

Risks in facility build quality and project handover

What happened?

Numerous hydrocarbon release incidents occurred during the start up and early phase of operations for a new facility. These incidents caused production losses and increased risk to people on board.

The incidents clearly demonstrate the need for a robust project management system (PMS) during a project. The PMS for this project did not adequately cover the project specifications, material selection, quality assurance, punch listing¹ and formal acceptance at project handover. The following is a summary of some of the failures that occurred:

1. Deficiencies in the make-up of pipe flanges and components. These deficiencies included:
 - unevenly torqued stud bolts in high pressure gas lift and gas compression piping;
 - incorrect sized studs found in a gas sampling spool;
 - loose body plugs found in gas compression system Shut Down Valve (SDV);
 - incompatible piping system materials;
 - leakage found in a pilot valve for a Pressure Safety Valve (PSV);
 - no traceable records for repairs conducted during the project.
2. Instrument tubing failures included:
 - cracked stainless steel tubing in a high pressure gas system transmitter due to poor construction quality and practices;
 - other failures due to a combination of over tightening, vibration fatigue and the tubing material not conforming to the specification.
3. Piping system punch list deficiencies included:
 - shipping line stops left in the small bore fuel gas piping connected to the high pressure flare header. This caused excessive stress loading in the piping which eventually caused the pipe to fail;
 - numerous spring supports left un-commissioned in the turret piping downstream of the swivel stacks. These were discovered after a period of production.

What went wrong?

All of these incidents resulted in gas releases. The most significant incident resulted in the loss of the high pressure flare header which is a safety critical system. This was caused by the failure of the fuel gas piping.

The following project management failures contributed to or failed to prevent the occurrence of these incidents. These failures included:

¹ System punch listing is a compilation of system deficiencies and / or incomplete work to be addressed by a project team or an operation team. Punch lists are generated based on site verification at project handover.

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- the required specifications and engineering standards were not established for equipment packages and equipment items;
- the quality control and commissioning checks were not effective. This process should have identified any defects before the handover. Examples of this included:
 - 'as-built' piping system line walks were not checked against the piping design intent using both piping isometric and stress isometric drawings;
 - the commissioning checks did not reveal some system defects. These included defects in the mechanical completions, the presence of faulty parts, incorrectly made up flange joints and the presence of shipping restraints;
 - the handover process between the project management and operations was inadequate regarding the keeping of records, the documentation of the management of change and the documentation of repairs carried out during the project.

Key Lessons

While there are lessons specific to each of the incidents that occurred, the following key lessons were common to all of the incidents:

- the project specifications must be established and approved at the start of the project in order to define the system requirements in sufficient detail;
- quality control inspections must be thorough during the installation and commissioning phases of the project. These inspections should include a comprehensive system of punch listing and rigorous system of verification and close-outs. These inspections will verify that the piping and equipment meet the approved specifications and the design intent;
- every field change or repair made during the construction, installation and commissioning phases of the project must be traceable and executed as an approved change or as an authorised work pack;
- commissioning and start-up procedures must be thorough. The procedures should enable verification that all pre-operational supports or restraints such as shipping locks are released from their spring supports or have been removed - piping system responses should be regularly monitored both during and after start up;
- commissioning and start-up activities should include, but not limited to, a thorough process of control-loop tuning and optimization of operational parameters that, if not addressed, may lead to loss of containment from flanges, mechanical seals and small-bore fittings;
- the operations workforce should be engaged as early as possible in the project to enhance their familiarisation with the facility and its systems. They should also be involved in the development of operational procedures;
- the operations workforce should be involved in the commissioning activities. In particular, they should be involved in the quality checks carried out after each system has been completed.



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NATIONAL OFFSHORE PETROLEUM SAFETY AUTHORITY

SAFETY ALERT 21

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Facility operators, and persons in charge of work activities for the relevant stage of the life of the facility, should review their work practices and the handover arrangements to ensure that the facility is safe (will be safe) and without risk to health.

Contact

For further information email alerts@nopsa.gov.au and quote Alert 21.