Verifying the safe design of an offshore expansion project

Sustaining safe and environmentally responsible assets is a major consideration for owners and operators of major accident hazard process plants. This requires assets which have been competently designed in accordance with appropriate standards and good engineering practices.

The client was delivering an expansion project that consisted of the installation of four new subsea wells. The production from the four new wells was routed through a subsea manifold and then onto the main platform through a 12” pipeline. A new crossover pipeline was also being installed to allow the increased production to be routed to additional separators.

Having completed a design safety review at an earlier phase of the project ABB was asked to verify that the process design was safe and to identify any flaws in the approach, detailed calculations or design that required rectification before start-up.

This was a critical part of the project and had to be completed in a short timescale before start-up.

Solution

ABB has supplied process safety verification services to a number of leading oil and gas companies and has developed a methodology of design verification for process safety. This project used the client’s own procedures, international standards and recognised good practice to assess the project design data against a consistent set of criteria. The safety critical design activities assessed included:

- Process safeguarding
- Design philosophies
- Relief and blowdown design
- Critical interfaces
- Layers of protection
- Hazard identification / assessment

The design verification methodology confirms that the detailed documentation and calculations supporting the requirements of the client’s internal safety standards have been correctly performed and also establishes whether there are any specific design areas that are flawed or unsafe.
In broad terms the objective of the third party verification exercise was to confirm the following:

- That all design deliverables complied with international standards and any specific client specifications and philosophies
- Adequate layers of protection were being provided throughout the process
- That all calculations had been correctly conducted and an appropriate basis had been used
- That relief, flare / vent system design had been adequately assessed and specified
- Any conformances or non-conformances or flaws in approach, calculations or design had been recorded

Several safety issues were identified, for example; type of material being purchased (e.g. For certain pressure safety valve instrument types), poor recording of the HAZOP, poor definition of the consequences which could lead to errors being made as to whether safeguards were adequate, start up and shut down were not adequately addressed (within the HAZOPs), the make up of the team for HAZOP wasn’t as per customer’s internal company standards and accurate operating procedures were not developed.

27 findings came out of the report of which 2 had to be remedied prior to plant start-up.

The output of the verification detailed the assessments for each element of scope, gave key findings and recommended actions. Periodic meetings were held in order to avoid any surprises at the report stage, manage client expectations and prioritise action close-out properly.

In addition to assisting with the compliance review, ABB provided a risk ranking assessment of the non-conformances, allowing the client project management team to identify priorities, maximising effectiveness of their team and the risk mitigation processes.

“I can say that the findings listed in the report demonstrated the capability of the engineers involved and the commitment to the project and process safety. From a project management perspective the ones leading these efforts from ABB side demonstrated commitment to support my project team as needed, especially in those situations where time was a concern. Several of the findings helped to keep raising awareness of type of material being purchased (i.e. certain PSVs instrument type), competent personnel attending in HAZOPs and developing operating procedures.”

Client Project Engineering Manager

Benefits
- Potential process safety issues and design hazards were identified and mitigated
- Potentially expensive retrofitting of additional safeguards during later design or operation were avoided
- Gave an independent assessment of compliance, specifications, technical reports, calculations and drawings against client and international standards
- Identified design errors which required remedial action before start-up
- Provided an action plan for moving forward. Non-conformances ranked according to level of risk, minimising the impact on a constricted schedule and on stakeholders