

Ensuring Quality in Process Hazard Analysis Studies

By

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Abstract

Employers have now conducted numerous Process Hazards Analysis (PHA) studies to comply with OSHA regulations for Process Safety Management (PSM) (29 CFR § 1910.119)¹. Since the regulation was non-specific as to the exact means of conducting a PHA, a wide variety of styles, levels of completeness, and overall quality of studies has resulted. If studies are less complete than is necessary, hazards may go unrecognized or improperly analyzed. This paper addresses the quality problems seen with PHA studies, and several means to ensure that quality is addressed in future studies.

The opportunities for improving the quality of PHA studies will continue because OSHA requires revalidation of PHA studies every five years. EPA's forthcoming regulations addressing risk management programs (RMP) for chemical accidental release prevention (40 CFR Part 68)², may also create the need for additional studies. These guidelines may assist employers in improving their understanding of process hazards and in ensuring regulatory compliance.

I. Purpose of Conducting Process Hazards Analyses

As the underlying basis of all program elements is to manage the hazards of chemical processes, the PHA element is often referred to as the foundation of the PSM program. Recognizing this fact, an employer understands the importance of high quality PHA studies. OSHA recognized the value of conducting a PHA to achieve the following purposes:

1. to identify and analyze the hazards of the process to ensure that safeguards are adequate
2. to provide documentation on the hazards of the process, so that it can later be accessed by any employee or contractor to make informed decisions on operating or changing the process

The PHA is intended to be a living document, such that the information mentioned above is always accurate and available. Consistent with this philosophy, OSHA requires that PHA's be conducted at three key occasions:

1. For existing facilities, an initial process hazard analysis (hazard evaluation) shall be conducted, in order to provide a baseline understanding of the hazards of the processes covered by the standard. This will allow the employer to develop appropriate Process Safety Management (PSM) program elements to address the hazards of the process. OSHA recognized that most employers had not conducted formal PHA studies to the extent required by the standard.
2. As changes are made to the process, a PHA shall be conducted to ensure that the hazards of the proposed change are well recognized and analyzed before the change is implemented.
3. When new facilities are proposed to be installed, a PHA shall be conducted to ensure the hazards of the new process are understood before the facility is operated.

OSHA requires that the PHA be appropriate to the complexity of the process and shall identify, evaluate, and control the hazards involved in the process. The process hazard analysis shall address:

1. The hazards of the process;
2. The identification of any previous incident which had a likely potential for catastrophic consequences in the workplace;
3. Engineering and administrative controls applicable to the hazards;
4. Consequences of failure of engineering and administrative controls;
5. Facility siting;
6. Human factors; and
7. A qualitative evaluation of a range of the possible safety and health effects of failure of controls on employees in the workplace.

These specific requirements are superseded by the general requirement that all hazards of the process be included. The scope of the PHA is to include all operating modes of the process, including startup, normal operations, normal shutdown, emergency shutdown, temporary operations, and maintenance.

II. Performance-Oriented Objective

The fundamental principle followed during the development of the PSM regulation was that it should be performance-oriented, and not prescriptive to the approach which industry should follow in managing risks. No specific guidance is given on how to conduct a PHA. The AIChE guidelines are referenced by the standard, but even these guidelines are not prescriptive.³

The OSHA regulation represents a very practical approach to risk assessment, where it is assumed that management will take prudent measures to reduce risk to an "acceptable" level. "Acceptable" is not defined, although it is assumed that a PSM program will ensure that the likelihood of any catastrophic accident will be sufficiently low. Good judgement of the PHA team is the key ingredient in determining acceptable risk and completeness of the study. Even so, not every team is aware of what constitutes a complete PHA.

III. Quality Problems with PHA Studies

Since the OSHA requirements are performance-based and the guidelines are somewhat vague, a wide disparity exists in how PHA studies are performed in different companies. Problems have included:

1. inadequate process safety information used as a basis of the study
2. unclear scope and objectives
3. lack of a set of assumptions for the study
4. lack of a common basis for acceptable risk decision-making
5. varying degrees of completeness (number of hazards discussed, thoroughness of documentation, hazards vs operability problems discussed)
6. varying amounts of time invested in the study

As a result, in some cases, the original objectives that OSHA established are not met. If this happens, employees and contractors cannot rely on the information in the PHA as complete. Management may not be presented with a consistent and thorough analysis from which to make risk decisions. The employer may not be in compliance, but, more importantly, unnecessary risks may be taken as a result.

Employers have an opportunity to improve the quality of their studies to minimize these problems. Setting new guidelines for PHA's is very timely and prudent right now because not all initial PHA studies are complete, facility and management of change PHA's are ongoing, and the revalidation requirement is just now being addressed.

IV. Setting a PHA Quality Standard

All employers should have a prescribed approach for conducting PHA's. In addition, a protocol for auditing the PHA's should be developed. These standards will encourage continuous improvement in process safety, and will, no doubt, greatly contribute to the entire PSM effort.

The following guidelines are recommended:

1. *Determine the desired PHA program objectives.* The scope and objectives of the PHA program should be established from the beginning. Choices include minimum levels of compliance to the OSHA PSM standard, inclusion of all hazards regardless of whether they are specifically required to be included by OSHA, and inclusion of all potential "losses", such as environmental risks and operability costs. Those companies that have established a comprehensive set of objectives tend to embrace the concept of continuous improvement in process safety most completely, and tend to reap the most value out of their PHA studies.
2. *Decide on an approach to conducting PHA's.* The particular steps desired of all PHA studies needs to be documented in order to ensure consistency and completeness. This includes both the overall PHA requirements, the steps in the process, and the format of the discussions and documentation. A model PHA study worksheet is helpful to set a style standard.
3. *Establish a quality assurance system.* Quality should be built into the study from planning through to completion. It is useful to have a quality assurance plan including a protocol for providing oversight to the study quality. The plan should be self-directed for use by the PHA team, such that the team is clear on the desired quality and works toward that end throughout the process. This differs from a mere checklist which is intended to be used at the end of a study. By then, repeating the efforts of the team would be very unpopular.

The plan could include such aspects as:

1. guidelines for each step of the PHA process
2. definitions for successful PHA completion
3. rules for ranking hazards
4. rules for assumptions
5. checklists to be used at each part of the PHA process
6. periodic audits of the studies (maximum 3 years)
7. a periodic revalidation requirement for all PHA's (maximum 5 years)

V. Conclusions

Now that many companies are involved in conducting PHA studies, it has become apparent that quality problems exist. It is recommended that companies adopt a standard, defensible methodology for conducting PHA's to avoid missing the complete benefits of the PHA effort and to ensure compliance. To ensure that it is followed consistently, quality assurance guidelines should also be provided.

References Cited

1. OSHA 29 CFR § 1910.119, "Process Safety Management of Highly Hazardous Chemicals," Federal Register, May 26, 1992.
2. EPA rule 40 CFR Part 68, "Risk Management Programs (RMP) for Chemical Accidental Release Prevention."
3. "Guidelines for Hazard Evaluation Procedures, 2nd Edition", American Institute of Chemical Engineers, New York, 1992.