

PHR revalidation



Using Process Hazard Review (PHR) revalidation for continuous improvement in process safety at Solutia.

Solutia UK Ltd (A wholly owned subsidiary of Eastman Chemical) operates a number of batch and continuous plants at the site in Newport, South Wales. They manufacture a range of products used as heat transfer fluids and in washing powders, floor coverings, safety windows and windscreens. The site is 'top tier' under the COMAH regulations due to storage and processing of a number of hazardous substances including Phosphorous Trichloride and Benzene.

In 2000 Solutia were faced with the requirement to prepare the first COMAH safety report for the site and the challenge of identifying all the credible major accident hazards and associated risk control systems. ABB was selected based on its' expertise in hazard identification and risk assessment. To ensure local ownership Solutia asked ABB to work with site engineering staff to develop their knowledge and competency. This allowed the safety report to be completed in-house giving ownership and facilitating updates on a 5-yearly cycle.

Solutia Inc., the US parent company, places requirements on the site to regularly update and revalidate the process hazards analysis. ABB was asked in 2006 to provide a re-validation of the PHR's carried out in 2000.

The standard ABB revalidation methodology needed to be adapted to meet Solutia requirements including an assessment of safety critical procedures. A further revalidation using the same approach was then requested in 2011, including detailed assessment of a selection of safety critical procedures using ABB's 'Human-HAZOP' methodology.

Solution

The initial requirement was to identify all the credible major accident hazards related to the storage and processing of COMAH dangerous substances, with the information then used by Solutia specialist staff to compile the site safety report. ABB advised the use of PHR on all the relevant plants, providing a time efficient and structured method to identify credible 'loss of containment' scenarios.

A series of PHR's covering all plants on the Newport site were carried out during 2000-2001, led by an ABB specialist with a team of experienced Solutia technical and operations staff. The scope meeting set the scene by gathering information on the systems to be included in the review, hazardous properties of substances, vulnerable locations on and off-site, emergency facilities, and the history of process safety incidents on the plant.

Using process P&ID's, team based sessions were carried out to identify potential 'loss of containment' events on each system on the plant. For each credible event, the severity was estimated, the existing risk controls measures for prevention and mitigation were identified, and the resultant likelihood and risk assessed using the standard Solutia risk matrix. The review was used to confirm that relevant good practice was being followed, and resulted in several recommendations for further assessment of hazards or improvements to risk control systems.

In 2006 ABB was asked to carry out a re-validation of the PHR's and had initial meetings with site management to agree the scope. The overall Solutia requirement was to check the completion of actions, assess concerns from further knowledge gained during the intervening period, assess the reliability of 'critical' procedural controls and consider any further risk reduction measures for major accident hazards. A methodology was developed using the same structured system-by-system approach. A key requirement was effective preparation for the review by both ABB and Solutia, ensuring that data was available so the review could be carried out efficiently.

The methodology used for the revalidation considered each process system and reviewed the following items; status of actions from previous review, learning from incidents on-site or elsewhere, thorough assessment of the implications of changes / projects, new knowledge on this plant, and any current operational issues. If the original PHR was considered inadequate the option was available to re-do the review, and this was used on one plant to assess a complex reaction sequence using a step-by-step batch HAZOP study approach.

During the 2006 PHR revalidations the opportunity was taken to carry out an ALARP (As Low As Reasonably Possible) demonstration of each COMAH scenario, using team expertise to consider any further risk reduction measures. These were either rejected as being impractical or the cost being grossly disproportionate, or put forward as options for implementation. Risk reduction measures involving operating staff were assessed as 'safety critical procedures'. An initial screening was carried out to check if these procedures were formally written, operators trained in their use, and whether it could be demonstrated that they were being effectively followed.



On a 5 yearly cycle to meet corporate requirements and to meet the need for 5-yearly reviews of the safety report, further PHR revalidations have been completed during 2011-12. These used the same methodology that was effective in 2006, building on the previous assessment and considering any new knowledge during the intervening period. The value of routinely reviewing and revalidating process safety assessments became more apparent during these studies, demonstrating the continuous efforts to drive down risks.

As part of the 2011 PHR revalidation, the opportunity was taken to trial ABB's 'Human-HAZOP' technique for safety critical procedures on a couple of activities for each plant. This broke the critical tasks into a series of key steps, then assessed the potential failures at each step and considered what improvements to the procedure or work environment could be taken to minimise the potential for error. These assessments were successful and will be followed up by Solutia as a general part of the process safety toolkit used on site.

Benefits

- Reduced risk of incident through effective identification of all credible major accident hazards
- Satisfied regulator COMAH safety report requirements
- Effective and time efficient methodology for periodic reviews of process safety hazards utilising the knowledge and experience of site based staff
- Continuous improvement in the control of process safety risks on the site, building in the learning based on new knowledge and experience
- Ensured the effective close out of actions raised during process safety studies