

Notifiable incident

Incident ID [6127](#)

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	02/09/2019 08:15 AM (WST)
Notification date	05/09/2019 05:45 AM (WST)
NOPSEMA response date	05/09/2019 07:21 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	05/09/2019
Final report received	27/09/2019
All required data received	27/09/2019
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 - UZV Shut down valve failed to close on demand
Location	Process deck
Subtype/s	Valve failure

Summary
(at notification)

> Facility OIM reported the following occurrence at the Prelude FLNG facility:

- Prelude facility is on a partial shutdown stage whilst the "warm" side of the facility still operational as part of a planned shut down;
- as part of this, it was required to run the LNG vaporiser unit to provide backup fuel gas if required;
- during the operation of the unit, this one tripped three times (being the first one on 2 Sep 2019 @ 08:15 hrs) due to what appears to be a problem with logic controls with the unit;
- the vaporiser trip (s) initiated the local shut down of the unit;
- on inspection of the vaporiser unit it was identified that one of the UZV valves in the system have failed to close on demand during the trip;
- the line in question is a liquid low pressure line which feeds the vaporiser with liquid LNG so it can be vaporised into gas;
- risk assessment (RA) has been completed by Shell support base and confirmed that equipment was safe to operate with the second UZV in that line and all protective functions on the system still operational;
- OIM explained to duty inspector that failed UZV was the nominated SCE in the system whilst the other UZV was not, but with the redundant UZV being identical, the other valve has not being nominated the SCE until such time the faulty UZV is back in full service;
- in addition, testing frequency on remaining UZV will be set to 6 monthly intervals to confirm performance on that valve until the other UZV can be reactivated;
- vaporiser unit has been re-started and is operational;
- Shell has raised an internal incident notification and a 3 day report to NOPSEMA will follow as well;
- tag name for failed UZV valve is 340-UZV-2342 located in 2P modules.

Details
(from final report)

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- tag name for failed UZV valve is 340-UZV-2342 located in 2P modules.

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

Brief Description: The LNG Vaporiser canned pump (P-34009), is used for intermittent supply of liquid LNG to the LNG vaporiser (E-34021) to create defrost gas, fuel gas or gas to pressurise or sweep the flowlines. The pump experienced a high level which activated a SIL1 SIF (34025). The purpose of the SIF is to avoid carry-over of LNG from the pump vent to the LNG vapour header, because the line is not designed for 2-phase flow and in case of rupture could result in single fatality. This SIF activated successfully, but it was found that one of the final elements, valve 340UZV-2342, did not close.

340UZV-2342 is in a 1oo2 configuration with adjacent upstream valve, 340UZV-2341, which closed successfully on demand. These valves are at a distance of 1.5m from each other on the same line and are configured to close together, they have the same functionality.

These valves are final elements on 5 separate SIFs associated with P-34009 and E-34021. Four of the SIFs are SIL 1 and these only required a SIF architecture of one valve on this line, including SIF 34025 that tripped. However, the fifth SIF is SIL2, and installing the two valves in series was intended to

enable reduced testing frequency of these valves.

The SIL 2 SIF is number 34016 and is initiated by a TZALL to avoid low temperatures in the piping downstream of E-34021. Low temperature could lead to loss of containment and potentially single fatality.

It is understood that 340UZV-2342 was added to the design to reduce the test frequency for 340UZV-2341, however, since the vaporiser is online only infrequently, a relatively high test frequency is actually acceptable from a production perspective. Note also, that the other final element for this SIF, that isolates a second source of LNG to the vaporiser (parallel to line with UZV-2341/2), is only 1oo1 configuration.

P-34009 and E-34021 are currently offline. They remain on standby to restore fuel gas to the boilers in case the normal supply of fuel gas fails.

Work or activity being undertaken at time of incident: Supplying LNG to LNG vaporiser for fuel gas to the boilers.

What are the internal investigation arrangements? Shell is conducting an investigation to understand why 340UZV-2342 did not close on demand.

Was there any loss of containment of any fluid (liquid or gas)? No

Action taken: The SIF protecting the vaporiser pump successfully prevented the hazard, despite 340UZV-2432 failing to close, because 340UZV-2341 closed.

Immediate action taken/intended, if any, to prevent recurrence of incident. Increase testing frequency of 340UZV-2341 to 6 monthly full function test and confirm this restores SIF 34016 to SIL2 integrity. Responsible Party - Maintenance Support Engineer. Completion Date: 4 October 2019

No an emergency response initiated.

Immediate causes of the incident: The cause of the valves' failure to close is still being investigated. Due to the unique configuration of having two valves on this line that are in intermittent use, the system was brought back online without repair of the valve. In addition, the adjacent 340UZV-2341 valve was successfully demonstrated to close during the trip, so its functionality was assured.

Root cause analysis:

Root cause 1 - An increase in demand on the actuator due to excessive friction

Root cause 2 - The excessive friction is a product of the presence of construction debris, preservation lubrication and/or water

Full Report:

An RCA has been conducted on similar PetroValve UZV On-Off Ball Valves installed on Prelude, using causal analysis via a Cause & Effect Tree.

The RCA was facilitated by Mechanical Static Engineer.

The observations of failure modes in the RCA are similar to the failure modes that prevented 340UZV-2342 from closing on demand. The failure modes were due to debris and fluid present in the valve body.

Additionally, it was determined that 340UZV-2342 was added in series to the design to reduce the test frequency for 340UZV-2341 (both valves in line approximately 1.5m apart). However, since the vaporiser is online infrequently, a relatively high test frequency for 340UZV-2341 is actually acceptable.

340UZV-2342 is not required to act as a Safety Critical valve and shutdown on demand, 340UZV-2341 can perform the required safety critical function. Therefore, this line can remain as it is with 340UZV-2342 in the open position acting as a spool piece.

A full assessment of the specific failure mode of 340UZV-2342 cannot be made until the valve is removed from service (spool piece installed) and sent onshore for strip down and assessment.

Actions to prevent recurrence of same or similar incident - Remove 340UZV-2342 from service, strip down and perform an RCA. Replace with a spool piece while the valve is being serviced. Responsible - Lead Support Engineer. Completion Date - 20 December 2020

Immediate cause/s

UZV valve on vaporiser unit failed to close on demand

Root cause/s	
Root cause description	Root cause 1 - An increase in demand on the actuator due to excessive friction Root cause 2 - The excessive friction is a product of the presence of construction debris, preservation lubrication and/or water

Duty inspector recommendation

Date	05/09/2019
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	05/09/2019
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	06/09/2019
Inspector	[REDACTED]
Risk gap	None
Type of standard	Established
Initial strategy	Inclusion in annual stats/data analysis

Recommended follow up strategy

Recommended strategy	Investigate
Supporting considerations	<p>Valve failure is part of a 1oo2 arrangement and a SIL 2 SIF protecting from a single fatality. Claim that 2 valves are required to justify reduced testing frequency and the 1 valve (current situation) can be justified with increased testing frequency.</p> <p>In principle this is a reasonable approach if increasing frequency still assures SIL 2 reliability, however a number issues seem apparent. Typically these valves can be quickly repaired and return to service, why is this not the case in this instance? It seems that second valve might not have been designated SCE in the CMMS, meaning the proof testing may be given lower priority without deferral procedures if needs to be delayed. There seems to be a few failures of a similar nature. What does this mean for the reliability of other valves and why are there no provisions for quick repair.</p>

Non-major investigation decision

Date	06/09/2019
RoN	[REDACTED]
RoN review result	Agree with recommendation
Strategy decision	Investigate
Supporting considerations	

Associated inspection

Inspection ID	2051
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