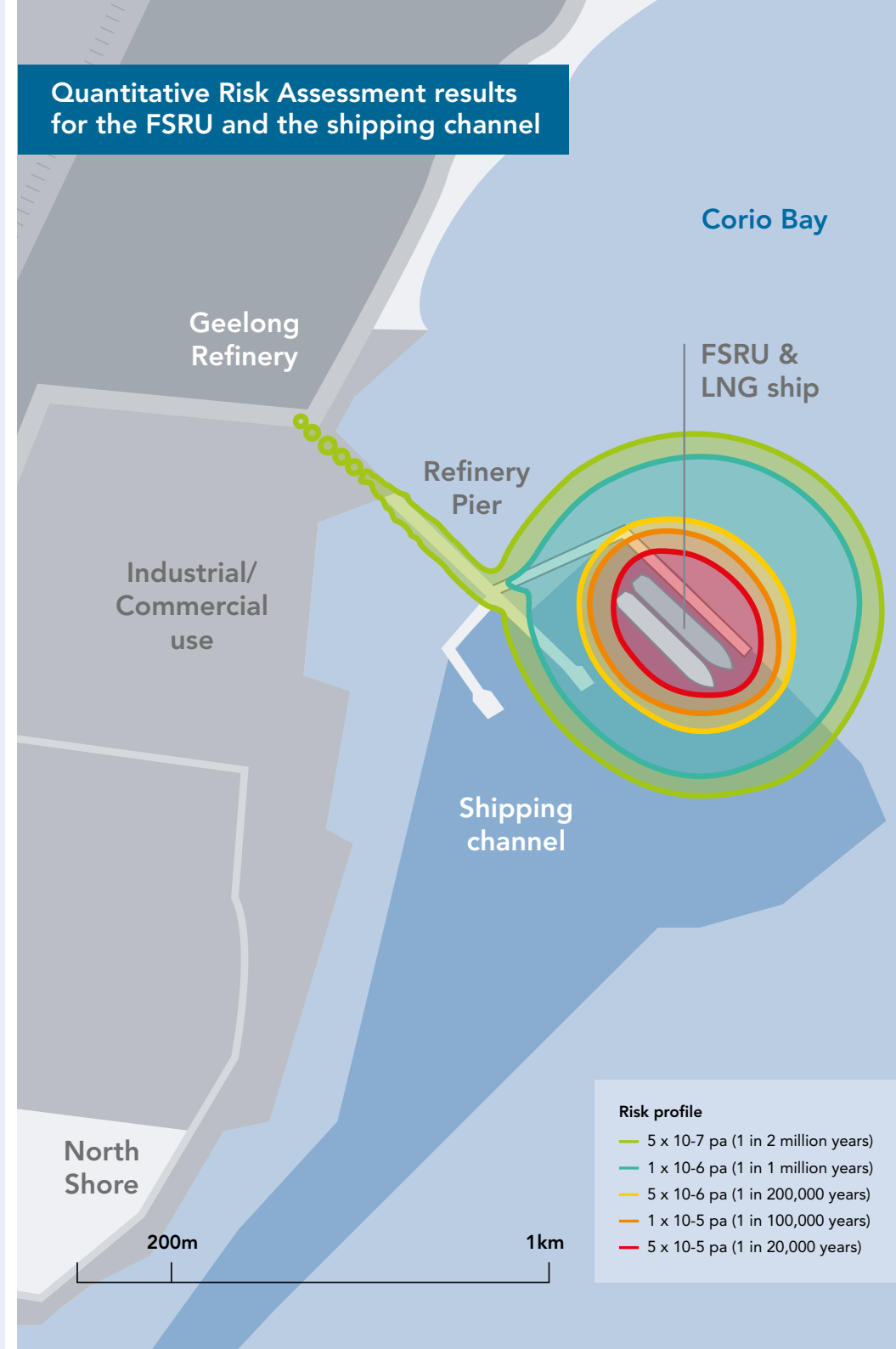
QRA considers all credible scenarios from different sized incidents, including looking at the 'worst case scenario'. It is used to estimate the likelihood of, and consequences from, hazardous events. Results are expressed quantitatively (as a number) as risk to people and/or property.

The QRA for the FSRU and the shipping channel is shown adjacent. This shows the area where people would be at risk in the unlikely event of a major accident at the floating gas terminal. The modelling shows that safety risk is localised to the area around the pier and the terminal operation.

The modelling of the shipping channel showed no measurable impacts (less than 1 in 2 million chance of a safety risk to people).

Under Government sensitive land use guidelines, a 'sensitive use' on the foreshore (i.e. outside the green line) would not be precluded solely by the FSRU operation.

Quantitative Risk Assessment results for the FSRU and the shipping channel



FACT

The floating gas terminal (FSRU) is designed for safe operation – and studies show that even in the unlikely event of a major accident, there would be no risk to the safety of local residents.

An incident on the FSRU is very unlikely. But as part of our risk assessment, we modelled a scenario where we have an LNG ship at berth, full of LNG, discharging, and the FSRU in operation.

The Quantitative Risk Assessment (QRA) looked at a range of risks including collision from another vessel, operational malfunction, fire, explosion, accidental release and quantified the risks in two ways – how likely is it to happen, and what would be the consequences?

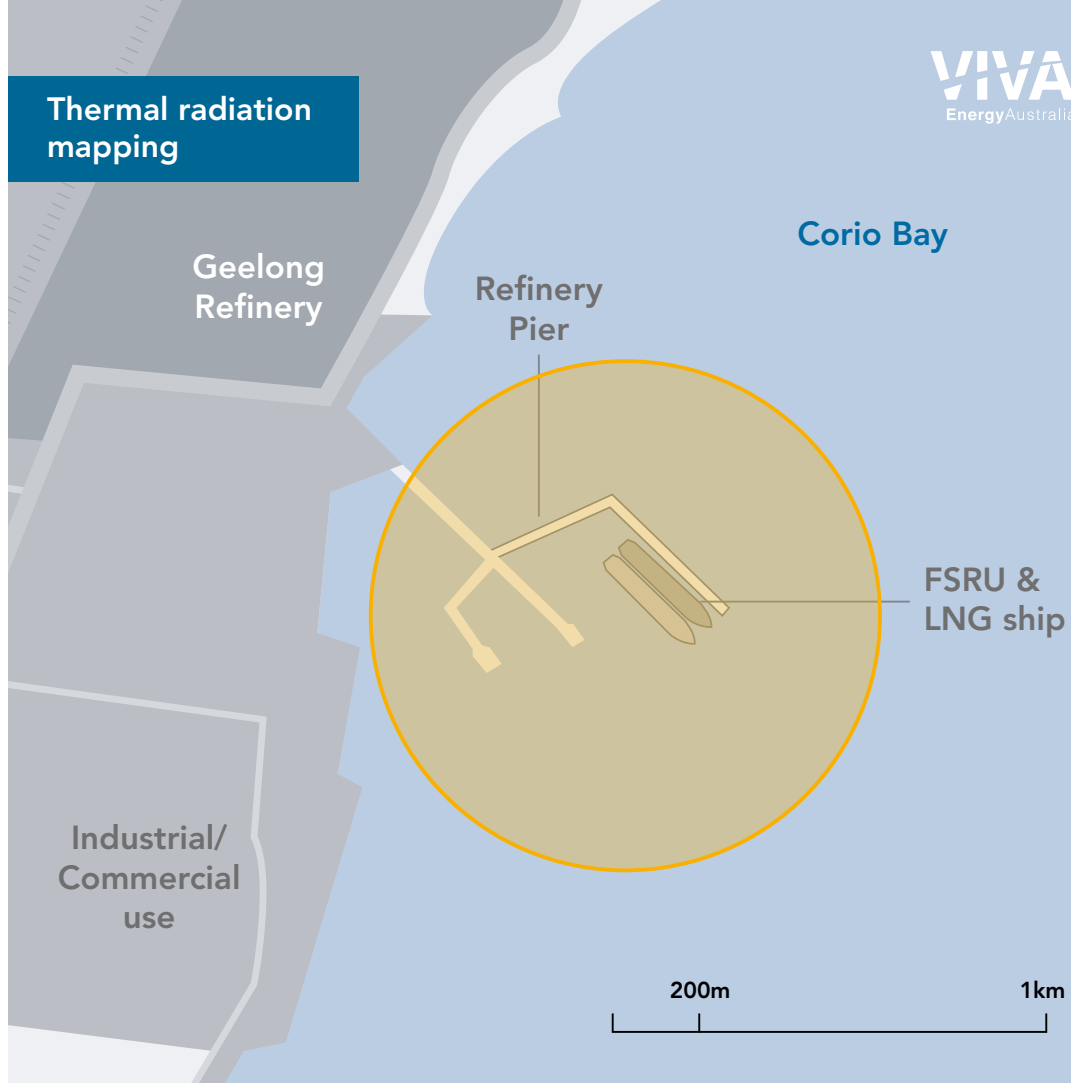
Results showed that land-based activities are at negligible risk of being impacted, and there are no measurable impacts to residential areas (note there are no residents living any closer than 1.3 km).

Thermal radiation modelling was used to assess the potential impact of a fire (pool fire on the water) resulting from a major spill to water.

There could not be an explosion in this scenario as there is no confinement that leads to overpressure.

Fire-fighting equipment will be installed on board the FSRU, LNG ships, at the pier and within the port. Safeguards will be in place to mitigate the risk of an accident, including a waterside exclusion zone around the jetty limiting access by other boats.

[View Safety Fact Sheet](#)



The diagram above shows the consequence zone in the unlikely event of an accident at the FSRU resulting in a fire. This includes a significant spill of LNG to water which then ignites in a 'pool fire'.

Anyone inside the zone would be exposed to heat and at risk of injury. There is no safety risk for anyone outside the yellow zone.

In this scenario, heat from a major fire could potentially be felt for some distance but the level of heat would not present a safety risk to people or buildings.

Facts about LNG shipping safety



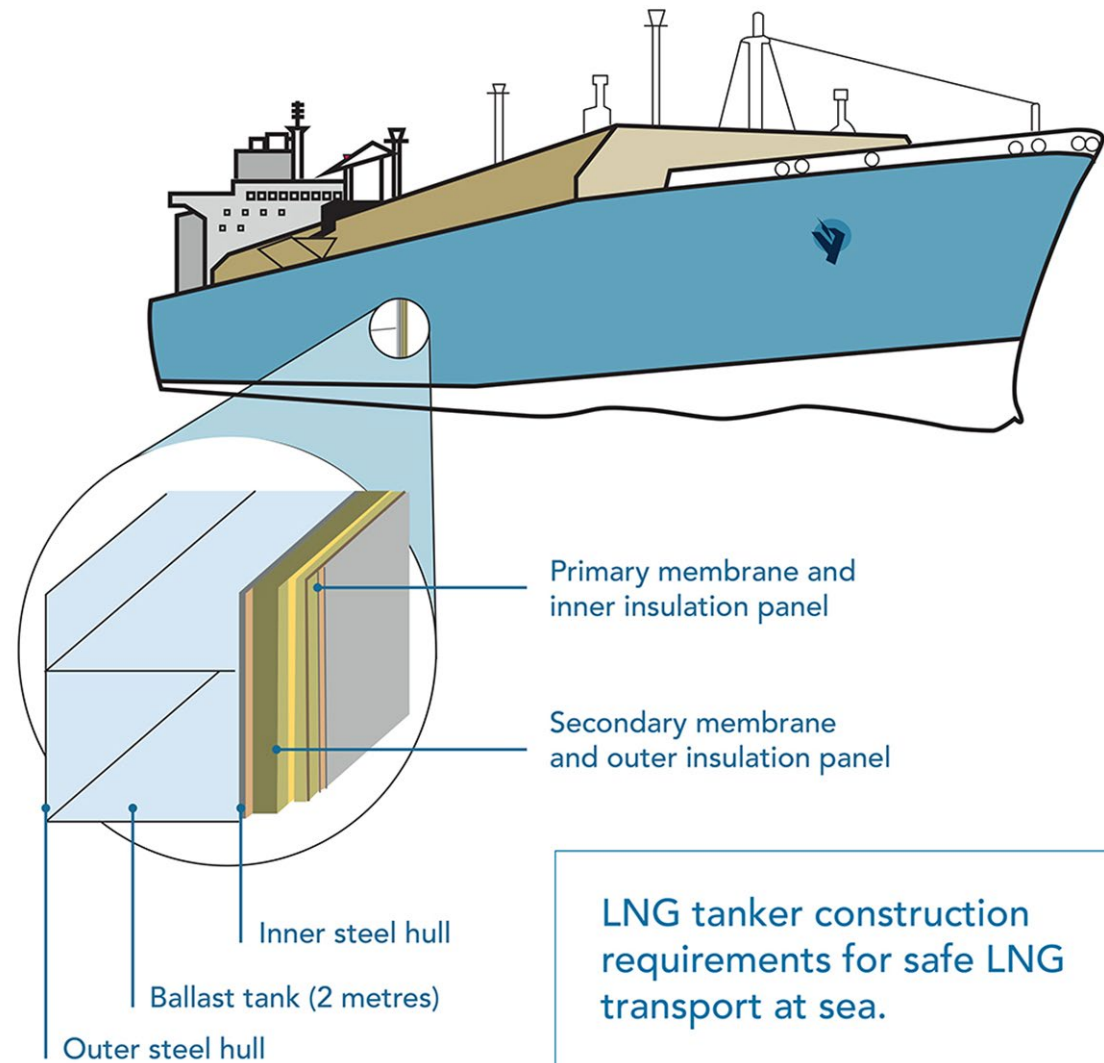
FACT

LNG carriers are modern ships specially designed and constructed to prevent leakage or rupture. LNG has been safely shipped worldwide for over 60 years.

LNG is carried by ship as a very cold liquid. Cooling the gas to very low temperatures, rather than pressurising it, means that it is not flammable or explosive and can be safely stored and transported.

LNG is stored in a special containment system within the inner hull of the vessel, designed to protect the cargo in case of an accident. The double hull design means that in order for a leak of LNG to occur from a tank on board the ship, two steel hulls would need to be pierced, as well as the tank insulation and inner containment system.

These safety features have been very successful – over 135,000 voyages have been completed covering over 100 million kilometres, without there ever being a significant spill, loss of cargo, or environmental incident.



LNG tanker construction requirements for safe LNG transport at sea.

FACT

Restrictions and safeguards will be in place to ensure safe shipping in Corio Bay.

LNG ships will be escorted by up to four tugboats based on Ports Victoria requirements for safe navigation of the shipping channel and berthing requirements.

An experienced marine pilot will board the ship and guide it through local waters to and from the berth.

LNG ships will be restricted to slow speeds, around 8 knots or less when loaded.

On board navigation and live water-depth monitoring technology through the use of dynamic under keel clearance (DUKC).

Vessels will stay within established shipping routes, which have been surveyed to ensure no grounding hazards.

Ports Victoria regulations and guidelines include one-way boat traffic, with rules in place to keep smaller vessels clear of large vessels and tugs.

An expanded waterside restricted zone at Refinery Pier to restrict access by fishing boats and all other vessels as a safety precaution.



FACT

Only high quality, modern ships with a good safety record will be used in Corio Bay.

Strict vetting procedures will ensure that only high quality, modern ships with a good safety record can access the terminal.

All ships used for Viva Energy business are inspected prior to being chartered to ensure they meet strict vetting criteria and all relevant laws, regulations and standards for ships entering Australian waters.

Every ship must have had a recent inspection under the international Ship Inspection Report Programme (SIRE) by an independent and experienced surveyor. The age, history, condition and certification of the ship are examined.

The ship's captain and crew must meet minimum requirements regarding qualifications, experience and pay.



FACT

An accident which led to a major LNG shipping incident would not present a safety risk to local residents.

All efforts are focused on mitigating the risk of an incident occurring.

[View Shipping Safety Fact Sheet](#)

LNG ships will be around 250 metres from the nearest residential areas as they transit the channel.

Grounding and collision with another vessel were identified in safety assessments as the primary risks which could lead to an accidental spill of LNG. Even these risks are assessed as very unlikely.

Safeguards are in place including the steel double hull of the ship to guard against a spill and limit the volume which would be released in an accident.

LNG will warm and evaporate once exposed to air, and is non-toxic to the marine environment.

The US Sandia report (2008) found that accidental grounding or low-speed collision would not result in a breach or spill, and therefore would have no impacts on residents.



FACT

Australia is overall a low-risk security environment and a very safe place to do business.

Security measures currently deployed at the Geelong Refinery and Refinery Pier will be extended to the new gas terminal.

An independent security risk and vulnerability assessment has been carried out, and found that security measures proposed were fully appropriate to the new operation.

The port also has its own strict security protocols and procedures in place to ensure the safe transit of over 1,000 ships projected to visit each year.

A Maritime Security Plan (MSP) setting out security control measures and mitigations in detail must be approved by the Federal Government.

There has never been a targeted attack on an LNG ship or FSRU, and we are not aware of any reason why a tanker or floating gas terminal would be a particular target of terrorism.

Security is a major priority for Viva Energy, and we will remain vigilant and continue to work closely with local, State and Federal authorities to keep all our facilities safe.





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