

Critical Evaluation of Hazards Operability Versus Safety Integrity Risk Analysis Techniques

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ABSTRACT

Many companies follow very systematic methodology for carrying out execution of Mega projects. Project risks are identified, analyzed and proposed mitigation actions are identified and agreed upon. This activity is carried out in Project Risk Workshop. While SIL and HAZOP workshops are broadly related to the process design. HAZOP technique is a highly disciplined and systematic in nature; it attempts to identify how a process may deviate from the design intent. The emphasis in the HAZOP study is on identifying potential problems, not necessarily solving them. SIL studies is a specialized area of Instrumentation and Control systems. The requirement for the safety instrumented system (SIS) is defined by SIL Levels. It identifies and analyzes layers of protection of major process upsets and emergencies. The SIL requirement tells how reliable a safety instrumented function needs to be. SIL determination and verification are part of inherent plant design for a chemical plant. This short article discusses these key concepts one by one and addresses their correlation with one another.

KEYWORDS

BPCS, Contingency, HAZOP, HAZOP Guide Words, Mega Projects, Petrochemical, PFD, PHA, Risk, Risk Register, Risk Workshop, SIF, SIL Determination, SIL Studies, SIS

INTRODUCTION

PHA (Process Hazard Analysis) is very well known in petrochemical and oil & gas industries. PHA can be HAZOP, SIL, HAZAN etc. to name a few techniques. HAZOP and SIL are the subjects of discussion here.

It is a well-established practice to conduct HAZOP (Hazards in Operability) and SIL (Safety Integrity Level) studies as part of process and design review; although concept of SIL studies is relatively new as compared to HAZOP. HAZOP is a well-established technique as a means of identifying potential plant design hazards and operability problems. HAZOP technique is a highly disciplined and systematic in nature; it attempts to identify how a process (e.g. petrochemical, pharmaceutical or Oil & Gas etc. process) may deviate from the design intent. The emphasis in the HAZOP study is on identifying potential problems, not necessarily solving them. SIL studies is a specialized area of Instrumentation and Control systems which overlaps between Process Engineering and Control System engineering. Project Risk Analysis is applicable throughout the project life cycle

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– right from idea conception till successful completion of the project. Critical evaluation of the two techniques and their correlation have been addressed in this article.

PROBLEM STATEMENT AND RESEARCH OBJECTIVES

For effective delivery of project, it is very common these days, among the petrochemical and process industries, to conduct Project Risk Workshops in addition to HAZOP and SIL studies. Question is: How are these exercises related to each other? Is there any double-dip? Purpose of the article is to discuss and link the HAZOP and SIL studies with project risk management.

LITERATURE REVIEW AND DISCUSSION

HAZOP – Hazards and Operability Study

HAZOP (Hazards and Operability Study) is a well-established method as a means of identifying potential plant design hazards and operability problems to help improve plant safety. The HAZOP technique is highly disciplined and systematic. It attempts to identify how a process (e.g. petrochemical, pharmaceutical or oil & Gas etc. process) may deviate from the design intent. The emphasis in the HAZOP study is on identifying potential problems, not necessarily solving them.

In a HAZOP study, a team of individuals systematically “brainstorms” the process under review in a series of meetings using a set of guide words to structure the review. The team consists of individuals representing a variety of Engineering disciplines / specialties. This multi-disciplinary team concept allows the various viewpoints of the team members to stimulate the thinking of the other team members and results in creative thinking. Consequently, a more thorough review is achieved than would occur if members of the team reviewed the same process individually.

A typical HAZOP study team, in addition to HAZOP leader and Scribe, may consist of the representatives from the following disciplines:

- Inspection
- Instrumentation/Control systems
- EHSS
- Maintenance
- Operations
- Process Engineering (Preferably one design process engineer and one independent process engineer)
- Other Specialists as required

It is highly recommended to engage an independent HAZOP leader i.e. S(he) should neither belong to the owner nor to the contractor side. This is a fundamental step towards having independent and un-biased study.

SIL – Safety Integrity Level

While the Hazard and Operability (HAZOP) study identifies and risk ranks hazards, Safety Integrity Level (SIL) Determination focuses on the adequacy of safeguards to mitigate hazards. Furthermore, SIL adds another dimension to safety analysis. Within the framework of a HAZOP, analysts are restricted to the limits of the governing risk matrix (i.e. specific range limits on frequencies of occurrence). In contrast, SIL analysis enables analysts to refine the estimates of frequencies of occurrence to obtain more realistic estimates of risk.

Safety integrity is a measure of the likelihood that the Safety Instrumented Function - SIF and other protection layers will achieve the specified safety functions. Once the tolerable risk has been set, and the necessary risk reduction estimated, the safety integrity requirements for the SIS can be allocated.

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