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## Design-Time PSM

*Process Safety is not an Afterthought*

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**S**afety is a primary goal in the design of chemical process systems. Modern safety practice includes the establishment of **process safety management (PSM)** systems to ensure that facilities are designed, constructed, maintained, and operated safely. Federal regulations require these programs for larger plants, while smaller facilities are subject to lesser "general-duty" requirements to ensure safety.

**W**hen a process safety program is required, it must be completely implemented when chemicals are first delivered. Unfortunately, AcuTech frequently encounters new facilities where process safety management systems are absent or poorly implemented. Lack of advance safety planning can have high costs: Some construction contractors have refused to start up facilities until process safety reviews are complete. The attendant startup delays can easily produce six weeks of expensive unplanned facility downtime. OSHA and EPA can also levy heavy fines for operating without a PSM program.

**E**stablishing a process safety and risk management program need not carry high costs, either in staff time or capital,

provided that the program is treated as a necessary element of a new facility (like the water supply or foundation) and **integrated** into the design and construction process.

***Process system owners and designers must incorporate process safety management programs and principles from the very beginning.***

**T**he **process hazards analysis (PHA)** is a frequent source of problems in facility PSM programs. The PHA is a systematic study of the health and safety hazards of a facility used to support other activities (operating procedures, emergency preparedness, preventive maintenance and testing) that act to reduce hazards. The PHA must address the specific design of the facility; it cannot be purchased "off the shelf." The PHA team **must** include employees of the facility owner/operator (not just design & construction company personnel – or consultants!) An invalid PHA essentially returns the program to "square one," requiring (at the least) review and update of all operating procedures, maintenance schedules, retraining of personnel, etc.

**P**erform the PHA study as soon as possible after the engineering design for the facility is set. This permits drafting of operating procedures and other information to avoid hazards identified in the PHA. Inevitably, the design changes during construction, requiring additional work to revalidate and update PSM materials. These added costs must be balanced against the additional delays occurring when performing the PHA later. Starting the PSM program after construction and before startup produces delays of around six weeks (for a crash program); the cost of capital for most projects easily justifies the extra expense from parallel development. A strong change-control procedure applied during design and construction can reduce these costs and can also familiarize the end-user with management-of-change skills required in their PSM program.

**A** formal pre-startup safety review is **required** for all PSM facilities (as well as for many facility improvements). This review typically evaluates construction against design specifications and assures that procedures and training are complete. Often, the review identifies additional issues, such as field piping exposed to forklift impact or improper pipe used for a transfer line. All these deficiencies must be addressed **before startup**.

**G**ood practice (and government regulations) requires written operating and maintenance procedures specifying safe work actions and practices. These procedures must be **specific** to the facility, and all affected personnel must be trained to use the procedures before they begin work. Notably, operating procedure requirements apply also to contractor personnel who operate systems for facility startup, routine operations, or maintenance purposes. We often find that initial startup procedures are poor and that untrained personnel conduct facility startup—statistically one of the most hazardous operations in a facility's lifetime. These deficiencies produce both safety risk and significant regulatory liability for both the facility owner and the engineering/construction firms.

**E**nd-user involvement is crucial for developing an adequate process safety management program. The facility owner **must** participate in many phases of development of the program; there are no “canned” PSM programs. Engineering-and-construction firms must help clients understand this point; a contract specifying that the constructor will provide the complete PSM program without owner participation is impossible to fulfill.

**E**ngineers and contractors should pay particular attention to the following items to reduce the risk of unplanned startup delays and regulatory action:

- Perform the process hazards analysis as soon as the design is set
- Control changes after the PHA using a suitable management protocol
- Write specific operating and maintenance procedures for the facility
- Provide training to all personnel involved in startup, operations, or maintenance
- Perform a pre-startup review to ensure that the facility meets specifications and that all elements of the PSM program, including training, are finished

**A**cuTech would be pleased to assist you in assuring that new facilities and facility expansions follow best practices in process safety in a cost-effective manner, whether the facility must comply with full PSM requirements or just the General Duty Clauses. Contact AcuTech for help with process hazards analyses (PHAs), operating and maintenance procedures, safety management systems, regulatory interpretation (including codes and standards), and other topics related to OSHA process safety management and the EPA Risk Management Program.

