



Shell Australia Pty Ltd
ABN 14 009 663 576
Shell House, 562 Wellington Street
Perth WA 6000
Australia
Website: www.shell.com.au

Tel: +61 8 9338 6000
Mail: PO BOX A47 CDC
Perth WA 6837

27 September 2016

To Whom It May Concern,

Prelude FLNG Environment Plan. Scope: Installation, Commissioning and Operations.

Under the *Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations*, in order to carry out works related to the installation, commission and operations of the Prelude FLNG Project, Shell Australia must first receive acceptance of its Environment Plan by the offshore regulator, NOPSEMA.

As part of the Environment Plan process and in accordance with Shell standards, Shell Australia continues to consult with those who may be impacted by its activities related to the Prelude FLNG project, ensure relevant persons have received sufficient information and been given a reasonable period to raise any claims or objections.

Following on from consultation already undertaken and a fact sheet provided to stakeholders in August 2015, this letter outlines the potential environmental risks, and the mitigations and controls, as detailed in the draft Environment Plan.

Shell Australia intends to submit the Environment Plan to NOPSEMA in early October 2016. Accordingly, should you or your organisation have any further questions, or potential claims or objections, please respond within 30 days, and no later than Friday, September 22, 2016.

Scope

This Environment Plan covers the following Prelude activities within permit area WA-44-L and infrastructure license WA-2-IL:

- Arrival of the FLNG within WA-44-L, installation of the FLNG and additional equipment and hook-up to pre-laid subsea facilities;
- Commissioning, start-up, operations and maintenance of the FLNG and subsea facilities;
- Transit of the support vessels and helicopter providing support to the FLNG operations at the Prelude facility;
- Well intervention activities using a light well intervention vessel.

Location

The Prelude FLNG Project is in WA-44-L, in Commonwealth marine waters, 200km offshore northwest Australia and 460km north-north east of Broome in 237m from Mean Sea Level (MSL) water depth.

For further detail on the location of Prelude FLNG and safety zones, visit <https://www.nopsema.gov.au/assets/Gazettal-notices/A441884.pdf>



Location of Prelude (Permit Area WA-44-L)

The Prelude FLNG facility is planned to be towed from South Korea where it is under construction and being partially commissioned. The installation, hook-up and commissioning is planned upon arrival of the FLNG, after which it will begin operation, with cash flow from production expected in 2018. The Prelude FLNG facility is designed to stay on location and operate for 25 years.

Fish Aggregation Devices (FAD)

Through our engagements, the issue of FAD has been raised. Some pelagic fish species will be attracted to the FLNG facility and subsea equipment, however, most of the pelagic species found in the region will not become permanent residents under the FLNG facility. Studies on other offshore oil and gas facilities worldwide indicate that generally, Fish Aggregation Devices work for only a relatively short period of time as fish shoals and fish will only be present for a number of days or weeks.

Although limited pelagic species associated with the FLNG and the safety zone will be afforded some protection from fishing activity, the benefit to fish ecology is considered to be of slight significance due to the temporary nature of the residency of fish near the FLNG and the total larger area for pelagic species in the region (compared to the area of the safety zone around the FLNG).

The Prelude FLNG Environmental Impact Statement (EIS) indicated that most demersal species are unlikely to occur within the project area as these species are strongly associated with shallow environments such as near shore shelf systems.

Risks and Mitigations

1 Physical Presence of FLNG and Vessels

Potential Risk	Potential Consequence	Mitigation or Control
1.1 Physical presence of the FLNG and vessels	Disruption of commercial or recreational fishing or shipping activity.	<ul style="list-style-type: none"> • A 'Notice to Mariners' advising of the presence of the installation vessels will be issued through the Australian Hydrographic Service (AHS) prior to the commencement of the activity. • FLNG and the vessels are equipped with suitable radar, ARPA, navigation aids and regulatory equipment. Competent crew maintaining 24 hour visual, radio and automatic identification system (AIS). • Safety Zone around the FLNG patrolled by an infield support vessel equipped with radar and ARPA.
1.2 Lighting of FLNG and vessels	Localised attraction and temporary disorientation of fauna, potentially leading to increased predation or feeding rates.	<ul style="list-style-type: none"> • Lighting of the FLNG facility is designed to minimise light spill. <ul style="list-style-type: none"> ○ Use of low-reflective paints. ○ Directing luminaires inwards on the FLNG facility and away from the ocean. • Flaring limited during normal operations to reduce impact of light emissions from the flare.
1.3 Noise generated by FLNG and vessels	Disruption to behaviour patterns of sensitive marine fauna from vessel operations and/ or movements.	<ul style="list-style-type: none"> • Routine vessel and FLNG noise thoroughly studied and documented – found to be below levels likely to cause physiological damage to marine fauna. • The FLNG facility is designed to meet occupational health and safety noise limits, which also limits environmental noise impacts. • A maintenance program is developed for the FLNG facility and supply vessels that include inspection and maintenance of noise suppression equipment. • Support vessels and helicopters during transit adhere to the requirements of the EPBC Regulations 2000 Part 8, Australian National Guidelines for Whale and Dolphin Watching (Commonwealth Government of Australia 2005), and industry experience.
1.4 Disturbance to seabed	Disturbance to benthic communities as a result of physical disturbance.	<ul style="list-style-type: none"> • Limited footprint of the Prelude facilities. • Post and as-laid surveys to confirm that the subsea facilities are laid according to planned locations. • Recording of significant seabed disturbance when ROV is being utilised.
1.5 Vessel collision with marine life	Injury and/ or death of a cetacean or other protected fauna.	<ul style="list-style-type: none"> • Installation and support vessels during transit adhere to the requirements of the EPBC Regulations 2000 Part 8, Australian National Guidelines for Whale and Dolphin Watching (Commonwealth Government of Australia 2005); and industry experience.
1.6 Introduction on non-native marine species via ballast water exchange or biofouling causing alteration to community composition and function, competition with indigenous species.	Introduction of exotic marine species via ballast water exchange or biofouling causing alteration to community composition and function, competition with indigenous species.	<ul style="list-style-type: none"> • All vessels and the FLNG to comply with Biosecurity Act 2015. • Development of the Prelude Biosecurity Management Plan will be in place before arrival and will involve stakeholder consultation and consideration of Department of Fisheries (DoF) inputs and comments.

2 Liquid Discharges

Potential Risk	Potential Consequence	Mitigation or Control
2.1 Discharge of drainage waste from the FLNG and vessels	Localised and toxic effects caused by contaminants in waste stream.	<ul style="list-style-type: none"> FLNG drainage system is such that areas with liquid hydrocarbons are directed to an open drain or closed drain system connected to the MARPOL system and oil/water separator system, designed to meet the MARPOL requirements (MARPOL 73/78 Annex I – Regulation for the Prevention of Pollution by Oil from Ships under the Commonwealth Protection of the Sea (Prevention of Pollution from Ships) Act 1983). Discharge to sea from the FLNG’s MARPOL slop tanks is monitored by Oil discharge monitoring equipment. A sampling point is also available for periodic testing of oil content (and other potential contaminants) by laboratory test. The system also has the ability to automatically stop the discharge when the 15ppm limit of oil is exceeded. Designated storage areas for oil products, which are contained to prevent discharge of oil to the sea. Designated containment zones for areas which are potential sources of oily discharges. For vessels, any discharge into the sea shall have a maximum dispersed oil content of 15ppm and no visible traces of oil are to be observed on or below the surface of the water in accordance with MARPOL 73/78. Chemical selection procedure is implemented which will assist in managing impacts associated with liquid discharges. FLNG induction to educate FLNG personnel on correct use of drains system.
2.2 Discharge of, food wastes sewage and grey water from the FLNG and vessels	Localised and toxic effects caused by contaminants in waste stream. (e.g. nutrient enrichment).	<ul style="list-style-type: none"> All discharges of food wastes and sewage from vessels will comply with the Protection of the Sea (prevention of Pollution from Ships) Act 1983, in particular AMSA Marine Order 96 (MARPOL 73/78 Annex IV: Sewage) and AMSA Marine order 95 (MARPOL 73/78 Annex V: Garbage). All the vessels are designed to be able to operate within 3NM of land under the MARPOL 73/78 requirements. For the FLNG, the designed treatment of the sanitary wastewater is in accordance with MARPOL 73/78 requirements (AMSA Order 96). Sampling point is provided on the treated sewage discharge line to perform the lab analyses to regularly monitor compliance of the discharge to the standards. Food wastes are macerated to pass through a screen of less than 25mm diameter prior to discharge, in accordance with Protection of the Sea (Prevention of Pollution from Ships) Act 1983 [Section 26F(7)] i.e. > 3 Nm from land (AMSA Marine Order 95).
2.3 Produced Formation Water (PFW)	Localised and toxic effects caused by contaminants in waste stream	<ul style="list-style-type: none"> Best Available Technology chosen for the PFW treatment system, which removes both dispersed and dissolved hydrocarbons from the waste stream. High availability of the PFW treatment system. The total oil content of the produced water discharge is not to exceed 30mg/l averaged over any 24-hour period, except during well clean-up and well fluids commissioning (when we will be discharging up to 100mg/l for a short period of time). Alarms and automatic switch-off of discharge to ensure water specifications are met before discharging. Online analyser for the Oil-in-Water is provided on the discharge point to ensure discharge limits are achieved. If the online analyser is down, manual sampling and analysis will be done. Full chemical characterisation and whole effluent toxicity testing of the produced water discharge to further understand and validate the impacts of the discharge. In-field sampling and monitoring to validate predicted impacts. Chemical selection procedure is implemented which will assist in managing impacts associated with liquid discharges to as low as reasonably practicable (ALARP) levels. An adaptive management to aid in understanding and managing the impacts of the produced water discharge particularly if there are changes in the process or operations.

2.4 Cooling Water Discharge	Localised and toxic effects caused by slightly warm water and residual chlorine in the discharge	<ul style="list-style-type: none"> Chemical dosing is automatically controlled to minimise residual chlorine at discharge. Online monitoring of temperature, residual chlorine and flow of the discharge.
2.5 Discharge of desalination brine	Localised and toxic effects caused by saline water in the discharge	<ul style="list-style-type: none"> Chemical dosing controlled to minimise chemicals at discharge. Online monitoring of flow and temperature.
2.6 Discharge of Chemicals during subsea activities	Localised and temporary acute toxic effects caused by chemicals	<ul style="list-style-type: none"> The subsea facilities are designed to minimise release of fluids to the environment. Chemical selection procedure is implemented which will assist in managing impacts associated with liquid discharges to ALARP levels. During installation and commissioning, the majority of preservation fluids flow back into the FLNG and are either used in the process system or sent to shore for treatment and disposal. The only exceptions to this are: (1) incidental releases during tie-ins and connections, (2) incidental releases during subsea interventions, and (3) limited volumes of dosed freshwater and dosed MEG during pre-commissioning of the flexible risers.

3 Atmospheric Emissions

Potential Risk	Potential Consequence	Mitigation or Control
3.1 Combustion Emissions	Reduction in air quality through combustion of fuel in the energy units of the FLNG and the vessels.	<ul style="list-style-type: none"> The boilers are designed to IFC Guidelines for Thermal Power; the essential generators to IFC General EHS Guidelines; and the emergency generators to MARPOL 73/78 Annex VI. The boilers are designed to preferentially use natural gas, and diesel will only be used during commissioning, turn-arounds and shutdowns. Low sulphur diesel will be used on the FLNG. Surveillance program is in place for the boilers to ensure that they are operating within the operating envelope. The boiler emissions are monitored through Predictive Emissions Monitoring. In addition, all exhausts are equipped with sampling ports for portable monitoring devices for NO_x, SO_x, CO₂ and PM monitoring if manual stack sampling is required. Preventive maintenance requirements are defined and implemented to ensure efficient operations of the power generation systems. All vessels utilised on the project comply with MARPOL 73/78 Annex VI Regulations for the prevention of air pollution from ships, as required by vessel class. Fuel usage is recorded continuously, allowing performance issues to be identified and ensuring engines are operating efficiently and thereby minimising emissions.
3.2 Flaring	Reduction in air quality through combustion of flared gas from the process	<ul style="list-style-type: none"> Flaring only occurs in emergency situations, shut downs and unplanned outages. Availability of the process is ensured to avoid or minimise any operational flaring. The flares are designed to be smokeless. Flaring emissions are monitored through Predictive Emissions Monitoring System. Actual flaring emissions and targets are reviewed annually. Controlled flaring during emergency shutdowns and start-ups
3.3 Acid Gas Venting	Increased CO ₂ and GHG emissions due to disposal of reservoir gas	<ul style="list-style-type: none"> Monitoring of the acid gas vent emissions is done through Predictive Emissions Monitoring System.
3.4 Fugitive Emissions	Increase methane and CO ₂ emissions due to fugitive emissions of gases	<ul style="list-style-type: none"> Design of the FLNG is such that fugitive emissions are minimised. This includes pumps with double seals, minimum number of flanges, use of relief valves instead of open vents in storage tanks, and closed sampling systems. Leak testing of all systems prior to introduction of hydrocarbons. Maintenance, routine monitoring/inspection regimes. Leak Detection and Repair program to be established for Prelude FLNG which includes routine monitoring/inspections to ensure leaks are identified, isolated and repaired.
3.5 Total Greenhouse Gas Emissions	Increased GHG emissions	<ul style="list-style-type: none"> Flow assurance to minimise the need for de-pressuring flowlines. Ensure high availability of process and therefore reduce trips and losses to flare. GHG and Energy Management Plan for Prelude FLNG, which drives continuous

		<p>improvement on emissions and energy use.</p> <ul style="list-style-type: none"> • GHG emissions are monitored and targets annually reviewed. • Shell will comply with all relevant laws including NGRS.
3.6 Increased GHG emissions during Hook-up and Commissioning	Localised and temporary increase in GHG emissions	<ul style="list-style-type: none"> • Shortened use of diesel fuel, optimised activities to reduce emissions. • Temporary, short-term increase only. • Monitoring of emissions.

4 Waste Management

Potential Risk	Potential Consequence	Mitigation or Control
4.1 Waste management	Localised and temporary acute toxic effects caused by unplanned wastes	<ul style="list-style-type: none"> • Shell Australia Waste Management Manual and Prelude Waste Management Procedure have been established to ensure cradle-to-grave management of wastes. • Dedicated wastes storage areas on the FLNG and vessels, which are contained. • Wastes recording and volume monitoring, waste reduction targets. • Correct waste management is part of the general HSSE inductions for the FLNG and the vessels.

5 Emergency Events

Potential Risk	Potential Consequence	Mitigation or Control
5.1 Accidental discharge of hazardous waste or chemicals into the ocean	Reduction in habitat/ water quality, acute/ chronic toxic effect on marine organisms.	<ul style="list-style-type: none"> • Storage tanks for bulk chemicals are designed for storage of the appropriate chemicals. • All permanent chemical storage facilities on the FLNG have been strength-tested and leak-tested prior to start-up. • Maintenance regime for the connections, hoses, storage tanks and other critical equipment for chemical storage. • Bunkering of fluids in accordance with relevant procedures. • Prelude Lifting and Hoisting Manual and Adverse Weather Standard minimise the risk of releases associated with dropped objects. • Prelude Oil Pollution Emergency Plan (OPEP) which lays out the response procedures in any chemical and oil spill incidents.
5.2 Fuel spill during bunkering at sea	Potential loss of diesel or fuel oil to the marine environment causing localised and temporary acute toxic effects and direct physical smothering of marine organisms.	<ul style="list-style-type: none"> • Use of dry break couplings. • FLNG and vessel refuelling procedures that includes communication systems, continuous visual monitoring of hoses and connections, commencement of operations in daylight, fuel hose inspections and testing. • Prelude Oil Pollution Emergency Plan (OPEP) which lays out the response procedures in any chemical and oil spill incidents.
5.3 Diesel spill resulting from a collision of vessels	Potential acute/ chronic toxic effects and direct physical smothering of marine organisms and or/ contribution to Marine Debris.	<ul style="list-style-type: none"> • A 'Notice to Mariners' advising of the presence of the installation vessels will be issued through AHS prior to the commencement of the activity. • FLNG and vessels equipped with radar, ARPA and navigation systems. • Safety Zone around the FLNG patrolled by two infield support vessels equipped with radar and ARPA. • All vessels employed for Prelude are subjected to a stringent inspection and assurance prior to engagement. • Collision controls during any simultaneous operations with vessels are in place such as Permit to Work. • Product off take tankers during berthing/offloading/de-berthing are assisted by Prelude deployed pilots and positioned by the in-field support vessels to reduce the risk of colliding with the FLNG. • Prelude Oil Pollution Emergency Plan (OPEP) which lays out the response procedures in any chemical and oil spill incidents.

5.4 Heavy Fuel Oil spill from product offtake tanker	Potential acute/ chronic toxic effects and direct physical smothering of marine organisms and or/ contribution to Marine Debris.	<ul style="list-style-type: none"> • A 'Notice to Mariners' advising of the presence of the installation vessels will be issued through AHS prior to the commencement of the activity. • FLNG and vessels equipped with radar, ARPA and navigation systems. • Safety Zone around the FLNG patrolled by two infield support vessels equipped with radar and ARPA. • All vessels employed for Prelude are subjected to a stringent inspection and assurance prior to engagement. • Collision controls during any simultaneous operations with vessels are in place such as Permit to Work. • Product off take tankers during berthing/offloading/de-berthing are assisted by Prelude deployed pilots and positioned by the in-field support vessels to reduce the risk of colliding with the FLNG. • Prelude Oil Pollution Emergency Plan (OPEP) which lays out the response procedures in any chemical and oil spill incidents.
5.5 Hydrocarbon Loss of Containment from the FLNG	Potential loss of gas and condensate to the marine environment causing acute/chronic toxic and physical effect on marine organisms and habitats.	<ul style="list-style-type: none"> • The FLNG facility is double-hulled and the condensate storage tanks are surrounded by ballast water tanks which provide added protection in case of a breach of the hull. • The drainage system reduces the risk of spills which do occur reaching the ocean. • Robust design of offloading arms and hoses which reduces the risk of spill associated with offloading products. • Ship-to-shore communications system and Emergency Disconnect System in place for LNG/LPG offloading. • Maintenance regime for the connections, loading arms, hoses, storage tanks, drains and other systems required for offloading. • Berthing trial during commissioning to test offloading systems and procedures. • Prelude Terminal Handbook and associated procedures. • Prelude Oil Pollution Emergency Plan (OPEP) which lays out the response procedures in any chemical and oil spill incidents.
5.6 Hydrocarbon Release from Formation	Potential loss of gas and condensate to the marine environment causing acute/chronic toxic and physical effect on marine organisms and habitats.	<ul style="list-style-type: none"> • Global Standards for Well Design Integrity • The design, layout and location of the Prelude subsea facilities reduces the risk of any dropped objects damaging any subsea equipment. • Rigorous lifting procedure has been developed by Shell to prevent the risk of dropped objects. • Non-corrosive materials selected for wellheads, and fail-safe design of the shutdown valves. • Prelude Oil Pollution Emergency Plan (OPEP) which lays out the response procedures in any chemical and oil spills. • Prelude Well Capping and Containment Plan (TEC_PRE_000532) that documents Prelude specific well capping mobilisation and deployment options and relief well locations, rigs and drilling strings.

Shell Australia will continue to provide timely information in relation to future milestones and activities taking place during installation, commissioning and operations of the Prelude FLNG project.

If you would like any further information in relation to these activities, or to raise any claims or objections, please contact Kate Richardson, Prelude External Relations Advisor in the first instance, either via email: kate.richardson@shell.com or call: (08) 9338 6056.

Yours faithfully,



Arphee Caymo
Environmental Engineer
Shell Australia