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Process Safety Management of Highly Hazardous Chemicals – Part 2

By Jerry Lacatena

Further to Part 1, this brief article continues highlighting Process Safety Management (PSM) requirements to minimize the possibility of unexpected or accidental releases of toxic, reactive, or hazardous chemicals listed in the OSHA PSM standard 1910.119, and to prevent potential disasters from occurring. It focuses on the elements of PSM, and information is largely obtained from the source documentation. Refer to OSHA 1910.119 for details. This subject is also covered under the US Clean Air Act amendments enacted in 1990.

The basic elements that the OSHA standard requires employers to do are indicated below:

- Develop/maintain written safety information identifying workplace chemical and process hazards, equipment, and technology used in the processes.
- Perform a workplace hazard assessment. This includes, as appropriate, identification of potential sources of accidental releases, identification of any previous release within the facility that had a potential for catastrophic consequences in the workplace, and estimation of workplace effects of releases.
- Consult with the workforce on the development and conduct of hazard assessments and the development of chemical accident prevention plans.
- Establish a system to respond to the workplace hazard assessment findings.
- Periodically review the workplace hazard assessment and response system.
- Develop/implement written operating procedures for the process, including startup, normal operation, shutdown, upsets, etc.
- Provide written safety/operating information for the workforce and training in operating procedures, emphasizing hazards, and safe practices.
- Ensure contractor staff are provided with appropriate information and training.
- Train workforce in emergency response procedures.
- Establish a quality assurance program to ensure that initial process-related equipment are installed as designed.
- Establish maintenance systems for critical process-related equipment, including written procedures, training, appropriate inspections, testing, etc., to ensure mechanical integrity.
- Conduct pre-startup safety reviews of newly installed or modified equipment.
- Establish/implement written procedures managing change to process chemicals, technology, equipment, and facilities.
- Investigate incidents that could have resulted in a major accident in the workplace, and communicate findings to operating personnel and modifications made, if appropriate.

Work Highlights

Mechanical Engineering

- Reviewed typical mechanical design details and repairs being used for external floating roof storage tanks installed at a refinery in Europe. Found that these generally meet current industry requirements, with improvements recommended for specific items.

Process, Operations & Safety

- Providing process consulting to review a refiner's FCC and HF alkylation processing capabilities, and high level gap analysis assessment including improvement action recommendations.
- Supporting process design reviews of existing foreign refinery facilities associated with their emissions reduction project, and resolution of technical issues.
- Completed cold eyes review of a contractor's front end design package for marine heavy fuel oil production to be located overseas.

Project Management

- Provided engineering quality control consulting support to the Owner's Project Management Team (PMT) for a grass roots chemicals plant located in China and being engineered by a Chinese prime contractor. The team consisted of mechanical, materials, machinery, electrical, civil, and instrumentation/process control engineers. After a kickoff meeting with the PMT and contractor held in China, the team's review work was effectively done from the US and Canada.

Companies must compile written safety information before conducting process hazards analysis (PHA). This includes information on the chemical hazards, process/technology and equipment, as described below.

Information on the hazards of the highly hazardous chemicals used in the process typically consists of the following:

- Toxicity
- Physical data
- Corrosivity data
- Permissible exposure limits
- Reactivity data
- Thermal and chemical stability data

Information on the technology of the process typically includes the following:

- Block flow diagram or simplified process flow diagram
- Process chemistry
- Maximum intended inventory
- Safe limits for such items as temperatures, pressures, flows or compositions
- Evaluation of the consequences of deviations, including safety/health consequences

Where the original technical information no longer exists, such information may be developed in conjunction with the PHA in sufficient detail to support the analysis.

Information on the equipment in the process typically includes the following:

- Materials of construction
- Piping and instrument diagrams (P&IDs)
- Electrical classification
- Relief system design and design basis
- Ventilation system design
- Design codes/standards employed
- Material and energy balances for processes (built after May 26, 1992)
- Safety systems (i.e., interlocks, alarms, detection or suppression systems)

The company must document that equipment complies with recognized and generally accepted good engineering practices. The above process safety information provides the basis for identifying and understanding the hazards of a process, and may be necessary for complying with other provisions of PSM, such as management of change and incident investigations.

Additional information on this subject will follow in a subsequent article.

About the Author

Jerry Lacatena has over 35 years of process engineering experience in a broad range of design applications and technologies. He is a proficient and organized multi-tasker, having extensive plant design experience on numerous revamp and grassroots projects throughout the world, with projects ranging from feasibility studies, technology evaluation, FEED, EPC development, to plant performance testing. Jerry has excellent presentation, communication, coordination, and interpersonal skills utilized to develop strong working relationships with team members, clients, vendors, sub-contractors, and technical licensors.

Please contact Jerry Lacatena, Process Department Manager (jlacatena@carmagen.com), if you'd like more information on Carmagen's expertise in this area. Carmagen Engineering, Inc. is an engineering consulting company with experienced staff that can support clients' efforts associated with the various PSM activities necessary for safe operation and compliance of their facilities.

