

# WHITE PAPERS

## PROCESS SAFETY MANAGEMENT



The building blocks of a successful Process Safety Management (PSM) program are detailed piping and instrumentation diagrams (P&IDs) and standard operating procedures (SOPs). In this white paper, we offer the key elements to include in these documents, along with the benefits of implementing a digital PSM program. The end game is having a successful PSM compliance audit so we'll share some of the top violations and how to avoid them.

## TEN ESSENTIAL COMPONENTS OF PIPING AND INSTRUMENTATION DIAGRAMS

Piping and instrumentation diagrams (P&IDs) are designed to communicate a general layout of your facility's process system piping, valves and equipment. These diagrams are the foundation for every Process Safety Management (PSM) program.

The Occupational Safety and Health Administration (OSHA) states that complete and accurate written information concerning process chemicals, process technology, and process equipment is essential to an effective PSM Program, and P&IDs can be used to comply with these requirements.

### ENSURE THAT YOUR P&IDS MEET THE NECESSARY PSM REQUIREMENTS BY

1. Documenting all components of the process, including valves and piping, even if the component or piping is isolated with no gas or liquid in the lines. If the gas or liquid can be introduced by opening a valve, or series of valves, it must be considered part of the process.
2. Including detailed piping information, from pipe size and service to flow direction on all piping lines. Piping that flows to / from other P&ID sheets should be detailed with continuation designations.
3. Uniquely identifying each component and valve in the process, including evaporators, compressors, condensers, pressure vessels and pumps, with a name or number tag. Also identify all pressure gauges, transmitters, level controllers, and pressure switches.
4. Making sure your layout mirrors your equipment in the machine room. This will allow easy recognition by individuals who may not be familiar with the facility.
5. Creating a valve legend, a list of valves in the process organized by component, number, size, type, and purpose. The P&ID page on which the valve is located is also useful.
6. Adding an equipment schedule page

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# THE IMPORTANCE OF DETAILED STANDARD OPERATING PROCEDURES

The Occupational Safety and Health Administration (OSHA) requires that PSM Standard Operating Procedures (SOPs) provide instructions clear enough that employees will be able to effectively utilize them. SOPs must be documented in sufficient detail and provide specific direction so that employees can follow the procedures and determine how to safely perform service and maintenance activities.

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The lack of procedural clarity and specificity in SOPs can result in employees failing to isolate the key specific valves, permitting possible exposure. Simply listing valves by their functionality, such as liquid valve or hot gas valves, may lead to confusion and error. It is recommended that SOPs use valve numbers to identify the particular valve(s) that must be opened and closed as indicated on the Piping and Instrumentation Diagrams (P&ID).

To eliminate any confusion among operators and maintenance staff, each of the following elements must be addressed in the SOPs:

## **1. STEPS FOR EACH OPERATING PHASE**

- Initial startup
- Normal operations
- Temporary operations
- Emergency shutdown, including the conditions under which emergency shutdown is required, and the assignment of shutdown responsibility to qualified operators to ensure that emergency shutdown is executed in a safe and timely manner
- Emergency operations
- Normal shutdown
- Startup following a turnaround or after an emergency shutdown

## **2. OPERATING LIMITS**

- Consequences of deviation
- Steps required for avoiding or correcting deviation

## **3. SAFETY AND HEALTH CONSIDERATIONS**

- Properties of, and hazards presented by, the chemicals used in the process
- Precautions necessary to prevent exposure, including engineering controls, administrative controls, and personal protective equipment

- Control measures to be taken if physical contact or airborne exposure occurs
- Quality control for raw materials and control of hazardous chemical inventory levels
- Any special or unique hazards
- Safety systems and their functions

Once written and implemented, SOPs are to be reviewed as often as necessary. However, they must be certified and updated annually to ensure they reflect current operating practices, changes in the process chemicals, technology, equipment and facilities. Keep in mind that an SOP revision would also require Management of Change in accordance with PSM best practices.

## **EIGHT REASONS TO DITCH THE PAPER AND GO DIGITAL WITH PSM**

The Occupational Health and Safety Administration (OSHA) mandates Process Safety Management (PSM) for industries involved with highly hazardous chemicals. For example, food processors often have large ammonia refrigeration systems and must comply with OSHA standard 1910.119, or Process Safety Management of Highly Hazardous Chemicals.

For many manufacturers, PSM means reams of paper and heavy, thick books – including numerous forms, operating procedures manuals, permits, process documents, training certificates and more. In a manufacturing environment, relying on paper or even computer disks is often bulky and inefficient.

However, compliance doesn't have to be this tedious or time-consuming. By choosing a digital PSM solution – especially one that does not have to be physically installed onsite – manufacturers can realize numerous benefits, including:

1. PSM programs and procedures are stored and accessed online, instead of being printed and bound.
2. Employee training or equipment maintenance tasks can be instantly viewed and assigned to individuals.
3. When corporate safety personnel perform audits of PSM programs, they can access and review the documentation from their own office instead of traveling to the facility.
- 4.

Digital PSM is Internet-based so that manufacturers can access and use the software via a Web browser at any location (rather than licensing the software and running it on their own servers). This provides increased security, storage, flexibility and cost reduction.

## **THE TOP SEVEN PSM COMPLIANCE AUDIT VIOLATIONS & HOW TO AVOID THEM**

Process Safety Management (PSM) compliance audits are intensive and comprehensive, focusing on 14 elements of OSHA's PSM Standards. A well-planned and organized audit process, including cross-trained personnel, audit checklists and self-audits, can help ensure a successful outcome.

### **THE MOST COMMON DISCREPANCIES FOUND DURING COMPLIANCE AUDITS INCLUDE**

1. Outdated process safety information - this includes the safety relief system, ammonia inventory, ventilation calculations and P&IDs. Many times, facilities have made changes to the ammonia system without updating this documentation.
  2. Previous Process Hazard Analysis (PHA) issues - outstanding PHA recommendations that have not been addressed or properly closed out.
  3. Vague Standard Operating Procedures (SOPs) - those that are generic in nature, not equipment specific and have not been reviewed / certified annually as required by the OSHA Standard.
  4. Improper Management of Change (MOC) documentation - too often, an MOC is completed after the equipment has been installed and is operational. Ensure that MOCs are fully completed and signed off by the authorizing personnel.
  5. Lack of proper PSM training - PSM requires that personnel involved with the operation and maintenance of the ammonia system receive initial training and refresher training every three years.
  6. Gaps in audit frequency - audits have not been conducted every three years as required by the PSM Standard or the action items that were generated from the previous audit have not been closed out prior to the next audit cycle.
  7. Improper or unorganized documentation - in preparation for the audit, ensure all of your written documentation is up to date and filed in a format that is easily accessible to the auditor.
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- PSM / RM coordinator / manager
- Refrigeration supervisor / technician
- Facility environmental, health and safety manager
- Facility engineer

## **BUILD AN AUDIT CHECKLIST**

The most current ammonia industry audit checklist was developed by IIAR in 2013 and combines the OSHA and EPA audit requirements into one complete audit. This checklist is available through the International Institute of Ammonia Refrigeration (IIAR) at [www.iiar.org](http://www.iiar.org).

## **UNDERSTAND THE AUDIT PROCESS**

The compliance audit should be a detailed examination of the effectiveness of your PSM program. The audit will review these areas:

- Written PSM program elements and all required documentation
- Ammonia system operating and maintenance procedures
- Observations of on-site conditions
- Kick-off meeting with the auditor to review agenda
- Interviews with key employees and contractors (if applicable)
- Post-audit meeting to review findings

The team leader is responsible for reviewing each item on the checklist with the team and explaining what criteria is acceptable for full compliance. All team members should have input on the findings of each checklist item and determine

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