

Notifiable incident

Incident ID [6159](#)

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	18/09/2019 02:05 AM (WST)
Notification date	20/09/2019 10:02 AM (WST)
NOPSEMA response date	20/09/2019 10:32 AM (WST)
Received by	[REDACTED]
Nearest state	WA
Initial category type <i>(based on notification)</i>	Dangerous Occurrence
Initial category <i>(based on notification)</i>	Damage to safety-critical equipment
3 Day report received	23/09/2019
Final report received	21/10/2019
All required data received	21/10/2019
Final category type <i>(based on final report)</i>	Dangerous Occurrence
Final category <i>(based on final report)</i>	Damage to safety-critical equipment
Brief description	OHS-DSCE-Blowdown performance standard not met on two units
Location	Process deck
Subtype/s	Facility integrity
Summary <i>(at notification)</i>	<p>Operator advised that following the ESD on 18/09/19 as part of the procedures for start up the blowdown times for the facility were analysed.</p> <p>The timings on two units 11000 (Asset Gas Recovery Unit) and 13000 (Molecular Sieve) were not as per the performance standards. The BDV's for each unit operated but further checks are being done as part a statement of fitness process. The units will remain shutdown.</p>
Details <i>(from final report)</i>	<p>Operator advised that following the ESD on 18/09/19 as part of the procedures for start up the blowdown times for the facility were analysed.</p> <p>The timings on two units 11000 (Asset Gas Recovery Unit) and 13000 (Molecular Sieve) were not as per the performance standards. The BDV's for each unit operated but further checks are being done as part a statement of fitness process. The units will remain shutdown.</p> <p>** As Supplied by Duty Holder**</p> <p>As part of the pre-start-up assurance of the EDP against Performance Standards, it was found that the emergency depressurisation for Unit 11000 and Unit 13000 did not meet the performance standard (de-pressure to 7 barg within 15 minutes). The emergency depressurisation times were 20 and 21 minutes respectively.</p> <p>Work or activity being undertaken at time of incident: Facility ESD2/EDP on confirmed detection of gas at 3S1 main deck</p>

What are the internal investigation arrangements? Investigation initiated and additional testing

Action taken to make the work-site safe: Facility remains shut-down pending investigation

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

Action: Retesting of Emergency depressurisation for Unit 11000 against the performance standard.

Responsible: Production Coordinator. Completion Date: Completed

Action: Review of operational modes to ensure meet the EDP PS for these zones. Responsible:

Production Manager. Completion Date: 24/09/19

What were the immediate causes of the incident? Further investigation is ongoing to understand why EDP for these units did not occur within the performance standard time.

**** As Supplied by Duty Holder****

Root cause analysis:

Root cause 1 Complicated modelling of blowdown for multi-bore restriction orifices (selected for AIV reasons).

Root cause 2 Previous bad actor valves identified during the N2 EDP were punched and previously considered resolved. However, for 110UZV-2811, this wasn't the underlying cause.

Root cause 3 Locked open valve found closed after de-isolation (around the regeneration compressor).

Full Report:

Following the emergency depressurisation event, a task-force was assembled to fully understand the causes behind the discrepancy of blowdown timings.

Offshore Activities:

As a result of the residual uncertainty around 110UZV-2811, a repeat blowdown test was performed (of the U-11000 unit) to ensure that the valves opened in accordance with expectations.

Onshore Activities:

Investigation undertaken involved Technical Safety, Operations, Process engineering, the SCE owners and contractors (for modelling input).

The investigation focused on the modelling of the blowdown system, the resolution of the previous punches on the valves. The model was checked for a number of blowdown sections. The accuracy of the blowdown model is dependent on a number of factors which are technically complex:

- i) Measurement accuracy
- ii) Valve opening timing
- iii) Volume estimation accuracy – including degassing / internals volume interactions
- iv) Restriction orifice/Valve pressure-flow predictability
- v) Initial temperature

The detailed investigations with the restriction orifice vendor showed that there were some discrepancies between the pressure-flow curve at lower pressures (i.e. the flowrate matched at the initial pressure, but not lower down the curve). The selection of multi-bore restriction orifices is from their improvement in noise performance. However, flow-pressure prediction is more complicated. Although the RO performance had been checked at the initial starting pressure, some discrepancies had been found at the lower end of the pressure-flowrate curve.

Given the above findings, the engineering team were assigned the task of documenting the necessary longer-term improvements. These activities have been completed and include the following tasks:

Using the original models, calculating the necessary flowrate to revert the blowdown time of 15 mins. U11000 and U13000 fall into one particular module and this module depressurisation was not the governing case for the flare headers and tip. However – a number of specific checks have been completed:

- Hydraulic assessments on the flare piping in question. (incl FIV, AIV, Mach number checks).
- Engagements with contractors and vendors to confirm the system can accommodate the increased flow capacity from the two units (11000 and 13000).
- Engagement with suppliers to determine availability of larger bore restriction orifices and larger low-noise trim valves was part of the process.

- Procurement has been raised for the necessary replacement parts and the installation timing of the hardware will be at the first relevant opportunity. The timing will be dependent on the operational risk assessment (to be separately transmitted to NOPSEMA).

In reference to discussion with NOPSEMA 16th October, an operational risk assessment document will be sent to NOPSEMA prior to reverting to normal operating pressure. This will be shared in the near future.

Actions to prevent recurrence of same or similar incident:

Complete review of the locked valves on the facility to ensure all in expected position. Responsible Party - Operations. Completion Date - Prior to restart note that the start-up was delayed by 24hrs to complete these checks. Completed

Restarted operation in LP mode (at significantly reduced throughput) as a mitigation – as a known mode of operation which would meet the prescribed blowdown time. Responsible - Operations. Completion Date - Completed

Review of blowdown model and discussion with vendors to understand the potential causes of modelling discrepancies. Responsible - Prelude Project (through Contractor). Completion Date - Completed

The design and procurement of larger restriction orifices and one low-noise trim valve in order to increase flowrate. Responsible - Engineering. Completion Date - Completed

Installation of the larger restriction orifices and one low-noise trim valve. Responsible - ██████████ ██████████ Completion Date - First relevant opportunity (as defined by operational risk assessment).

Immediate cause/s	TBC
Root cause/s	
Root cause description	<p>Root cause 1 Complicated modelling of blowdown for multi-bore restriction orifices (selected for AIV reasons).</p> <p>Root cause 2 Previous bad actor valves identified during the N2 EDP were punched and previously considered resolved. However, for 110UZV-2811, this wasn't the underlying cause.</p> <p>Root cause 3 Locked open valve found closed after de-isolation (around the regeneration compressor).</p>

Duty inspector recommendation

Date	20/09/2019
Duty inspector	██████████
Recommendation	Do not conduct Major Investigation
Reasoning	Does not meet MI threshold based on information received
Supporting considerations	

Major investigation decision

Date	20/09/2019
Decision	Do not conduct Major Investigation
Reasoning	Does not meet MI threshold based on information received
Supporting considerations	

Non-major investigation review and recommendation

Date	20/09/2019
Inspector	██████████
Risk gap	Moderate
Type of standard	Established
Initial strategy	Investigate

Recommended follow up strategy	
Recommended strategy	Investigate
Supporting considerations	At the previous ESD event in June 2019, Shell reported that the facility B/D operated within the performance standard (to 690 kPa in < 15 mins), however this time (September 2019) Shell reported that the sections of the plant in question have blown down to 690 kPag in 20 minutes versus the performance standard of 15 minutes. This could be for multiple reasons to be determined, including assumptions regarding starting conditions of B/D (pressure, temp, Molecular weight etc.) or slow valve response time. Shell are investigating the cause. Resolution of the cause and potential repair should be followed up at the next inspection.

Non-major investigation decision	
Date	23/09/2019
RoN	
RoN review result	Agree with recommendation
Strategy decision	Investigate
Supporting considerations	

Associated inspection	
Inspection ID	2051