5.0 Emergency Response

Introduction

The information presented in this section is a general composite of best practices and current information about emergency response plans including emergency response planning guides (ERPG), acute exposure guideline levels (AEGL), EPA's integrated contingency plan guidance, EPA's risk management program (RMP), OSHA's HAZWOPER and process safety management of highly hazardous chemicals (PSM), fire, gaseous leaks, liquid spills, mutual aid, and offsite release planning.

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.

Contents

5.1. Emergency Response Plan

5.1.1. General

The U.S. Code of Federal Regulations (CFR) provides directives for site-specific emergency plans in 29 CFR1910.120 (q). See regulatory text for details.[1]

(1) Elements of an emergency response plan. Federal requirements dictate that employers subject to this requirement develop an emergency response plan that shall address, at a minimum, the following items to the extent that they are not addressed elsewhere:

(i) Pre-emergency planning and coordination with outside parties.
(ii) Personnel roles, lines of authority, training and communication.
(iii) Emergency recognition and prevention.
(iv) Safe distances and places of refuge.
(v) Site security and control.
(vi) Evacuation routes and procedures.
(vii) Decontamination.
(viii) Emergency medical treatment and first aid.
(ix) Emergency alerting and response procedures.
(x) Critique of response and follow-up.
(xi) PPE and emergency equipment.

Additional Items for Emergency Response Plans

The following items may also be included or considered as part of emergency response planning. Depending on specific circumstances, the following alternative or additional items may be considered when developing an emergency response plan:

- Key company personnel evaluate the feasibility of including alternate personnel and how to contact those individuals if the need arose (e.g., phone, pager). Automatic pager calls and phone ring-down systems are available and may be helpful especially where large numbers of people must be contacted quickly.

- Key outside personnel may be contacted directly or by automatic ring-down, and messaging systems may be incorporated to speed the process and document that the calls were made.

- Titles of individuals as they function in Emergency Response activities and their associated duties before, during and after the emergency can be explained in the plan.

- A description of the facility, layout and chemical inventory will aid in communicating with outside agencies and mutual aid groups.

- Preplanning the location and staffing of the incident command team, management and staging area(s), including a possible location offsite should a catastrophic emergency arise, can facilitate response actions.

- Companies have found it beneficial to have training and drills simulate real situations and have personnel trained to act as if the activity was not a mere preparation exercise.

- Alarm systems have included directional sirens, strobes or public announcement systems, and local annunciation systems. Evaluate whether alarm systems have sufficient volume to reach all affected personnel

- Consider utilizing suitable back-up systems for emergency response systems. For example, you might consider utility systems, communication devices, and emergency shut-down equipment.

- Evacuation/Shelter-in-Place: Establishing procedures that include communication equipment **INSIDE** the safe shelter in the event it becomes necessary for persons to evacuate the safe shelter or for occupants to communicate information back to the On Scene Incident Commander (OSIC). Escape respiratory protection should be considered and made available for shelter areas in the event that evacuation is needed. This can include for example: the 5 minute escape type or the NIOSH approved mouth bit type respirators.

- Downwind or perimeter monitoring has been used to help better draw boundaries for personnel protection. Detection instruments help to determine when concentrations have dropped and the “all clear” can be safely given. Consideration may be given to any structures downwind that are or could be occupied by personnel. Phosgene can become “trapped” in buildings, where it dissipates slowly. Keep in mind that IDLH (Immediately Dangerous to Life or Health) conditions will affect the staffing requirements for the downwind/perimeter monitoring person(s).

- Personnel and PPE decontamination procedures have been included in emergency plans. Before removing PPE, the use of badges or direct reading phosgene analyzers helps evaluate whether phosgene is present.

- Given the frequency of personnel turnover at hospital emergency rooms, addressing medical procedures for offsite personnel can be useful. Procedures for medical transport may include Phosgene Material Safety

Data Sheets, the current version of the American Chemistry Council "Phosgene, Information on Options for First aid and Medical Treatment,"[2] or other information on treatment.

- Companies have found it is useful that incident and drill critiques can generate action items that can be resolved in a timely manner.

- When developing written plans consider past incidents, near misses and credible emergency situations that could arise. A detailed plan for phosgene may be incorporated into the general site emergency plan. Other practices that benefit response plans include: familiarizing all employees in the phosgene process with the plan; reviewing the plan on a periodic basis; and training the plant emergency responders to handle phosgene emergencies.

- Community standards (e.g., Emergency Response Planning Guides (ERPG's) and Acute Exposure Guideline Levels (AEGL's)) are also potentially relevant to Emergency Response Plans.

Emergency Response Planning Guides (ERPG)

ERPG's are values developed by the American Industrial Hygiene Association Emergency Response Planning Committee to assist emergency response personnel planning for catastrophic chemical releases to the community.

ERPG-1 is the maximum airborne concentration below which it is believed nearly all individuals could be exposed for up to
1 hour without experiencing anything other than mild transient adverse health effects or perceiving a clearly defined objectionable odor.

ERPG-2 is the maximum airborne concentration below which it is believed nearly all individuals could be exposed for up to
1 hour without experiencing or developing irreversible or other serious health effects or symptoms that could impair their abilities to take protective action.

ERPG-3 is the maximum airborne concentration below which it is believed nearly all individuals could be exposed for up to 1 hour without experiencing or developing life-threatening health effects.

The current AIHA ERPG values for phosgene can be found on the AIHA website at http://www.aiha.org.[3]

Acute Exposure Guideline Levels (AEGL' s)

The National Advisory Committee for the Development of Acute Exposure Guideline Levels for Hazardous Substances (AEGL Committee) develops guidelines to help both national and local authorities, as well as private companies, deal with emergencies involving spills, or other catastrophic exposures.

AEGL's represent ceiling exposure values for the general public and are applicable to emergency exposure periods ranging from less than 1 hour to 8 hours.

AEGL 1 is the airborne concentration (expressed as ppm and mg/m^3) of a substance at or above which it is predicted that the general population, including "susceptible" but excluding "hypersusceptible" individuals, could experience notable discomfort. Airborne concentrations below AEGL 1 represent exposure levels that could produce mild odor, taste or other sensory irritations.

AEGL 2 is the airborne concentration (expressed as ppm and mg/m^3) of a substance at or above which it is predicted that the general population, including "susceptible" but excluding "hypersusceptible" individuals, could experience irreversible or other serious, long-lasting effects or impaired ability to escape.

AEGL 3 is the airborne concentration (expressed as ppm and mg/m^3) of a substance at or above which it is predicted that the general population, including "susceptible" but excluding "hypersusceptible" individuals, could experience life-threatening effects or death.

The current AEGLs values for phosgene can be found on the EPA website at http://www.epa.gov/oppt/aegl/.[4]

5.1.2. EPA's Integrated Contingency Plan Guidance

("One Plan")

An Emergency Response program for sources subject to the requirements is required under 40 CFR Part 68.[5] Compliance with other Federal contingency plan regulations or consistency with the EPA's "One Plan" is also discussed in this Part.

5.1.3 OSHA's HAZWOPER and Process Safety Management of Highly Hazardous Chemicals (PSM).

Requirements for emergency response planning for phosgene are also found in the OSHA rules governing Hazardous Waste and Emergency Response (HAZWOPER
29 CFR Part 1910.120)[7] and the OSHA Process Safety Management of Highly Hazardous Chemicals (29 CFR Part 1910.119).[8]

5.2. Fire

Phosgene is nonflammable. At temperatures above 250°C (482°F), phosgene decomposes to form mixtures of carbon monoxide (CO), chlorine (Cl_2), carbon dioxide (CO_2) and carbon tetrachloride (CCl_4). In the presence of oxygen, the carbon monoxide may burn to form carbon dioxide.

In case of fire and in the absence of phosgene leaks, the removal of cylinders from the fire zone and immediately shutting off phosgene sources can reduce some potential risks. When containers cannot be moved and if no phosgene is escaping, water can be sprayed on containers and piping to keep them cool.

Vessels and piping containing phosgene can be cooled with water spray. In such cases, cooling may be imperative because boiling of the phosgene and subsequent rupture of the vessel could create an extremely hazardous situation.

In case of fire and if only gaseous phosgene is leaking, water can be sprayed on containers and piping to keep them cool. Water applied to the point of leak may cause enlargement of the leaking opening because of corrosion. Consider removing cylinders from the fire zone if possible and shutting off phosgene sources immediately. Water fog may not be very effective in neutralizing phosgene vapor, but can help reduce concentration in the air. Aqueous ammonia spray may be more effective in neutralizing phosgene vapor, but use with caution due to hazards associated with breathing high concentrations of ammonia.

The selection of sprinkler systems, firewater monitors or portable firewater supplies is based on factors including the quantity of phosgene and the requirements of the insurer and local fire marshal. Structural fireproofing where phosgene is stored, piped and used may affect the requirements.

In case of fire associated with phosgene, it may be critical to keep all authorized persons upwind a safe distance from the phosgene area and all other personnel evacuated from the area. Firefighting personnel may need respiratory protection. For additional information on respiratory protection, see Section 4.0 *Health Factors, Industrial Hygiene, Medical Preparedness, First Aid and Protective Equipment, subsection* 4.5.8 *Respiratory Protection*.

5.3 Gaseous Leaks

As soon as there is any indication of phosgene present in the environment, immediate steps to evaluate include stopping the release of gas/liquid and simultaneously protecting personnel downwind, including the community. Indication of phosgene's presence in the environment may come from personnel or area monitoring systems, process control indicators or other sources. Authorized, trained personnel equipped with suitable protective equipment can conduct an evaluation. Where appropriate, it is

prudent to assume that Immediately Dangerous to Life and Health (IDLH) conditions exist when responding to emergencies. An excerpt taken from 29 CFR 1910.134(g)(3) (OSHA Respiratory Protection Standard)[9], lists the following requirements:

If the leak or spill is extensive or uncontained, sounding an evacuation alarm and warning all persons in the path of the gas helps prevent further concerns. Pre-arranged meeting points, crosswind or upwind, can be planned and used in practice to help ensure everyone is accounted for. Gaseous phosgene often lies close to the ground because it is heavier than air. Wind socks and instrumentation indicating wind speed and direction can provide important information for communication to those in the immediate area.

Notify relevant regulatory and community organizations as appropriate.

The use of Safe Shelters may provide a safer short term alternative to evacuation. These designated buildings can provide greater safety when constructed to be relatively air-tight and under positive pressure, assuming the air supply is phosgene-free or is adequately filtered. These locations may be labeled, and direction given to occupants about procedures to follow when the Safe Shelter is downwind as well as upwind. Persons entering a Safe Shelter DOWNWIND of a release have been known to contaminate the building with phosgene.

Anyone critical to the orderly shutdown of a process system that could be downwind of the release, may require respiratory protection. See Section 4.0 *Industrial Hygiene and Protective Equipment, subsection* 4.2.8 *Respiratory Protection* for further information.

Persons can reduce potential risks by staying upwind of the leak or spill keeping in mind potential responsibilities as part of the emergency response team. 29 CFR 1910.120[1] gives direction as to what constitutes normal job duties and the point where the event has escalated to a full emergency. This is a critical decision left to the evaluation of the On Scene Incident Commander. The use of the “buddy” system is required for IDLH concentrations per 29 CFR 1910.134(g)(3).[9]

5.3.1 Small Leak Detection

The detection limit of some direct reading instruments may be insufficient to detect very small leaks. Colorimetric paper can be used as a mechanism for low level leak detection, especially in open-air environments where tiny leaks may escape detection using hand held monitors or area monitors. Colorimetric paper can be placed and remain for long periods of time (subject to the manufacturer’s recommendations for maximum sampling time) to identify low concentrations of phosgene. Colorimetric paper is also used to confirm adequate clearance and decontamination of equipment prior to opening. Dosimetry badges are reserved for personal dose measurement, and

are not designed to confirm adequate clearance and decontamination of equipment because it could introduce opportunity for a misinterpretation of the badge that could result in erroneous exposure conclusions. Dosimetry badges with a low limit of detection can also be used but such dosimetry badges need to be identified and labeled for leak detection only, and workers do not use their personal dosimeter badges that are intended to monitor their exposure to detect leaks. While means of detection such as ammonia vapors/mists can provide information on possible leak locations, it also introduces additional hazards to responders, as well as being highly corrosive to certain materials. The additional risk associated with using ammonia vapors for leak detection must be fully considered before developing it as an option for leak response.

For other types of portable and fix monitoring devices reference section 6.9.

5.4 Liquid Spills

In case of fire and if liquid phosgene is leaking, firefighting foams have been used to cover the liquid spill until disposal. Use water for firefighting with caution so as to avoid adding water to the liquid pool if at all possible. Liquid phosgene reacts slowly with water to form carbon dioxide and hydrochloric acid. The heat of reaction increases the vaporization rate of the liquid phosgene and therefore may increase the potential hazard to personnel. Subject to such issues and depending on overall circumstances, it still may be useful to spray containers with water to keep them cool.

All of the OSHA requirements and considerations for handling gaseous phosgene leaks also apply for liquid phosgene spills.

5.5 Mutual Aid

Industrial plants in one vicinity can help one another by establishing plans and an organization for rendering mutual aid in the event of an emergency or disaster such as phosgene spill or a fire. As part of these efforts, making mutual aid organizations thoroughly aware of the presence of phosgene in a facility facilitates proper response and training. Staging areas (including alternates) may be designated during the planning stage.

Phosgene emergency procedures that may involve persons outside the plant can be incorporated in Mutual Aid Instructions and Public Department Procedures (see Section 5.6 below *Offsite Release Planning*).

Written provisions may be included in a Mutual Aid-Private Industry Agreement to allow for reimbursement for damages.

5.6 Offsite Release Planning

Preplanning for offsite releases of phosgene is critically important. Integration of site emergency response plans with public and private entities in the vicinity of the facility are useful for fast and effective response to an offsite release. Considerations in preplanning include:

- Identification of planning zones
- Communications & notification
- Sheltering in place
- Evacuation planning
- Consideration of assembly areas in the planning zones
- Emergency medical treatment
- Emergency information on phosgene.

Identification of zones that may be impacted in the event of a phosgene release should be identified so that emergency response pre-planning can be performed. The EPA RMP worst case and alternate release scenario's for phosgene are useful planning tools.

In the event of an actual or potential off site release of phosgene, the means of communication and notification are critical. Identify means of immediate notification of the authorities and the areas impacted to quickly alert potentially affected parties. Evaluate means to communicate with the public and employees families like using press releases, existing phone systems, or emergency information systems established by the company (Emergency information hot lines).

Rapid notification to potentially affected parties can insure proper sheltering in place or evacuation to minimize the impact of an offsite release. Consider utilizing the local Emergency Alert System (EAS) in place, automated phone dialing systems such as the Community Alert Network or reverse 911, and the use of community alert sirens when appropriate.

Sheltering in place of residents and other potentially affected parties can be one of the most effective means of minimizing the impact of an offsite release. Consider procedures that are in place and rehearsed to insure effective implementation.

Evacuation plans and drills are a good method to insure quick and effective implementation.

Pre-planning with areas where large numbers of people may congregate in the planning zones is imperative to effective and quick response. Work with local emergency responders to identify these areas and address notification, sheltering and evacuation plans.

Coordinate first aid and medical treatment of people affected by an offsite release with the local hospitals and EMS (Emergency Medical Service) personnel. Use of the phosgene panel's guidance titled, "Phosgene, Information on options for First Aid and Medical Treatment, current version," may be helpful for this coordinated response planning. www.americanchemistry.com/phosgenepanel.[2]

Make emergency information for phosgene readily available for first responders, the media, and people affected by the release. One available resource is the Safety Data Sheet (SDS) for the local company.

References

[1]29 CFR 1910.120
https://www.osha.gov/pls/oshaweb/owares.do_search?p_doc_type=STANDARDS&p_search_str=1910.120+

[2]"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

[3]Current AIHA ERPG values for phosgene
http://www.aiha.org/get-involved/AIHAGuidelineFoundation/EmergencyResponsePlanningGuidelines/Documents/2013ERPGValues.pdf

[4]Current EPA AEGLs values for phosgene
http://www.epa.gov/oppt/aegl/.

[5] An Emergency Response program for sources subject to the requirements is required under 40 CFR Part 68. http://www.gpo.gov/fdsys/pkg/FR-1996-06-20/pdf/96-14597.pdf

[6]42 U.S.C. 11003 Comprehensive Emergency Response Plan
http://www.gpo.gov/fdsys/granule/USCODE-1999-title42/USCODE-1999-title42-chap116-subchapI-sec11003/content-detail.html

[7]OSHA rules governing Hazardous Waste and Emergency Response (HAZWOPER 29 CFR Part 1910.120)
https://www.osha.gov/pls/oshaweb/owasrch.search_form?p_doc_type=INTERPRETATIONS&p_toc_level=3&p_keyvalue=1910.120&p_text_version=FALSE

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

[9]OSHA Respiratory Protection Standard 29 CFR 1910.134(g)(3).
https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_id=12716&p_table=standards