Process Hazard Analysis

A Process Hazard Analysis (PHA) is an iterative series of events where a structured review of the system design and operation is evaluated. In addition to deviations from its designed functional steady state operation parameters, its possible abnormal states are identified and evaluated for safety of personnel and the equipment itself. A PHA is a required component of the Federal OSHA Process Safety Management program. In some cases, a PHA is required by law, in others it is a good manufacturing practice that should be followed.

Process Safety Management

1. Employee participation
2. Process Safety Information
3. Process Hazard Analysis
4. Written Operating procedures
5. Documented Training
6. Contractor Compliance Controls
7. Pre-Start Up Safety Review
8. Mechanical Integrity Inspection Programs
9. How Work Permit Procedures
10. Management of Change Processes
11. Investigation Procedures and Documentation
12. Compliance Audits

A PHA identifies potential causes and consequences. It determines a risk profile and mitigation steps that can be taken to reduce the risk.

There are many types of structured analysis tools that can be used as a PHA. The three most common are a “What-If”, a Guide Word Approach, and Failure Mode Effects Analysis. All three share similar components.

A system is broken down into its component pieces. The detail is determined by the facilitator in order to insure that any possible hazards or failure modes can be identified. The pieces must also be analyzed as a system as each piece might share an interdependency with other pieces that collectively create a failure mode for the system. Nodes are identified that can be clearly described. The function and intent of the node is established. A brainstorming session is then commenced documenting all the various possible deviations from the intent. In a what-if, those words simply being the deviation definition. In a guide word approach, certain deviation

types are prompted to identify deviations from the intent. The brainstorming events are completed interactively with a qualified facilitator who is skilled n keeping the group focused and allowing team members to build upon comments as the discussion spurs other possible scenarios.

A risk ranking matrix is applied to each deviation. The risk ranking most common is made up of the following components:

1. Probability of occurrence
2. Consequences of occurrence
3. Detection of occurrence

Each deviation is ranked commonly using a 1 to 10 scale. Preprocess uses a simpler 1 to 3 scale which eliminates the debate between too many ranking levels. The overall risk is the geometric combination of the three rankings.

The ranking is applied to unmitigated deviations.

The highest ranked risks are then subjected to possible design and operational changes that would lower the risk. These changes are then implemented and a mitigated risk is determined.

The report is usually then presented to management of the enterprise to insure that any risk remaining in the design is consistent with expectations and the risk tolerance profile allowable for the effort.

In recent years, a newer additional analysis tool has become popular, the Level of Protection Analysis, or LOPA. This method looks at the different levels of mitigation implementations and the levels of failure of that protection that would have to occur for a high risk deviation to occur.

The PHA not only applies to the process safety parameters which are usually temperature, pressure, level, and other process control parameters, but also the Standard Operating Procedures and the human factors that are present.

The abnormal operation case is also reviewed as these are the most common that lead to an unmitigated deviation. Commonly when maintenance is being performed on one part of a system, it exposes the system to some reduced level of safety and mitigation due to some part being out of service. If the placement and location of parts and equipment is such that it forces technicians to access or rig equipment in a abnormal way which would not have been planned, these can lead to some high risk deviations. Reviewing the abnormal operations is usually after the steady state analysis has been completed.