



Ian Blayney MLA
Economics and Industry Standing Committee
Parliament House
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17th December 2014
Your ref: A473240 and A478028

Dear Mr Blayney,

I refer to your letters to Shell Australia Country Chair Andrew Smith on November 17th and December 8th 2014 requesting further information to assist with the *Inquiry into Safety-related matters concerning FLNG facilities*.

Enclosed is a response to the Committee's requests for further information. Shell Australia's draft *Adverse Weather Working Standard (Revision 2)* is also attached to this correspondence.

Should you have any further questions, or require clarification on any of these matters, please contact Lauren Gorton, External Affairs Advisor, Shell Australia.

Yours sincerely,

A handwritten signature in blue ink, appearing to read 'Damian Doherty', is written above the printed name.

Damian Doherty
General Manager HSSE & SP
Shell Australia

Questions from letter dated 17th November 2014
Ref: A473240

Question 1

1. During the hearing, mention was made of Shell Australia's adverse weather policy, including the disciplined controls to be acted on by the offshore installation manager in the event of an extreme weather event. Refer to page 5 of the hearing transcript for this discussion. Please provide a copy of this adverse weather policy to the Committee.

Response:

Please see attached copy of the draft Shell Australia "Adverse Weather Working Standard" (Revision 2). Please note this document is not finalised and is under continuing revision. Shell requests this document is treated as 'commercial in confidence'.

The document outlines the 'Cyclone Philosophy for Prelude' on page 19, please see an excerpt from the document below:

CYCLONE PHILOSOPHY FOR PRELUDE LNG DEVELOPMENT

The FLNG barge is designed to withstand a 10,000 year period return event and will not be disconnect from the moorings during impact associated with the tropical cyclone categories as classified by the Australian Bureau of Meteorology.

- *When a cyclone is approaching, the asset is expected to continue production until wind speeds of 180 km (97 kts - 50m/sec Force 12) reach the facility.*
- *The shutdown philosophy is expected to be for categories 4 and 5 cyclones.*
- *The Critical Path Duration in this context would primarily be set by the time to make safe the facility, such that there would be no requirement for personnel to access the topsides during the adverse weather.*
- *The personnel required for managing the day-to-day FLNG activities will stay on board during the impact of a cyclone, thus avoiding exposure to risks associated with helicopter and boat transfer operations during adverse weather conditions.*
- *All personnel will take shelter in the accommodation module when the wind speed exceeds a level of 130 km/hr (70 knots) averaged over a 10 minute period.*
- *Operations on board the FLNG barge will be impacted and production and facilities shutdown as a precautionary measure to minimise overall risk to personnel and assets. Activities for preparing and making safe the facilities, including the upstream facilities and tug boats, for the possible impact of a cyclone will commence when a cyclone or cyclone activity enters a 1500 km watch circle around the FLNG facilities. The timing for specific follow-on activities to commence will be related to the moment that a cyclone gets within the, 500 km and 250 km radius watch circle from the Prelude facilities.*

The current draft version of this document is in the process of being revised in line with our ramp up to operations and maintenance. The next revision will address the operational marine and aviation strategies based on the technical specification and capability. The revised document is expected to be available towards the middle of 2015. The "Adverse Weather Working Standard" will be fully aligned and consistent with the Prelude FLNG Safety Case Revision 2 document submitted to NOPSEMA in accordance with the OPGGS Act 2006.

Shell Australia is willing to provide an overview of the future implementation of the "Adverse Weather Working Standard" to the Committee members, if the Committee felt it was useful and appropriate.

Question 2

2. Considerable evidence has been presented to the Committee in hearings, briefings and site visits in relation to the design of the Prelude facility to enable it to withstand a one-in-10,000 year weather event and to remain manned during a cyclone. The Committee appreciates the critical design decisions made by Shell in designing its FLNG facility. During the Committee's visit to MARIN in the Netherlands, Professor Efthymiou, Shell EMI Chair of Offshore Structures, UWA, advised that Prelude had been designed to withstand an:

- Extreme design event of a one-in-100 year event, with damage; and a
- Survival design event of a one-in-10,000 year event, with damage that does not harm functionality.

Given that these design parameters acknowledge that there would be some damage, the Committee wishes to better understand how Shell can be sure that the structures on board the facility will allow personnel to safely stay on Prelude during an extreme and a survival weather event. For example, what equipment or structures will make it safe for people to stay on board the facility, rather than de-man? Is there a specially designed refuge space in the accommodation facilities to ensure personnel are not harmed? What reassurance can Shell offer the Committee that personnel on the Prelude will survive remaining on the facility during extreme weather events? How is the area in which your staff will shelter in the event of a cyclone significantly different from any other facility that operates in the world and in the North West?

Response:

In the event of an extreme adverse weather condition (as defined in the "Adverse Weather Working Standard") the topsides process, in accordance with the Adverse Weather Working Standard, will be turned-down or shut-down and de-pressurised to mitigate the threat of pressurised hydrocarbons. This reduces the potential escalation for fire and explosion events. In the event of adverse weather all personnel will muster in the main accommodation module (temporary refuge)

and be accounted for. They will remain inside the accommodation for the duration of the adverse weather event.

The definitions of *Extreme Design Event* and *Survival Design Event* are as below:

Extreme Design Event: All structural systems (hull, topside structures, mooring, turret, risers) shall satisfy extreme environmental conditions with a return period of 100 years **without damage**.

Survival Design Event: Longest return period of survival event is 10,000 years. The accommodation module (temporary refuge) is a safety critical element. The temporary refuge shall provide protection for people in case of a hazardous event and have the necessary command and control to organise emergency response. The temporary refuge (accommodation module) shall be designed to withstand the survival event **without damage** and be operable after a 10,000 year event.

Life support requirements include leak tightness to prevent smoke and gas ingress into the temporary refuge, while structural support includes consideration of extreme and survival wind loads and extreme and survival vessel motions.

The modelling (theoretical and model based) performed at the MARIN institute, confirm that the Prelude FLNG main accommodation (temporary refuge) module facilities and cabin layout remains comfortable, habitable for health, safety and welfare of people on board throughout an adverse weather event.

When comparing Prelude FLNG facility motions with motions of a typical North Sea operated FPSO (per unit wave height) the motions of the Prelude FLNG facility are lower for all wave periods of equivalent interest. Extreme FLNG facility motions at the Prelude location are lower than most extreme FPSO motions operated in the North Sea at the 100 and 10,000 year conditions. Note, the North Sea operated FPSOs considered here are permanently moored, manned and have been operating satisfactorily over the last 15 years under the UK offshore oil and gas safety regime.

Once the storm period has passed a structured process safety and integrity inspection of the topside module equipment will be initiated to assess for any damage. The process production operation will not be re-started until the process safety integrity of the entire FLNG facility is functionally assured.

Question 3

NB: Temp should read TEMPSC (totally enclosed motorised propelled survival craft) and ISB's should read ISVs (infield support vessels).

3. Shell has stated that its philosophy is to maintain people on board Prelude through cyclonic conditions. During the hearing, though, Mr Gerry Dixon advised that:

if the platform OIM decides to abandon and evacuate the asset, he will make that decision on the basis that people's safety is paramount. The facility will blowdown naturally and staff will leave either by helicopters or by temp and the ISBs will be placed locally surrounding the facility to manage that evacuation and the de-manning of the asset. At no point is there any pressure on any individuals to stay on the asset. (Hearing transcript, page 7)

In the interests of clarity, please advise whether Mr Dixon's comments relate to an extreme weather situation or if he was referring to other types of emergencies. Is there any option for workers to evacuate due to an extreme weather event? What consultation has Shell undertaken with oil and gas workers to determine that workers would be prepared to stay on the facility during extreme weather events?

Response:

The Shell comments around evacuation by helicopter, TEMPSC (totally enclosed motorised propelled survival craft) and infield support vessels (ISVs) do not relate to the manning philosophy during adverse weather events. These Shell comments relate to abandonment in an extreme emergency situation.

Evacuation by helicopter (primary arrangement) or by life boats (secondary arrangement) or by life rafts (tertiary arrangement) and use of the ISVs would occur if there was an emergency incident that occurred resulting in a potential threat to personnel safety.

During a cyclone, a major accident event is significantly reduced as in accordance with the Adverse Weather Working Standard, the production will be turned down or shut-down and the topsides inventory depressurised.

Prelude FLNG personnel will remain on board in all foreseeable weather conditions including a category 5 cyclone. There may be occasions where it is decided well in advance of a weather event to reduce general maintenance and operational activities to optimise staffing levels. This is because they will not be required to participate in any adverse weather actions and non-routine and general maintenance will not be priority.

Prelude FLNG personnel are engaged on cyclone manning arrangements from the earliest point of their recruitment, throughout their on-boarding to the project and in their regular mandatory offshore training. Video footage of the simulator motions in cyclonic weather is a key communication component of the induction material for all on-boarding sessions.

Through these engagements, our personnel understand that it is safe to stay on the FLNG during all weather conditions and that the decision to not de-man during a cyclone is based on results from an extensive 15 year research and development program, real model testing and advanced 4D simulation by the MARIN institute, supported by subject matter experts in Shell.

In addition, Shell Prelude FLNG operations personnel with offshore experience have witnessed

first-hand the motions and support the policy of remaining on the facility in the most severe of weather conditions.

Question 4

4. The Committee acknowledges Shell's evidence that safety is its primary focus, with multiple formal safety assessments completed to ensure that the design and risk levels are as low as reasonably practicable (ALARP). The Committee also understands that the ALARP standard will vary, depending on the facility and the situation. Please advise what differences there are between the ALARP established for onshore processing facilities such as those in Karratha and the ALARP for FLNG facilities.

Response:

Shell applies a rigorous approach to ALARP whether the facility is offshore or onshore.

The Hazards and Effects Management Process (HEMP) is the process by which Shell identifies and assesses hazards, implements measures to manage them, and demonstrates that their risks are reduced to a level that is As Low As Reasonably Practicable (ALARP).

ALARP outcomes will be different for every project and is the summation of risks over the whole project scope (not based on a preferred development option versus another). For an onshore LNG plant, the ALARP assessment will not include the risk of travelling in a helicopter. However, most onshore plants receive gas from an offshore platform that processes and compresses the gas to shore. This means that those offshore workers will have exposure to helicopter travel risks. The overall offshore/onshore ALARP needs to be considered when comparing to FLNG.

Demonstration of ALARP on the Prelude FLNG facility Project has considered different options to provide assurance that inherent risks in the chosen concept are reduced to ALARP. Through our ALARP studies, it was determined that the levels of risk for each worker group are comparable to other offshore oil and gas facilities. In addition, the temporary refuge impairment frequency (a measure of the safety of the temporary refuge facility) benchmarks favourably (i.e. is an order of magnitude lower) against other current offshore oil and gas facilities.

Questions from letter dated 8th December 2014

Ref: A478028

1. Please confirm that Prelude has two helidecks, with helicopters based onshore at Broome.
2. Shell's submission states there are freefall lifeboats and integrated chute-based life rafts. Please advise how many lifeboats and life rafts there will be and the capacity of each.
3. Please outline what the response will be on Prelude to a man over-board, a fire and a leak of hazardous material?
4. Please advise whether Prelude will have divers, search boat capability or repair capability on board and, if so, outline what is available.

Response:

1. Yes, there are two helidecks on the Prelude FLNG facility and the helicopters are based in Broome.
2. There are five freefall lifeboats each with capacity of 70 people and therefore total capacity of 350 personnel. There are integrated chute based life rafts located both aft and forward and located on both port and starboard sides. The aft life rafts have a total capacity of 170 people on each side. The forward life rafts have a total capacity of 70 people on each side.
3. Prelude FLNG responses to these scenarios will be no different to that of any other offshore installation operating in the region. Summary given below:
 - a. Man overboard (MOB): MOB typically only relates to rare situations where workers will be required to work over the side of the facility. The design of the facility and handrails is such that there is minimal risk of anyone falling over the side unintentionally. Only planned operations activity over the side of the facility would be done having considered the Manual of Permitted Operation (MOPO), the Adverse Weather Working Procedure and managed strictly under a safe system of work procedure. The infield support vessels and the use of their fast rescue craft would be on close standby during any such works to monitor and manage any rescue and recovery of any MOB event.
 - b. Fire: On offshore facilities the standard response to fire scenarios is to fight the fire if safe to do so, i.e. if there is a small fire in its incipient stage then all personnel are trained in using portable fire extinguishers/hydrants etc. However, if there is any risk to personnel, then all personnel are to muster in the temporary refuge and let the platform automated systems manage the fire scenario (see item c below). There are sufficient detectors and active fire protection systems designed to contain foreseeable fire scenarios.
 - c. Leak of hydrocarbons: There is a fire, explosion and cold spill strategy developed for Prelude FLNG. Loss of containment from the hydrocarbon system is managed via the following measures:
 - i. Fire and gas detection
 - ii. Automatic emergency shutdown and emergency depressurisation (primary means of hazard and escalation control)
 - iii. In the case of large cryogenic releases, overboard drainage ensures any liquids are removed overboard
 - iv. The process piping design for rundown and loading lines ensures removal of any collection of hydrocarbon inventory in the process system when a shutdown occurs

- v. Passive fire protection and cold spill protection (as an assured secondary means of escalation prevention) on structures and equipment which can generate escalation outside the associated fire zone
 - vi. Designing critical structures and equipment to withstand residual consequences
 - vii. Active fire protection will cool equipment and manage sources of specific pool fires/smaller fires
 - viii. Use of fire water monitors to create water curtains to separate port and starboard to control heat radiation, and for dedicated areas such as flammable chemical storage
4. There is no plan to have any divers on board in normal operations. There are contingent diving operations for the hook-up scope and therefore this will be managed in accordance with the OPGGS (Safety) Regulations 2009 (chapter 4). In regards to repair capability, remotely operated vehicles (ROVs) can be deployed to inspect below the water line and carry out minor repairs in the first instance.

The infield support vessels (ISVs) act as the standby boats, with each ISV having a fast rescue craft onboard and search and rescue capabilities. Both hook-up and operations will be supported by the all weather search and rescue helicopter based in Broome.