Managing Process Safety through a Project Life Cycle in High Hazard Industry

Decarbonisation is a subject at the forefront of everyone's mind and the goal of decarbonisation in high hazard industry is a pivotal one.

The pressure is on for organisations to decarbonise their infrastructure, assets, and business models but this does not come without its challenges; whether that be cost, a lack of clear regulation and policy, logistical challenges, stakeholder resistance, or the pressures to meet targets. But what about the need to integrate process safety management as early as possible in the project life cycle of emerging technologies? Whilst there is no difference between the need for early identification and mitigation of safety risk in this growing sector to that of more traditional industry, with growing levels of public awareness, the stakes might be just that bit higher.

Let's take hydrogen. It's a hot topic. Hydrogen is an ideal source of clean energy but it's a very small molecule, making it prone to find ways out or equipment, and it has a wide flammability range in air, a low ignition energy, and can be explosive even when unconfined, making it harder to manage, factors that must be considered when designing hydrogen systems. If we fail to acknowledge these and other safety considerations at the design stage, the potential for large safety consequences and, indeed publicity, could be catastrophic and delay if not derail the progress to achieving the goal of high hazard industry decarbonisation.

The preliminary stages of the project life cycle are where most of your preparation should be done you should be looking for ways to achieve inherent safety. Returning to hydrogen and its inherently unsafe properties as an example, where substitution for a safer material isn't possible, you need to look for inherently safer options elsewhere. Can you reduce stored volumes, reduce pressures, or minimise process steps?

Next, look at separation distances between equipment, layout and configuration of plant units, and distances between occupied areas. Checklists exist that can help with these considerations; for example, the IChemE Safety Centre guidance 'Applying process safety during a concept select phase of a project' or the Energy Institute's guidance on 'Applying inherent safety in design: Reducing process safety hazards whilst optimising CAPEX and OPEX.'

Whilst the importance of inherent safety is clearly recognised, our experience is that it is not often given the attention it deserves. All projects have pressures, whether it be from the multitude of teams involved in the concept vs detailed design phases, to a lack of documented processes, and this often means that safety is not given enough focus and is rarely documented. Using a stage-gated project system which includes confirmation that appropriate studies have been conducted to inform the project's feasibility decisions are, therefore, crucial to ensuring that safety has remained one the main priorities. It also makes good business sense. Looking to minimise risk at the initial stages of a project will de-risk the project overall. Without considering process safety at this point, there is the potential for the design to progress only to be found that when the risks are finally assessed they are found to be unacceptable.

As the detail of the design develops, so too will the detail of the risks. Whether you are a COMAH establishment or not, a risk assessment is both a legal requirement and an essential tool for ensuring that your risks are properly understood and managed. The starting point in any risk assessment is hazard identification and techniques will differ depending on the project. The essential reference for anyone considering a risk assessment in a process industry is Lees' 'Loss Prevention in the Process Industries,' and it does an excellent job of summarising the numerous techniques available to us. Another valuable reference is hySafe's HIAD database which provides research into past incidents and enables us to learn from past mistakes. Remember, it's essential to keep in mind the reasons why you are conducting a risk assessment.

Risk assessment can take many forms and is made of many parts so it's important to understand the toolbox that is available to you and to pick the right tool for your situation. Once again, we return to the example of hydrogen. With projects appearing in populated areas, the stakes are higher and a larger amount of quantification is likely to be required. Consequence modelling is one such approach that will assist with this, and with the extensive levels of research into the outcomes of hydrogen releases currently underway, especially as we move to handling and storing it in large volumes, the Fire and Blast Information Group (FABIG) are an essential reference.

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