

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 Education and Training

The education of employees and contractors in the safe handling of phosgene is critical to helping prevent unwarranted 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 prevent incidents.

Phosgene boils at 7.56°C (approximately 46°F) at atmospheric pressure, so it is normally in a gaseous state. As a gas, phosgene is toxic. 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 so that handling it can present the same toxicity concerns as handling phosgene gas. The toxicity of phosgene depends on the degree of exposure or dose. Proper education and training of employees and contractors before their assignment to operating and maintenance responsibilities in areas handling this material, as well as, observing proper engineering practice are important, 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 education; proper training in safe practices; the safe use of equipment; and the proper application from the employee of the knowledge and skills learned. Knowledgeable supervision and management support can assess and improve on this process.

Before undertaking any employee 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 that the employee has understood the material, and documentation of the testing procedure, may be needed. Frequently, Material Safety Data Sheets (MSDSs) are relied upon to provide up-to-date information on phosgene safety and handling. The National Institute of Occupational Safety and Health's (NIOSH) Criteria Document on Phosgene also provides information.¹

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) rule² and Environmental Protection Agency's (EPA) Risk Management Program (RMP) rule³ are applicable. Each contains requirements for employee training (see 29 CFR 1910.119(g)(1)-(2) and 40 CFR 68.54 & 68.71, 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 handling training that includes line-breaking practices.
- Phosgene neutralization practices.
- Qualifications of workers authorized to approach and contain phosgene leaks.
- Instructions and periodic drills or quizzes regarding items such as:
 - Potential emergency scenarios
 - Physical characteristics of phosgene

- Health hazards associated with exposure to phosgene
 - First response measures
 - 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
 - Spill and disposal procedures
 - Emergency procedures
 - Hazards associated with thermal expansion properties of phosgene
 - Review of previous incidents and industry published incident
 - Awareness of permeability of certain polymeric elastomers to phosgene and phosgene-containing solutions
- Instructions on reporting to the proper authority all incidents involving either the inhalation of the vapors of phosgene or direct contact with the liquid, as well as all signs of illness, particularly respiratory distress.
 - 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*⁴ for additional information on incidents and near-misses, determination and investigation.
 - Instructions on reporting all cases of personal protection equipment failure to the proper authority.

In addition to initial training, periodic re-training of all current phosgene workers can 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.

Informing workers in neighboring areas of emergency procedures in the event of phosgene releases or spills may help provide for appropriate actions should an event occur.

One source for information is the publication entitled "Phosgene, Information on Options for First Aid and Medical Treatment,"⁵ available from the American Chemistry Council's Phosgene Panel website at <http://www.americanchemistry.com/phosgenepanel>. Many companies find it useful and may be required by law to maintain a record of those personnel who are instructed, retrained and tested.

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), 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 hazard evaluation, the hazards of the process, past incidents, engineering controls, 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 noted. The need for personal protective equipment, its maintenance and its proper use, as well as its limitations should be determined. Establish procedures for reasonably foreseeable emergencies (29 CFR 1910.119(n)). Consider determining suitable locations for and the operation of safety showers, fire extinguishers, alarms, etc. Both routine and non-routine operations must be considered including the startup and shutdown of a process (29 CFR 1910.119 (f)). Emergency planning and response procedures must be considered (29CFR 1910 (n)).

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

To increase training effectiveness, all significant hazards can be explained together with precautions to be followed 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)). Periodically checking of employees can help ensure that they are 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 Criteria Document on Phosgene
<http://www.cdc.gov/niosh/docs/1970/76-137.html>

² OSHA Process Safety Management (PSM) rule 29 CFR 1910.119(g)(1)-
(2) https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARD_S&p_id=9760

³ EPA Risk Management Program (RMP) rule 40 CFR 68.54 &
68.71 <http://www.epa.gov/emergencies/content/rmp/index.htm>

⁴ CCPS *Guidelines for Investigating Chemical Process Incidents, Chapter 5: Reporting and Investigating Near-Misses*. Available for free at <http://www.wiley.com/WileyCDA/WileyTitle/productCd-0816908974.html>.

⁵ *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>.