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Relief and depressuring verification - the missing link in the functional safety lifecycle?

Blog by Paul Dumain

Paul Dumain, Process Engineering Team Leader, ABB

In accordance with the IEC61511 safety lifecycle, phase 2 identifies the allocation of safety functions to ‘protection layers’ of either Safety Instrumented Systems (SIS) or ‘other technology’, which includes pressure relief and depressuring systems. However, whilst the standard recognizes that the assessment of ‘other technology’ safety related systems is included in the lifecycle, the relevant design guidance and technical requirements are to be found elsewhere. Eventually the two safety related systems of SIS and ‘other technology’ are brought together in the IEC61511 safety lifecycle at phase 5 (commissioning and handover phase). Whilst the current attention is on SIS, which is further reinforced by the current hot topic of cybersecurity, the equivalent requirements for relief and depressuring may not necessarily have the same focus and rigour applied.

Predominant ‘other technologies’

As part of overall safety, ‘other technology’ safety related systems will typically comprise relief and depressuring systems working in conjunction with other protection such as specific operating procedures as well as passive safety systems including fire walls and tank bunding. However, when it comes to functional safety for over and under pressure protection, the predominant ‘other’ safety system typically deployed will be the relief and depressuring infrastructure. Similar to the requirements of a SIS, a relief and depressuring design dossier should be developed for each system, detailing safety

requirements in accordance with relevant standards which can be used as the basis for subsequent detailed engineering and installation.

The missing link?

Experience suggests that inadequate initial design caused by a mis-understanding of best practice standards, coupled with limited hand-over of design calculations from the EPC contractor, means that many operating companies do not have a documented and robust basis of design for their relief and depressuring systems. This issue is exacerbated during the operating life of an asset due to initial relief and depressuring designs being lost over time, not being transferred between companies when assets change hands, or the impact of plant modifications not being adequately incorporated into relief and depressuring designs.

How to align relief and depressuring to the safety lifecycle

In alignment with the requirements for SIS, the organization responsible for relief and depressuring needs to have the following processes and pre-requisites in place to successfully bridge the gap between IEC61511 phase 2 and phase 5:

- An appropriate Functional Safety Management System (FSMS) in place
- A competency assurance program specific to the lifecycle requirements
- Implementation of proper Functional Safety (FS) audits and FS assessments
- Recognized and authoritative independence for lifecycle verification and validation

Once the relief and depressuring system is put into the operational phase, the requirements identified above are still applicable to ensure that the typical issues of unauthorized or uncontrolled plant modifications do not happen, the basis of over-pressure protection is current and accurate and that the asset owner can readily demonstrate that the necessary calculations and assessment are available for inspection by relevant stakeholders, e.g., regulatory authorities and business insurers.

Bridging the relief and depressuring gap

Independent organizations that possess the detailed understanding of relief and depressuring design and legislative requirements can support asset owners/EPCs in achieving the requirements of the IEC 61511 safety lifecycle in order to present an appropriate protection layer than can be readily validated at phase 5, i.e. prior to hazards being present within the manufacturing facility. Further, during phase 6 in the operational stage, the relief and depressuring design information should be reassessed as part of a

stage 4 FSA so that all protective layers are subject to the same rigour and assessment activity. Experience suggests that over the lifetime of the operation, ongoing plant modifications, maintenance activities and changes in process conditions results in relief and depressuring systems that are no longer providing the required over-pressure protection and therefore also not providing the necessary layers of protection.

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For further information please email me at paul.dumain@gb.abb.com or see ABB pressure relief