INTERNAL USE ONLY

Notifiable incident

Incident ID	6128
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	01/09/2019 12:17 PM (WST)
Notification date	06/09/2019 01:18 PM (WST)
NOPSEMA response date	06/09/2019 01:53 PM (WST)
Received by	[redacted]
Nearest state	WA
Initial category type *(based on notification)*	Dangerous Occurrence
Initial category *(based on notification)*	Damage to safety-critical equipment
3 Day report received	06/09/2019
Final report received	27/09/2019
All required data received	27/09/2019
Final category type *(based on final report)*	Dangerous Occurrence
Final category *(based on final report)*	Damage to safety-critical equipment
Brief description	OHS - DSCE - Riser UZV Valve did not fully close on demand
Location	Turret
Subtype/s	Valve failure
Summary *(at notification)*	Conducting testing on riser valves. Valve UZV 7505 on riser 5 did not fully close on demand Riser 5 is shut in and out of service while further testing and inspection is ongoing Late reporting is due to miss-communication of failure which was initially reported as change in valve limits. Once it was understood that the root is unknown notification was made Investigation ongoing 3 day report to follow
Details *(from final report)*	Conducting testing on riser valves. Valve UZV 7505 on riser 5 did not fully close on demand Riser 5 is shut in and out of service while further testing and inspection is ongoing Late reporting is due to miss-communication of failure which was initially reported as change in valve limits. Once it was understood that the root is unknown notification was made Investigation ongoing 3 day report to follow ** As Supplied by the Operator** As three of the risers were being closed in for the pit-stop shutdown, the riser ESD valves were tested (first valve downstream of the riser). During the test on 086UZV-7505, it is understood that this valved failed to close.

On the initial test, the feedback to the DCS was ‘undefined’, i.e. not ‘closed’, and in the field the valve position indicator showed it as being at 20%. After subsequent attempts to close the valve resulted in the same response, and the hydraulics were verified as functional, an issue with the position indicator was suspected. The position indicator was adjusted, then the valve was tested again and shown to close fully within the required time and passed its leak off test – demonstrating that it was actually fully closed.

Testing 086UZV-7505

Shell is conducting an investigation to understand if and why 086UZV-7505 did not close on demand. In particular, staff are being interviewed to understand exactly what happened, and valve hydraulics are being investigated to determine whether they truly functioned as intended.
In case further testing of the valve is conducted, extra mitigations will be in place, e.g. ensuring ESDV immediately downstream of 086UZV-7505 if closed.
Criteria to allow 086UZV-7505 back into service is not yet confirmed.

No loss of containment.

Action taken: Riser was already being taken out of service as preparation for the pitstop. UZV immediately downstream of 086UZV-7505 was already closed.

Immediate causes of incident: The cause of the valves’ failure to close is still being investigated.

As Supplied by Duty Holder

Immediate action taken/intended, if any, to prevent recurrence of incident - Per MOPO, production through riser upstream of 086UZV-7505 to remain out of service until 086UZV-7505 is confirmed as functional. OIM 6/9/19 (completed)

Root cause 1 - With no current limiting protection in-line with the proximity reed switch, degradation of the reed switch occurred due to surge current caused by discharging cable capacitance.

Full Report:

Technical investigation and causal reasoning investigation completed by Prelude onshore engineering investigation team. Investigation was to determine why the valve position monitor failed to indicate the true state of the valve following an ESD event. This investigation was conducted in accordance with Shell 5 Causal Reasoning questions investigation process.

Initial Observations: Riser 5 ESD valve was manually closed as part of a leak-off test and was expected to close within the prescribed 14 second time period. The valve position monitor feedback to the DCS indicated “Undefined”. Therefore, the actual valve closing time was not confirmed. The valve was opened and closed a number of times and demonstrated to function, however, feedback from a mechanical technician gave doubt that the valve actually closed on initial demand.

Investigation: Investigation determined that the Valve and Actuator mechanical equipment was working as per design and ‘Leak Off Tests’ confirmed that the internal integrity of the valve had not been affected.

The investigation included a check of the hydraulic control circuit, components and media to confirm that they were operating as per design. The cleanliness of the hydraulic oil was confirmed through laboratory analysis. No integrity issues were identified. This included the actuator motion box and internals.

The position indicator monitor has clearly been identified as the cause of the intermittent and inconsistent feedback readings to the DCS. With no current limiting protection in-line with the switch, degradation of the proximity reed switch due to surge current caused by discharging cable capacitance has occurred upon every change in state (i.e. every switch activation). The switch is therefore degrading slowly over time. This was confirmed by internal resistance readings taken from the defective switch.

All Riser ESD valve position indicator monitors will be replaced with modified units at the earliest opportunity. As part of these replacements, Riser ESD tests are planned to be conducted at the same time to confirm the reliability and integrity of the feedback signals.
Investigations have determined that there is no evidence of any other issue with the valve, actuator or hydraulic control system components. Since the initial uncertainty of the valve closure, the valve

	has been confirmed closed on every demand, including the recent trip on 18/9/19. Actions to prevent recurrence of same or similar incident: Action 1: Replace all existing internal reed switches and cams with like for like replacements (086UZV-7505) to ensure that correct valve position and timing is achieved.Responsible - Offshore INLEC. Completion Date - 20 September 2019. Action 2: Install the new position monitors on all RESDVs and test all RESDVs to satisfy the performance criteria. In the current plan, subsea works will create an opportunity for each RESDV between Oct 2019 and Feb 2020. Responsible - Maintenance Coordinator. Completion Date - 1 April 2020. Action 3: Engineering to evaluate all remaining cable run lengths where these valve position monitors are installed to confirm whether the cable runs exceed the maximum length of 50 metres as recommended by the manufacturer. Implement replacement plan to change out all identified units. Responsible - Snr Inst Engineer. Completion Date - 29 November 2019
Immediate cause/s	TBC
Root cause/s	
Root cause description	Root cause 1 - With no current limiting protection in-line with the proximity reed switch, degradation of the reed switch occurred due to surge current caused by discharging cable capacitance.

Duty inspector recommendation	
Date	11/09/2019
Duty inspector	[redacted]
Recommendation	Do not conduct Major Investigation
Reasoning	Does not meet MI threshold based on information received
Supporting considerations	

Major investigation decision	
Date	11/09/2019
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	11/09/2019
Inspector	[redacted]
Risk gap	Moderate
Type of standard	Established
Initial strategy	Investigate

Recommended follow up strategy	
Recommended strategy	Investigate
Supporting considerations	Similar valves including the riser base isolation valves have had similar issues. Root cause is unknown. Moderate risk gap.

Non-major investigation decision	
Date	11/09/2019
RoN	[redacted]
RoN review result	Agree with recommendation
Strategy decision	Investigate
Supporting considerations	

Associated inspection	
Inspection ID	2051