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HAZOPs in a Cash Constrained Environment

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Abstract

Year 2015 has been another difficult year for the oil and gas (O&G) industry. For the upstream industry, low prices of oil have resulted in operating companies making drastic changes to their economic canvas due to shrinking budgets. Irrespective of the type of industry, changes in the economic environment dominate the operations. To add to this, there are challenges with budgetary cuts on practices and personnel. This results in a common tendency to overlook required process safety needs, which in turn cause more challenges to maintaining safe work environments.

In order to meet these moral and obligatory requirements, with dwindling finances, existing traditional PHA techniques require trimming, but without compromising on the objectives of protecting human lives, environment and businesses. Based on recent experiences, and successful outcomes, the author provides modified approaches to PHAs including HAZOPs, HAZIDs and What-ifs.

Weighing these necessities versus the economic challenges, the authors' modified their approaches to existing typical practices of HAZOPs and other PHAs, and made trimmings and cuts, where deemed appropriate, without compromising on the original intent behind these studies. This paper is a compilation of their thoughts and successes while making these modifications, that were an outcome of "sharpening the pencil" making the studies smarter and shorter in duration, thereby bringing about a saving in time and effort.

Introduction [1.2.3]

In the last two years, the oil and gas sector has faced tremendous challenges for survival [1]. The falling crude oil prices [2] have resulted in more than 30% reductions in capital expenditure, need for divestments and reductions in workforce [3].

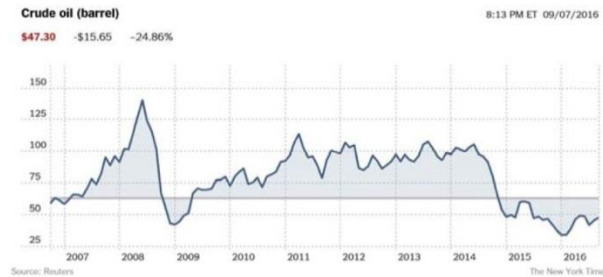


Figure 1. Falling Crude oil prices [2]

The major impacts of these dwindling profitability and reducing budgets result in reduction in workforce, elimination or reduced scopes for capital projects and changes in the way facilities operate. In a sector, where there are very risky operations, one would expect that these changes are subject to a formal risk based assessment prior to elimination. What is observed is rather a reduction in various protocols. One of the prime observations includes the drastic reduction in safety assessments due to budgetary reasons.

In several instances the authors, observed that the speculation of reductions resulted in more distraction amongst workforce, thereby leading to more minor incidents, that could potentially result in higher escalations of incidents. While these are reactionary modes and tendencies observed on workforce [4], however it is the responsibility of the operating company to maintain safety and thereby protecting lives of its workforce, and nearby human developments.

General approach to a HAZOP and other PHAs [5,6,7]

The HAZOP methodology has always been in existence for over 4 decades now, and it still considered as a highly popular and recommended methodology[5]. While it has its advantages and disadvantages [6], it sure is widely applicable in the industry with several variations, to make it fit for purpose.

A hazards and operability (HAZOP) study is one of the most widely used techniques. and is carried out in a workshop setting with a multidisciplinary team. It focuses on process hazards and operability issues caused by irregularities or deviations from the design intent that could lead to potential hazardous scenarios [7]

In spite of all its variations and transitions, it has not changed in concept. Till date the HAZOP methodology follows the steps [5,6] –

- Organize the processes to be reviewed into nodes
- For each of the nodes, list the associated deviations
- Identify causes and potential consequences due to the deviation
- List the effective and existing safeguards/barriers/control
- Propose any additional enhancements by way of recommendations or actions,

HAZOP studies cover a lot of detail that workshop teams tend to get into and hence their long durations. As a result, they are also one of most dreaded techniques due to time required.

The success of a HAZOP study depends on the accuracy of the process safety information (PSI) that is made available and reviewed during the workshop such as process flow diagrams (PFDs) and piping and instrumentation diagrams (P&IDs) are available. Hence for capital and small projects, HAZOP studies are highly recommended in the later stages of the project – when the design is clearly defined and during detailed engineering. For existing facilities, HAZOP studies can be conducted any time, but they are recommended during the periodic process hazard analysis (PHA) revalidation required by regulatory agencies [7].

While switching methodologies from HAZOP to others such as HAZID, What-Ifs, FMEAs, Preliminary Hazard Analyses (PrHAs), the concept remains the same, but the level of detail varies [7].

Irrespective of the methodologies used in PHAs, it is important that adequate preparation time for review of PSI and organizing the workshop be set aside. Also, the workshops being team efforts, involve a lot of human interactions, thereby leading to distractions. At the same time, there exists the tendency to move off topic on tangents. Hence the facilitator's experience in handling multi-disciplinary teams becomes of the utmost importance. Achieving the workshops goals are recognized by the final report, that documents the findings, actions and their respective reasoning behind the actions.

The need for Smart HAZOPs

As indicated above, HAZOPs are time consuming. In the event of budgetary cuts due to an economic downturn, the time consuming elements face reductions. Hence, the HAZOP studies may face the axe

But the need for the HAZOPs still persists, whether it is the design development or regular operation.

Hence the authors summarized their thoughts and modifications, which served the purpose, achieved the goals and were well within the reduced constraints. These thoughts can be categorized under four broad areas –

- Revisit the choice of methodologies
- Considerations for revalidations
- Effective Preparation
- Workshop modifications
- Reporting

Choice of methodologies

Prior to making a choice of methodology thought needs to be given to the purpose. Also electing to conduct a HAZOP, just because that was the methodology used in the past, may not always be

the best decision. The various methodologies for such quantitative risk assessments can be reviewed for validity and applicability, and then the most appropriate selection must be made [7,8].

Also for the same process, there are some typical time reductions observed, when comparing methodologies. It should be note that the reduction in time required may be considered as a saving, but it also comes with a compromise in the amount of detail that will now be covered in the newly chosen methodology. This compromise is more of a reduction in detail, and the decision makers need to ask the question of do we need that reduction or can we safely operate the facility if we make this reduction?

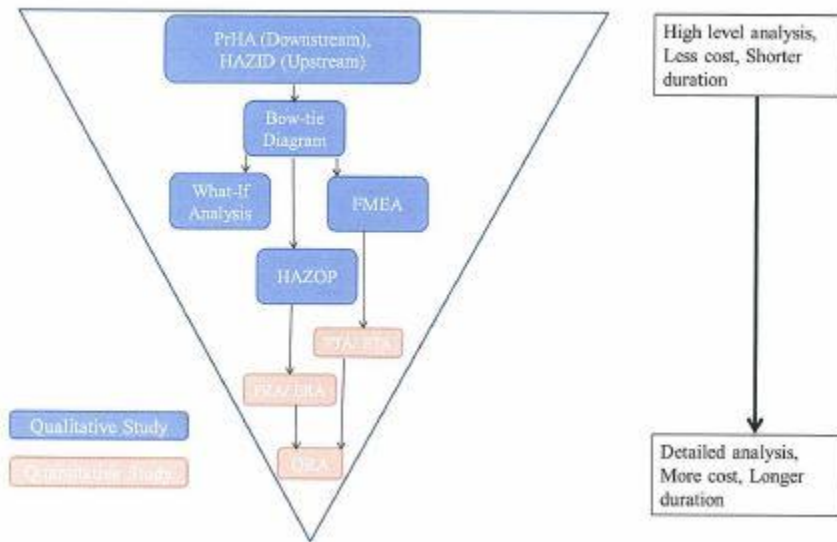


Figure 2. Tool to select the appropriate qualitative risk methodology [8]

Table 1 below indicates a small comparison of the other methodologies in comparison to a HAZOP

Table 1. Comparison with HAZOP

Methodology	Time saving as compared to a HAZOP	Comments on reduction of information
What-If methodology	Workshop Time reduces by about 25%	The study is not as streamlined as a HAZOP, tendency to miss information that would otherwise be covered in a HAZOP and needs additional checklists to fill in the gaps
What-If / Checklist	Workshop Time reduces by about 15%	The study is not as streamlined as a HAZOP, tendency to miss information that would otherwise be covered in a HAZOP and needs very good quality/comprehensive checklists

FMEA	No comparison as the applications are totally different. FMEAs are more for pieces of equipment	
HAZID/PrHA	Very short workshop times compared to HAZOPs	The HAZID approach is very high level and good only for preliminary stages

Considerations for Revalidations

In the event that there are regulatory requirements to re-validate the existing HAZOPs, every few years, e.g. five years if governed by PSM OSHA 1910.119 rule. At the time of revalidation, the following factors need to be considered prior to deciding the methodology –

- Was the previous study of a good quality?
- Have there been minor or minimal changes to the process since the previous HAZOP?
- Have all the changes since the previous HAZOP been assessed via a Management of Change (MOC) process?
- What has been the incident rate for the process since the previous HAZOP?
- If there were a lot of incidents in that time frame, were these incident related to process safety?

Should the responses to the above, be favourable, then the revalidation exercise could essentially a quick review of the previous HAZOP, including a review of the MOCs, incidents and the potential for offsite consequence analysis; along with any new regulatory requirements

However it should be noted certain operating companies do have stringent requirements on the choice of methodology for revalidation and also the need for a complete process re-do HAZOP. Should that be the case, then it is only optimum to go by the operators' guidelines/requirements.

Preparation for HAZOPs

If the decision is made on the methodology to be a HAZOP, then the next step is to begin the preparation. The success of a HAZOP highly depends on the preparation, prior to the workshop. The preparation work is performed by the facilitator and scribe (if available). This involves –

- Review of any previous HAZOPs/PHAs – to help plan the unique situations that require emphasis, and eliminate the need for certain discussions that are already public knowledge.
- PSI documentation including P&IDs be the most current, if possible even walked down in the field and use those marked up drawings for the preparation

- Creating of efficient Nodes – e.g. if it makes more sense in combining a few consecutive nodes as they are similar or follow a logic, do not include too many changes in properties individually, then that creates a much more effective node, minimizing repetition on similar sections.
- Familiarity with the documentation tool – The scribe must be well versed and well prepared with the documentation tool, or must learn the usage of the tool, minimizing documentation related delays and interruptions while in the workshop.
- Planning the schedule for the HAZOP workshop – This helps in deciding the composition of the multidisciplinary team for each node, thereby if a specific discipline does not require to be present for the entire workshop, then it saves on the input of that individual and their time. E.g., the rotating equipment specialist is needed only during nodes that involves pumps and compressors, and so they need not be present during a reactor node that does not include pumps or compressors.
- Providing a pre-read for the attendees, before they come in for the workshop, also ensures a much more coherent audience for the workshop.

The effectiveness of the workshop depends on the amount of preparation work and accuracy of documents provided.

Smart HAZOP workshops

The workshops must always have presence of operators, engineering, and above all representation from safety. This core team provides the mandatory support, at all times. In addition, the preparation work, availability of documentation and a planned daily agenda, assists in securing attendance of the required disciplines.

The onus of the workshop does lie with the facilitator and scribe, where –

- The facilitator is responsible for keeping the team on track, maintain focus, steering the team in the correct direction, and avoiding going off on tangents for excessive amounts of time.
- The scribe is responsible for the accuracy of the documentation. A well prepared scribe, assists in minimizing documentation related interruptions, which in turn helps retain the interest of the team in the workshop, reducing boredom.
- While facilitating, if there has been adequate preparation, then the facilitator is able to guide the team on where they need to spend time on detail, and there similar issues can be combined or is a case of repetition.
- While going through the node-deviation-cause exercise, a time saving technique can be to identify and analyse the safety and environmental consequences. The consequences related to asset damage and or operability delays can be identified but parked on the side, to be analysed later if desired.

Workshops durations are also critical. Sessions that run for excessively long hours, e.g. 10 hour days, hinder the concentration of team members. Ideally these sessions should not be longer than 6-8 hours [6]

The facilitator needs to be experienced handling different traits within team members.

Smart HAZOP reports

Last but not the least is the documentation process for the workshop. If the workshop proceedings have been accurately captured in a clear and concise manner, the reporting process becomes a lot easier.

The reporting process must be fit for purpose. It should include any regulatory requirements, and serve the objective in the first place. This could be more of a compilation of the workshop proceedings and may not need fancy narratives. Irrespective, the information in the reports, should be appropriately drafted such that even when the report is reviewed years later, by another team, they should be able to understand the true purpose and message conveyed.

How does this apply to other PHA methodologies

Should the choice of the methodologies, indicate the need for another method instead of a HAZOP, the same criteria for preparation, workshop and reporting is still valid, irrespective of the choice of the methodology

Conclusion

Economic downturns are always challenges, which bring about reductions of all sorts. In terms of safety, if the reductions bring about improvement in efficiencies without safety compromise or rather bring about safety enhancement, and then those changes are welcome.

However changes requiring eliminating safety assessments and reviews, results in reducing awareness and thereby increasing uncertainty which leads to unsafe situations. It is important that safety registers and assessments be maintain, constantly. There might be a change in technique or approach, and the factors discussed in this paper will assist in improving efficiencies in the HAZOPs and PHAs.

The Success of a safety study does not just depend on a successful completion, but rather on a successful and sustainable implementation, and continuous improvement [9]. This philosophy ensures a safe, sustainable and adaptive working environment with the appropriate knowledge transfer. This philosophy does not necessarily have to be followed in a cash constrained environment. Improving and implementing an efficient or a smart way to conduct the HAZOPs, and other PHAs are beneficial even during an economic upturn.

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