Notifiable incident

Incident ID	6308
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	18/12/2019 12:00 AM (WST)
Notification date	18/12/2019 12:00 AM (WST)
NOPSEMA response date	18/12/2019 12:00 AM (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	09/01/2020
Final report received	17/01/2020
All required data received	23/01/2020
Final category type *(based on final report)*	Dangerous Occurrence
Final category *(based on final report)*	Damage to safety-critical equipment
Brief description	OHS-DSCE-Relief valves fitted with plugs in vent ports
Location	Process deck
Subtype/s	Valve failure
Summary *(at notification)*	Operator advised that during routine maintenance and testing of 1 of 4 relief valves on the mixed refrigeration unit it was found to be fitted with a plug in the vent port preventing pressure relief as per design. The valve was last certified in 2017. The system pressure is approx 30 bar with the relief valves set at 60 bar. The remaining three valves were checked and one other valve was found to have a vent in its vent port. This valve was replaced. The system was reinstated with 3 of 4 valves as required by design. There are 110 valves of this type on the facility and 104 of these were checked (not tested). Of these 4 additional plugs were identifed in two systems which are not currently in service as are required at end of field life only. A full investigation is to be conducted by Shell.
Details *(from final report)*	Operator advised that during routine maintenance and testing of 1 of 4 relief valves on the mixed refrigeration unit it was found to be fitted with a plug in the vent port preventing pressure relief as per design. The valve was last certified in 2017. The system pressure is approx 30 bar with the relief valves set at 60 bar. The remaining three valves were checked and one other valve was found to have a vent in its vent

port. This valve was replaced.

The system was reinstated with 3 of 4 valves as required by design.

There are 110 valves of this type on the facility and 104 of these were checked (not tested). Of these 4 additional plugs were identifed in two systems which are not currently in service as are required at end of field life only.

A full investigation is to be conducted by Shell.

** as supplied by duty holder **

6. Brief description of incident -
What happened:
Activity being undertaken: Normal plant operations
What happened:
- Pilot operated relief valve 140-RV-1034A failed to lift during planned recertification in the workshop on 16/12/19. RV is one of four RV's on the MR compressor discharge line of which three must be lined up at all times to provide relief capacity as per design.
- Cause of failure to lift identified as a plug fitted in the pilot exhaust port. Plug was removed from pilot exhaust port and RV functioned as intended. RV reinstated in field 17/12/19 (but not lined up).
- On inspection of three remaining RV's on MR compressor discharge at 15:10 on 18/12/19, it was found that 140-RV-1034B also had a plug fitted in the pilot exhaust port. 140-RV-1034C and 140-RV-1034D did not have plugs in the pilot exhaust port.

7. Work or activity being undertaken at time of incident - Normal Production Operations

8. What are the internal investigation arrangements? - Initial 5 Causal Reasoning Investigation

15. Action taken to make the work-site safe -
- At 16:32 on 18/12/19, 140-RV-1034A was brought online and 140-RV-1034B was taken offline. This brought the MR compressor discharge line back to design status with three RV's lined up in service without plugs in the pilot exhaust port
- Confirmation received from Static Mechanical TA that plug in pilot exhaust port impairs functionality of the RV.
- Facility survey of all pilot operated RV undertaken

21. Immediate action taken/intended, if any, to prevent recurrence of incident. -
Action -
- All operations with potential to impact stability of plant suspended
- All 110 pilot operated RV's on Prelude to be visually inspected immediately to confirm no plug in pilot exhaust port
111 plugs were checked.
• 6 outstanding as under insulation
• 5 found to have plugs and removed from service
- 100 ok as per design
Responsible party - Prelude Production Coordinator
Completion date - Completed

Action - - Detailed Investigation
Responsible party - Perth House engineering
Completion date - Open

22. What were the immediate causes of the incident? - Plug in pilot exhaust port (note no incident classified as "unsafe condition" as per internal Shell reporting guidelines

Has the investigation been completed? Yes

Root cause analysis:
Root cause 1 - Relief valves are sometimes supplied from the factory with drain/exhaust plugs to protect the pilot during painting or from debris ingress during storage. OR Plugs may have been installed ad-hoc in the facility during project construction and completions phase.
Root cause 2 - The installation check sheet for the relief valves did not include a specific check on the pilot drain/exhaust in the open/unplugged condition.
Root cause 3 - Knowledge gap on drain configuration requirements for the pilots during project completions phase.

	Full report: Describe investigation in detail, including who conducted the investigation and in accordance with what standard/procedure with reference to attachments listed in the 'attachments table' (following) as applicable Pilot operated relief valve 140-RV-1034A failed to lift during planned recertification in the workshop on 16/12/19. Cause of failure to lift identified as a plug fitted in the pilot exhaust port. Plug was removed from pilot exhaust port and RV functioned as intended. RV reinstated in field 17/12/19 (but not lined up). On inspection of three remaining RV's on MR compressor discharge at 15:10 on 18/12/19, it was found that 140-RV-1034B also had a plug fitted in the pilot exhaust port. 140-RV-1034C and 140-RV-1034D did not have plugs in the pilot exhaust port. 111 pilot operated valves which require open pilot drain/exhaust ports were surveyed and completed on the 20th of January finding and additional 4 relief valves with blocked drain ports 100RV-1057, 100RV-1257, 160TRV-4004 and 160TRV-4005. 100RV-1057 and 100RV-1257 were safely isolatable and removed from service immediately. Bypass overrides were placed on the other two to mitigate the blocked-in case and notifications raised for recertification. A causal reasoning (CR) investigation was carried out by an Onshore Asset team with information sought from offshore, project and vendor personnel. The investigation team included: • Mechanical engineer • Maintenance Engineer • Mechanical Static Lead Findings of the CR identified the plug found in the relief valve 140RV-1034A had been installed prior to its 2017 calibration and was reinstated after this calibration as evidenced by project completions check sheet and punch data. The findings of the CR investigation are similar for the other 5 RV's found after the asset wide survey with evidence showing the plugs had been installed prior to their recertifications in the offshore project phase. The installation date of the plugs on the RV outlets is unknown however it is possible in some cases these plugs were installed by the manufacturer for painting or debris ingress protection in transit. Interviews with the project completions team indicates they were aware some valves were shipped with plug in the drain/exhaust ports however had provided instructions to have these removed on the installation inspections. Despite this not all plugs were removed as there were no specific checks on pilot drain/exhaust openings in the BC-I-11 relief valve check sheet, which was a project phase visual inspection after installation. This is evidenced with clear traceability of 4 relief valves tested in the project phase and reinstated with the drain plugs reinstalled and punches raised questioning the drain configuration. In addition, the team indicated that there was no ability to control random application of plugs The investigation found the following root causes of the plug installation in the relief valves: 1. Relief valves are sometimes supplied from the factory with drain/exhaust plugs to protect the pilot during painting or from debris ingress during storage. During the construction phase the factory calibration was accepted and valves were installed as received. 2. Plugs may have been installed ad-hoc in the facility. 3. Knowledge gap on drain configuration requirements for the pilots during project completions phase. 4. The installation check sheet for the relief valves did not include a specific check on the pilot drain/exhaust in the open/unplugged condition. Note: For newly procured pilot operated relief valves on Prelude FLNG, manufacturers have been informed that they are not to be supplied with plugs installed and the team preforming recertification have been requested to ensure no plugs are installed. Actions to prevent recurrence of same or similar incident: Action - Survey all similar configuration pilot operated relief valves for plugs. Responsible - Prelude Maintenance Coordinator. Completion Date - Complete Action - Update Contractor Pressure Relief Device Testing Work Instruction (Shell Doc Number: 2000-4513346016-H05-00001 Contactor Doc Number: VM-OPS-WFS-WI043) to include pilot drain/exhaust plug check. Responsible - Mechanical Static Lead. Completion Date - 31/03/2020 Action - Update In-service External Visual/ Commissioning Inspection Check List in TEC_PRE_009996 to include specific check on pilot drain/exhaust port (BC-I-11 check sheet is not used by Prelude Asset). Responsible - Mechanical Static Lead. Completion Date - 31/03/2020
Immediate cause/s	TBC

Root cause/s	
Root cause description	Root cause 1 - Relief valves are sometimes supplied from the factory with drain/exhaust plugs to protect the pilot during painting or from debris ingress during storage. OR Plugs may have been installed ad-hoc in the facility during project construction and completions phase. Root cause 2 - The installation check sheet for the relief valves did not include a specific check on the pilot drain/exhaust in the open/unplugged condition. Root cause 3 - Knowledge gap on drain configuration requirements for the pilots during project completions phase.

Duty inspector recommendation	
Date	19/12/2019
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	19/12/2019
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	19/12/2019
Inspector	[redacted]
Risk gap	Substantial
Type of standard	Established
Initial strategy	IInvestigate within 45 days

Recommended follow up strategy	
Recommended strategy	Investigate within 45 days
Supporting considerations	Consequence - serious process event, potentially leading to injuries / fatalities. Likelihood - benchmark - nil/negligible, rising to remote. Risk gap - substantial. Standard - established as per SoV and safety case. Recommend investigate within 45 days.

Non-major investigation decision	
Date	19/12/2019
RoN	[redacted]
RoN review result	Agree with recommendation
Strategy decision	Investigate within 45 days
Supporting considerations	Agreed.

Associated inspection	
Inspection ID	2134