

## 26 PROCESS SAFETY MANAGEMENT

### ANSWERS—QUIZ 1

1. a
2. a
3. a
4. b
5. a
6. b
7. a
8. b
9. c
10. d
11. b
12. The CMA defines process safety as “the control of hazards which are caused by poor operation or malfunction of the processes used to convert raw materials into finished products, which may lead to the unplanned release of hazardous material.”
13. The Strategies for Today’s Environmental Partnership is aimed at addressing public concern by improving industry’s environmental, health, and safety performance.
14. This rule affects those facilities that store, handle, manufacture, or use more than the threshold quantity of a listed substance in a process.
15. It should use the following criteria: extent of the process hazards, number of potentially affected employees, operating history of the process, and age of the process.
16. Pre-start-up safety reviews should be conducted (1) before start-up of new process facilities, (2) before introduction of hazardous chemicals into new facilities, (3) following a major turnaround, or (4) where facilities have had process modifications that affect the process safety information.
17. An incident investigation report should cover the date of the incident, the investigation start date, a description of the incident, a list of contributing factors, root cause assessments, recommendations, follow-ups, and resulting actions.
18. A company might decide to stop routine process safety audits because its audits may not be confidential and could be used against the company in a civil or criminal proceeding. The audits are subject to review by OSHA or others in the event of an inspection or incident investigation.

19. Chemical information includes the chemical and physical properties, reactivity and corrosive data, and thermal and chemical stability of the highly hazardous materials used in the process. It also includes information about the potential hazardous effects of inadvertently mixing incompatible materials, as well as data that may be needed to conduct environmental hazard assessments of toxic and flammable releases. This information may be found on Material Safety Data Sheets or may be gathered from other sources.
20. Process facilities are subject to external and internal standards and regulations. External codes, standards, and regulations apply to the design, operation, and protection of process facilities and employees. They typically include government regulations and association/industry standards and practices. Internal policies, guidelines, and procedures are developed or adopted by the facility to complement external requirements and to cover distinct or unique processes. They should be reviewed periodically and changed when necessary, in accordance with the facility’s change-of-management system.

### ANSWERS—QUIZ 2

1. a
2. b
3. b
4. b
5. a
6. c
7. a
8. d
9. c
10. d
11. b
12. Its mission is to promote the improvement of process safety management techniques among those who store, handle, process, and use hazardous materials.
13. Management should keep in mind incident prevention objectives, existing employer and contractor process safety management programs, and the use of internal resources versus outside consultants.
14. Management must be able to determine whether company or regulatory quantity limits for listed chemicals are being exceeded.

15. Block-flow diagrams and simple process-flow diagrams can help the safety professional gather and provide a description of the chemistry of each specific process and general process technology information.
16. Operating instructions should cover the processing unit's operating limits, including consequences of deviations, steps to avoid or to correct deviation, and functions of safety systems related to operating limits.
17. The four types of PSM inspections OSHA can carry out are (1) inspections resulting from response to accidents and catastrophes, (2) unprogrammed process safety management-related inspections, (3) programmed general industry inspections, and (4) program quality verification inspections.
18. A process safety audit must include an orientation, a process safety management program overview, a preliminary walkthrough, a documentation review, and a review of selected process units.
19. Operating instructions should cover the following points:
  - initial start-up and start-up after turnaround
  - normal start-up
  - normal and temporary operations
  - normal shutdown
  - emergency operations
  - shutdown and start-up after emergency and after temporary operations
  - conditions requiring emergency shutdown
  - assigned shutdown responsibilities
  - nonroutine work
  - operator/process and operator/equipment interface
  - administrative versus automated controls
20. The team typically will need to look at plot plan, siting, spacing, electrical classification, drainage, and other related issues. It will need to conduct a hazards analysis and a process chemistry design review and examine project management issues. The team will have to study the design and integrity of process and mechanical equipment and review piping and instrument drawings (P&IDs). It will have to consider reliability engineering, alarms, interlocks, reliefs, safety devices, construction materials, and compatibility.

## ANSWERS—CASE STUDY

1. ChemStar should include both employees and management representatives on its process hazard analysis team. The team should be multidisciplinary (a requirement for the HAZOP method) and members should have experience in engineering and general process operations. The team should include at least one person who is thoroughly familiar with the process being analyzed and one person who is competent in the HAZOP method. The team should base its priority order on the extent of the process hazards, the number of potentially affected employees, the operating history of the process, and the age of the process.
2. HAZOP stands for the hazard and operability study method. It is commonly used in the chemical and petroleum industries. The approach uses specific guide words (“no,” “increase,” “decrease,” “reverse”) and systematically applies them to parameters (e.g., temperature, pressure, flow) to identify the consequences of deviations (e.g., reduced flow) from design intent.
3. A program quality verification (PQV) inspection is used to evaluate procedures used by facilities and their contractors to manage hazards associated with highly dangerous chemicals. The goal is to evaluate the employer's and contractor's PSM programs, compare the quality of the programs to acceptable industry practices, and verify that the programs are effectively implemented.