

2.0 Training and Job Safety

Introduction

The information presented in this section is a general composite of best practices about the education and training of employees and contractors in the safe handling of phosgene. It also provides information on possible components for conducting a safety review. The information provided in this section should not be considered as a directive or as an industry standard that readers must adopt or follow. Instead, the information is intended to provide helpful ideas and guidance that users may wish to consider in a general sense (See Section 1.1 *Preface and Legal Notice*). Also included is a reference list of useful resources.

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2.1 Employee/Contractor Education and Training

The education of employees and contractors in the safe handling of phosgene is critical to help prevent phosgene releases and exposures. A formal training program can help to ensure that personnel understand the hazards associated with handling phosgene and the proper procedures to design, operate and maintain phosgene processes, prevent incidents and respond to emergencies. Some companies have found it beneficial to develop contractor training programs that differentiate training requirements based on the type of contractor. Those programs include a more extensive training for long term or “resident” type contractors and have an abbreviated training for short term contractors (and visitors) who are often accompanied at all times in the workplace by a trained employee.

Phosgene is normally found in a gaseous state, with a boiling point of 7.56°C (45.61°F) at atmospheric pressure. The primary route of exposure for phosgene as a toxic gas is through inhalation. However, it may be in a liquid state under certain pressure and temperature conditions. Liquid phosgene can cause skin and eye burns. Liquid phosgene will usually have a sufficiently high vapor pressure to vaporize to a gas from a splash or spray of liquid phosgene. Therefore, handling of liquid phosgene can present the same toxicity concerns as handling phosgene gas. The severity of health consequences of phosgene depends on the concentration and duration of exposure, also known as dose. .

Proper education and training of employees and contractors before their assignment to operating and maintenance responsibilities in areas handling phosgene is important, as is observing proper engineering practices, due to the hazards associated with the use and handling of phosgene.

Safe handling of phosgene depends to a great extent upon the effectiveness of employee and contractor education; proper training in safe practices; the safe use of equipment; and the proper application of the knowledge and skills learned by the employee. Knowledgeable supervision and management support can assess and improve upon this training process.

Before undertaking any employee and contractor training on the handling or processing of phosgene, the trainer needs to be thoroughly familiar with the properties and characteristics of the chemical. While reviewing the information provided in this document will be helpful to users, consult with supplier(s) or internal resources to help ensure that all appropriate recommendations and precautions are followed. Consider whether the training materials include up-to-date information and are presented in a format that is easily understood by all employees.

Verification and documentation that the employees and contractors have understood the material may be needed. Maintain a record of those personnel who are instructed, retrained and tested as part of a training program. Frequently, Safety Data Sheets (SDS) are relied upon to provide up-to-date information on phosgene safety and handling. The National Institute of Occupational Safety and Health's (NIOSH) has a website with workplace safety and health topics relating to phosgene ¹. The NIOSH Criteria Document on Phosgene also provides more specific workplace safety, health and training information ².

Employee and contractor education and training programs should be thorough and accurate. Consideration should be given to whether Occupational Safety and Health Administration's (OSHA) Process Safety Management (PSM) rule³ and Environmental Protection Agency's (EPA) Risk Management Program (RMP) rule⁴ are applicable. Each contains requirements for employee training (see 29 CFR 1910.119(g)(1)-(2) and 40 CFR 68.54 & 68.71⁵, respectively). In developing an education and training program, topics and information that many companies have found important and beneficial include, but are not limited to, the following:

- Exposure symptoms and exposure signs with emphasis on possible delayed effects.
- Phosgene dosimeter badge use, reading colorimetric badge color changes and medical response
- Phosgene handling training that includes equipment isolation, clearing and line-breaking practices
- Phosgene neutralization and decontamination practices
- Qualifications of workers authorized to respond, mitigate, contain and clean-up phosgene releases (see OSHA's Hazardous Waste Operations and Emergency Response Standard, also known as HAZWOPER)
- Potential emergency scenarios
- Decomposition systems
- Process Hazards Analysis (PHA) outcomes and safety critical variables
- Physical characteristics of phosgene
- First response measures
- Rescue chain procedures (refer to Medical Treatment and First Aid Options Document and SPG Section 5.0 Emergency Response)
- Personal Protective Equipment (PPE)
- Occupational Exposure Limits (OELs)
- Fire and explosion information, including the additional risk, associated with solvent mixtures containing phosgene

- Gas detection equipment, gas alarms and emergency shutdown equipment such as valves and switches
- Emergency procedures, including evacuation procedures
- Hazards associated with thermal expansion properties of phosgene
- Review of previous incidents and industry published incident
- Awareness of the permeability of certain polymeric elastomers to phosgene and phosgene-containing solutions (refer to SPG Section 6.2a Materials of Construction)
- Awareness of the importance of proper materials of construction
- Incident reporting requirements per company policy (refer to SPG Section 4.1.3 Industrial Hygiene and Personal Protective Equipment)
- Instructions on the immediate reporting and prompt investigation of all potential (near miss) phosgene releases/incidents. Recording and evaluating the causes for near misses can be helpful in considering management practices to improve the safe handling of phosgene and phosgene-containing chemicals. See the Center for Chemical Process Safety (CCPS) *Guidelines for Investigating Chemical Process Incidents, Chapter 5: Reporting and Investigating Near Misses* ⁶ for additional information on incidents and near-misses, determination and investigation.
- Instructions on reporting all cases of personal protection equipment failure.

In addition to initial training, periodic re-training, and periodic drills of all current phosgene employees and contractors should be carried out on a regular basis to reinforce and update important information. Companies and organizations that handle phosgene may also consider providing training and education programs for maintenance and emergency personnel who may frequent a phosgene area.

Training employees and contractors in neighboring areas on phosgene hazards and emergency procedures, in the event of phosgene releases or spills, may help provide for appropriate actions should an event occur.

Some companies have developed training packages on phosgene, phosgene exposure and medical treatment for health care professionals. On a periodic basis these companies have provided this training to site health care personnel and also to off-site personnel at hospitals that might be involved in infrequent treatment of a phosgene exposed individual.

One source for information is the publication entitled "Phosgene, Information on Options for First Aid and Medical Treatment,"⁷ available from the American Chemistry Council's Phosgene Panel website at <http://www.americanchemistry.com/phosgenepanel>.

2.2 Safety Review

The Process Safety Management (PSM) rule (29 CFR 1910.119) requires Process Hazard Analyses (PHAs) to be conducted every 5 years where the standard is applicable.

Section 1910.119 also provides detailed information regarding process safety management of highly hazardous chemicals. While users must consult the actual regulatory text to review all the U.S. requirements in their entirety (and to learn of potential updates or letters of interpretation), some safety review information contained in the regulations is provided below.

After becoming thoroughly familiar with the properties and hazardous characteristics of phosgene, operating procedures must be written and reviewed by appropriate personnel (29 CFR 1910.119(f)). Once the procedures have been finalized, they should be reviewed by appropriate personnel, especially workers who will be handling phosgene.

During the process hazard analysis (PHA), the hazards of the process, past incidents, engineering controls, management of change documents, failure consequences, mechanical integrity and facility siting must be considered (29 CFR 1910.119(e)). The rule states that a review should not only be concerned with the hazards of contact with or exposure to phosgene, but also with hazards that may be involved in handling containers and using the operating equipment. Other hazards associated with the work should be identified.

The need for personal protective equipment, its maintenance and proper use, as well as its limitations, should be determined. Procedures should be established for credible scenarios (29 CFR 1910.119(n)). Consider determining suitable locations and the operation of safety showers, fire extinguishers, alarms, etc. Both routine and non-routine operations must be considered including the startup, shutdown and temporary operation of a process (29 CFR 1910.119 (f)). Emergency planning and response procedures must be considered (29 CFR 1910.119 (n)).

During safety review of the operations, it may become apparent that some hazards can be eliminated. Follow the Management of Change procedures required in the OSHA Process Safety Management regulation when making any process change. In chemical processing, even a slight deviation or seemingly minor alteration may cause disastrous results.

To increase training effectiveness, hazards of the process should be explained together with necessary precautions in the standard operating procedures. Safety precautions can be an integral part of the operating instructions.

For example, if specific-level personal protective equipment is required by OSHA while line-breaking, the standard operating procedure which describes the line-breaking can also make it clear that the specific personal protective equipment is required for that operation. Since each aspect of operation has elements of safety, it is helpful if the manuals and operations documents incorporate safety information for all steps.

Periodic audits are required at least every 3 years under the OSHA Process Safety Management regulation (29 CFR 1910.119(o)). Periodic assessment of employees can help ensure that they are knowledgeable in the process, and following instructions and precautions as directed. Complete and current standard operating procedures that embody safety information can help prevent injuries and accidents.

Management of Change procedures must be followed when change is indicated by the Process Hazard Analyses or for any other reason (29 CFR 1910.119(l)). For those special types of activities where an existing Standard Operating Procedure does not exist, besides the Management of Change review, a Job or Task Safety Analysis may be helpful. The purpose of this analysis is to review the steps associated with the activity to address possible safety concerns before a job is commenced.

References

¹ NIOSH Workplace Safety and Health Website

² NIOSH Criteria Document on Phosgene

³ OSHA Process Safety Management (PSM) rule 29 CFR 1910.119(g)(1)-(2)

⁴ EPA Risk Management Program (RMP) Website

⁵ EPA Risk Management Program (RMP) rule 40 CFR 68.54 & 68.71

⁶ CCPS *Guidelines for Investigating Chemical Process Incidents, Chapter 5: Reporting and Investigating Near-Misses.*

⁷ *Phosgene, Information on Options for First Aid and Medical Treatment*, available from the American Chemistry Council's Phosgene Panel website at <http://www.americanchemistry.com/phosgenepanel>.