

Notifiable incident

Incident ID [6056](#)

Duty holder: Shell Australia Pty Ltd
Facility/Activity: Prelude FLNG
Facility type: Floating liquefied natural gas facility

Incident details	
Division	Occupational Health and Safety
Notification type	Incident
Incident date	23/07/2019 09:30 PM (WST)
Notification date	24/07/2019 06:21 PM (WST)
NOPSEMA response date	24/07/2019 06:36 PM (WST)
Received by	[REDACTED]
Nearest state	WA
Initial category type <i>(based on notification)</i>	Dangerous Occurrence
Initial category <i>(based on notification)</i>	Other kind needing immediate investigation
3 Day report received	26/07/2019
Final report received	22/08/2019
All required data received	22/08/2019
Final category type <i>(based on final report)</i>	Dangerous Occurrence
Final category <i>(based on final report)</i>	Other kind needing immediate investigation
Brief description	OHS - OKNI - Worker struck on hard hat by piece of ice which fell from LPG Loading Arm
Location	
Subtype/s	Dropped object, Near miss / high potential
Summary <i>(at notification)</i>	<ul style="list-style-type: none"> - The facility OIM notified NOPSEMA of a dangerous occurrence which took place whilst loading LPG into the carrier / tanker(vessel) alongside; - A piece of ice which was suspected as falling from the LPG loading arm struck a member of the Prelude facility Marine crew on the hard hat; - the person was reported as position adjacent to the LPG tank on the carrier side; - the crew member was checked by the facility doctor and no injuries were sustained other than the worker complaining of "Stiff Neck"; - size and weight of the ice piece were still being determined but OIM mentioned that initial estimation could be leading to a weight of 8 kg; - the OIM also mentioned that the height could be up to 30 meters, but it was not known at this point where exactly it fell from the LPG loading arm; - the OIM informed the duty inspector, that NOPSEMA inspectors [REDACTED] and [REDACTED] are currently on board the Prelude facility conducting an inspection, and both have been informed of the incident and updated accordingly with the process of the investigation; - LPG export activities have been completed and work area made safe; - detailed 3 day report will follow shortly.
Details <i>(from final report)</i>	<ul style="list-style-type: none"> - The facility OIM notified NOPSEMA of a dangerous occurrence which took place whilst loading LPG into the carrier / tanker(vessel) alongside; - A piece of ice which was suspected as falling from the LPG loading arm struck a member of the Prelude facility Marine crew on the hard hat; - the person was reported as position adjacent to the LPG tank on the carrier side; - the crew member was checked by the facility doctor and no injuries were sustained other than the

worker complaining of "Stiff Neck";

- size and weight of the ice piece were still being determined but OIM mentioned that initial estimation could be leading to a weight of 8 kg;
- the OIM also mentioned that the height could be up to 30 meters, but it was not known at this point where exactly it fell from the LPG loading arm;
- the OIM informed the duty inspector, that NOPSEMA inspectors [REDACTED] and [REDACTED] are currently on board the Prelude facility conducting an inspection, and both have been informed of the incident and updated accordingly with the process of the investigation;
- LPG export activities have been completed and work area made safe;
- detailed 3 day report will follow shortly.

** as supplied by duty holder **

6. Brief description of incident: A team member was conducting an inspection adjacent the loading arm connections on the LPG carrier. The team member approached a manifold and was struck on the helmet by a large piece of ice from the upper section of the marine loading arm 01 (LPG). The estimated weight of the piece of ice is 8.3kg with a fall distance of approximately 20m. The event is currently under investigation.

7. Work or activity being undertaken at time of incident: Terminal team lead (TTL) undertaking inspections and preparations for LPG cargo disconnection. TTL was on deck of the LPG carrier.

8. What are the internal investigation arrangements? Internal Investigation commenced immediately. NOPSEMA notified. FIM event raised (TBA).

15. Action taken:

- Team member assessed at FLNG medical centre
 - Investigation underway
- Details of any disturbance of the work site
- Disconnection activities were completed and the LPG Carrier departed FLNG.

17. Injured persons (IP) Terminal Team Lead (Shell employed) – First Aid Treatment administered for minor bruising

IP full name: [REDACTED]

IP date of birth: [REDACTED]

Sex: [REDACTED]

IP residential address: [REDACTED]

IP phone no. [REDACTED]

IP phone no. [REDACTED]

IP occupation/job [REDACTED]

Contractor or core crew [REDACTED]

Details of injury: Minor bruising. No restrictions or modifications required. First aid administered.

Based on TOOCS

Nature of injury: g. Other (minor bruising)

Part of body: G2. Neck and G4. Shoulder or arm

Mechanism of injury: G8. Other - Struck on helmet by falling ice

Agency of injury: 9. Other - Falling piece of ice

Details of job being undertaken: Inspection and assessment of manifold area on LPG Carrier Deck in preparation for hot gas purging as part of LPG disconnection activities.

Day and hour of shift: 3rd day of 7 (3 / 7) - 5th hour of 12 (5 / 12)

21. Immediate action taken/intended, if any, to prevent recurrence of incident:

Team member reported to FLNG medical centre for assessment, Team member/supervisor, 24/07/2019

Investigation commenced to identify root causes and actions to prevent reoccurrence, [REDACTED]

[REDACTED] 05/08/2019

22. What were the immediate causes of the incident? Preliminary investigation ongoing. Assessed and identified ice exclusion zone not suitable for this activity.

32. Has the investigation been completed? Yes

Root Cause Analysis:

Root cause 1 - Difficulty in seeing the presence of ice

Root cause 2 - Ice build-up on the inboard MLA pipe spool

Root cause 3 - Hot Gassing of MLAs

Other root causes - Ice fall drop zone

Full report:

Incident description

At 2130 on 23/07/2019 a team member was conducting an inspection adjacent the Propane loading arm connections on the LPG carrier Secreto. The team member approached a manifold and their hard hat was impacted by a piece of ice from the upper section of the marine loading arm 01 (LPG). The estimated weight of the piece of ice is between 2- 8kg with a fall distance of approximately 20m. The exact weight is estimated however the force of the dropped ice was great enough to release the ear defenders from the team member's hard hat.

Problem statement - Ice Fall

Expected: During the hot gassing process, it is expected that ice will form and then melt off the loading arms. It is expected that personnel should not be standing in the drop zone area and should not be exposed to ice fall risk.

Actual: Team member was standing in the manifold area and was impacted on the hard hat by a piece of ice that fell from the upper section of the marine loading arm during the Hot Gassing process.

Actual Consequence: Ice (estimated 2-8kg) fell from the loading arms (approx. 20m), and impacted the IP's hard hat. The IP received first aid treatment, with no injury.

Initial Offshore Investigation

Initial offshore investigation was conducted by Services Coordinator and Offshore HSSE immediately after incident with personnel impacted by ice and team members present on the Secreto LPG Carrier.

Shore based Investigation

The shore-based investigation looked at the cause of ice build-up and subsequent fall using the causal methodology.

During the LPG export to the LPGC Secreto, at the completion of cargo transfer a piece of ice detached and fell from the Propane Marine Loading Arm striking one of the terminal Team personnel. The investigation was carried out in a group session utilising the Terminal Team members who were onboard at the time of the incident including the IP. Written statements were also tendered by all team members involved.

Causal Investigation Findings:

Difficulty in seeing the presence of ice

There was no ice present on the outboard MLA pipe section closest to the LPGC's manifold immediately prior to the incident occurring. It was reported by the Terminal Team members that prior to the ice falling it was not easily identified that there was ice still on the inboard pipe section; reasons for this were given as:

? It was night time (poor light).

? The inboard pipe section is some distance above the deck.

? The inboard pipe section was in shadow. The contrast between the colour of the ice and the light colour grey of the MLA pipework

After the ice fall it was then clearly observed there was ice on the inboard MLA pipe spool as a section of ice was missing on the underside of this spool at the LPGC end of the pipe. This was only apparent with the section missing which provided a direct contrast in colours. The inboard section is directly above the manifold area.

Ice build-up on the inboard MLA pipe spool

The presence of ice on any part of the discharge pipework of the MLA indicates the presence of liquid product still present in the pipe.

At the end of cargo, the inboard MLA was configured to drain back to the LPGC, However the altitude of the inboard MLA pipe spool resulted in liquid accumulation in this spool and subsequently it did not self-drain. This contributed to the ice formation.

Hot Gassing of MLAs

The hot gassing activity is used to vaporise any residual liquid remaining in the lines and MLAs after draining; it also has the effect of sweeping any liquid back to Prelude; the gas is supplied from the LPGC's re-liquification compressor. The line temperature at the LPGC manifold is around 55°C during hot gassing and on Prelude the S&L Technician will see a temperature gradually rise with a temperature approaching around 30°C indicating all the liquid has vapourised.

Any ice build-up on the pipework of the MLAs and other pipework will be melted during the hot gassing process. However, if the duration of hot gassing is inadequate an 'Ice sleeve' can form.

For the LPG arm purge, Procedure OPS_PRE_002562, LPG Storage, Loading & Transfer - Initial Start-Up - Offloading Mode, Task 514, the hot gas purge should be continued till the temperatures in the loading arm are above +20 degC and the arm is confirmed as ice free. The procedure currently states that the purge should be continued till 350TI-1012 reaches around 2-3degC.

The documented procedure for the butane arm purge states the same thing.

Purging to +20degC ensures that all heavier fractions in the LPG arm are effectively vapourised. (Boiling Point of butane = -1degC). This would also ensure that ice on the arm is melted.

Ice fall drop zone

The IP was impacted by the falling ice at a position approximately 2.5 to 3 meters aft of the centreline of the LPGC Propane manifold. Notwithstanding the fact that ice had not been identified on the inboard MLA pipe spool (for the reasons given in Cause 1 above), it was considered that this distance was sufficient to avoid being in an ice drop zone. The fact that the ice fell from a point on the manifold centreline (from the MLA) and landed at a point 2.5 to 3 meters aft of this centreline indicates that the ice most likely struck part of the MLA structure as it fell and was deflected away from the centreline.

33. Actions to prevent recurrence of same or similar incident:

Action: Increased situational awareness of ice hazard for the offshore team. Ice awareness is included in the offshore induction received upon arrival on Prelude and continually included in the daily newsletter

Responsible party: Offshore HSSE advisor

Completion date: Completed and ongoing

Action: Increasing the area of ice fall exclusion zones.

Responsible party: Services Coordinator

Completion date: Closed

Action: Procedurally changing hot gassing activities to ensure ice is completely melted from the MLAs prior to personnel accessing the exclusion zones.

Responsible party: Services Coordinator

Completion date: 30 Sept 2019

Action: Amend procedure: OPS_PRE_002562 LPG Storage, Loading & Transfer - Initial Start-Up - Offloading Mode to change hot gas temperature from 2-3deg to + 20deg

Responsible party: Marine Terminal Manager

Completion date: 30 Sept 2019

Action: Developed an Ice register detailing varying operational modes and locations where ice is forming, and the associated risk and controls.

Responsible party: Offshore HSSE advisor

Completion date: Completed and ongoing (Register developed. Register being used)

Action: Conduct study into permanent protection options against ice formation and falling across the facility.

Responsible party: Lead Structures Engineer

Completion date: 31 October 2019

Immediate cause/s	piece of ice fell from LPG loading arm
Root cause/s	
Root cause description	

Duty inspector recommendation	
Date	25/07/2019
Duty inspector	
Recommendation	Do not conduct Major Investigation
Reasoning	Does not meet MI threshold based on information received
Supporting considerations	

Major investigation decision	
Date	29/07/2019
Decision	Do not conduct Major Investigation
Reasoning	Does not meet MI threshold based on information received
Supporting considerations	This incident does not meet the threshold for a major investigation but is nonetheless considered quite serious and a high potential dangerous occurrence.

Non-major investigation review and recommendation	
Date	01/08/2019
Inspector	[REDACTED]
Risk gap	Moderate
Type of standard	Established
Initial strategy	Investigate

Recommended follow up strategy	
Recommended strategy	Investigate ASAP
Supporting considerations	<p>The inspectors [REDACTED] were at the Prelude Facility at the time of the incident, for inspection 1990. The estimated weight and height of the dropped object (ice) was 8.3 kg from 20 m and was a potential fatality according to the drops-online calculator. An individual was struck by the ice, but did not suffer significant injuries. A similar incident (NOPSEMA # 6025) was reported to NOPSEMA on 3 July 2018. Due to relevant incident history and the presence of the inspectors at the facility of the time of the incident, the follow up strategy was elevated to Investigate ASAP.</p> <p>The inspectors investigated the incident during inspection 1990. The results of that investigation will be reported in inspection report 1990.</p>

Non-major investigation decision	
Date	01/08/2019
RoN	[REDACTED]
RoN review result	Agree with recommendation
Strategy decision	Investigate ASAP
Supporting considerations	

Associated inspection	
Inspection ID	1990