

# 6.1 Plant Layout and Siting

---

## *Introduction*

The information presented in this section is a general composite of best practices and current information about the design layout of your phosgene equipment for new construction, expansions and existing operations. It describes Plant Siting and Layout Guidelines with information relevant to the design and layout of new or revised facilities. Once the preliminary design and layout work have been completed, consider conducting a siting and plant layout 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 resources.

## **Contents**

6.1 Plant Layout & Siting .....	1
References.....	7

## **6.1 Plant Layout & Siting**

The purpose of this section is to provide considerations for safety aspects that could be affected by the location and layout of phosgene containing equipment with respect to workers, environmental receptors, and the surrounding community. The design layout of phosgene equipment is an important factor to consider for both new construction, expansions and modifications. For existing operations, this is also important, but the review approach might be different because the equipment is already fixed in location. Aspects relevant to design layout include proximity to populated buildings, other operations, and surrounding community. Consider any occupied temporary facilities such as trailers used during construction, maintenance activities and office space.

There are published technical materials and guidance books that specifically address Facility Siting and Building Siting. Some of these include:

Last Revised April 2024

Check <http://www.americanchemistry.com/phosgenepanel>  
for Potential Updates

Copyright © 2024  
American Chemistry Council  
All Rights Reserved

- Guidelines for Facility Siting, CCPS
- Guidelines for Evaluating Process Plant Buildings for External Explosions, Fires and Toxic Releases, CCPS
- Management of Hazards Associated with the Location of Process Plant Portable Buildings, API RP 753
- Management of Hazards Associated with the Location of Process Plant Permanent Buildings, API RP 752

The guidance discussed in this section is not meant to replace reference books, but to provide additional considerations for the siting of phosgene containing equipment.

“Siting” means conducting a review of the location of equipment and piping with regard to: 1) possible impact on human or environmental receptors, or 2) where other plant operations could have impact on the phosgene equipment. In case one, for example, design layout might consider items such as predominant wind direction and populated areas down wind. In case two, the considerations might include items such as any flammable or potential explosive processes which could have an impact on the phosgene equipment.

The following section provides information relevant to the design and layout of new or revised facilities. It is important to note that the following criteria represent considerations often used by facilities handling hazardous materials. However, given the highly toxic nature of phosgene, secondary mitigation measures should be considered during the construction of new phosgene handling facilities or significant modifications to existing ones. These measures may be necessary to reduce the potential risk to workers, local communities and environment resulting from a significant loss of a primary containment.

Items to consider may include:

A) Plant Siting

- Locating phosgene containing units with consideration of prevailing wind direction as far as possible from the general community outside the site boundaries.
- Protecting on-site buildings occupied by people through a combination of engineering controls, administrative procedures and/or distance, together within a site to minimize the spread of phosgene-containing areas.

- Conducting a facility siting risk assessment regarding location of phosgene facilities within a site
- Locating phosgene containing units away from other processes which have potential for explosion or fire, or events which may impact or damage equipment containing phosgene.
- Incorporating additional safety and loss prevention precautions if phosgene must be transported across plant boundaries either by pipeline or in pressurized containers.

#### B) Plant Layout

- Providing that all sections of the plant are easily accessible for maintenance and emergency response purposes.
- Locating phosgene generating or processing sections in plant areas with low traffic density whenever possible and minimizing phosgene containing pipelines.
- Having additional engineering controls for prevention and mitigation of leaks from the equipment where plant sections have special process conditions, or where because of the surrounding situation, other controls may be needed. There are several other parts of Section 6 that provide guidance for such controls including materials of construction, secondary containment, and spill mitigation. Refer to those parts for additional information. Designs that incorporate “layers of protection” rather than relying on a single method of control are relevant in this capacity.
- Selecting the location of the control building in relation to the phosgene containing sections and with consideration of the prevailing wind direction. An elevated fresh air intake in the control building with toxic gas monitoring and a building under positive pressure have been used to minimize infiltration of phosgene in the event of a release.

- Ensuring that temporary facilities (such as trailers) used during construction, maintenance contractors or office space for plant support personnel are located with consideration to the hazards of phosgene. Emergency procedures should include the occupants of these temporary facilities.

### C) Design Final Review

Once the preliminary design and layout work have been completed, consideration should be given to conducting a siting and plant process or a simple review using a series of questions or checklists. There are a number of published approaches available. Some of these include:

- Center For Chemical Process Safety Dow F&EI (Fire and Explosion Index) and CEI (Chemical Exposure Index) Guidelines;
- Center For Chemical Process Safety Book on Guidelines for Safe Storage and Handling of Highly Toxic Hazardous Materials; and
- US EPA Risk Management Planning (RMP), Section 112 regulations and application guidelines.

Other considerations such as pressurized control buildings, shelter in place locations (safe havens), phosgene leak detectors and alarms, explosion resistant windows and walls can also be relevant.

In addition to the plant siting and layout options noted above, the following are some possible questions that can be used in facility siting reviews. The questions can be applied to both existing plants and new plants.

1. For facilities in the United States, has a phosgene release been addressed as part of the US EPA's RMP Plan Worst Case and Alternate Case Scenarios?
2. Do you have local plot plans?
3. Do you have local maps showing potential offsite exposure / receptor sites?
4. Do you have historical meteorological data, wind rose and stability classes?

5. Has the maximum release quantity of phosgene been identified?
6. Are there occupied buildings or occupied temporary trailers in or near (e.g., within 100 meters) the possible phosgene release or storage points?
7. Are there roadways (public or private), bridges or tunnels near the possible phosgene release or storage points?
8. Is there some other public transportation (e.g., railways, marine, aviation) near possible phosgene release or storage points?
9. Has access for maintenance equipment (e.g., cranes, forklifts, and cherry-picker devices) been addressed in the design of the phosgene storage and handling areas?
10. Has the design addressed multiple and reliable emergency escape routes for egress? Have these routes considered any temporary occupied trailer facilities?
11. Is the phosgene storage vessel potentially exposed to a credible external fire scenario?
12. Is there a need for, or consideration of, a formal API RP 752
  - a. Facility Siting Study or Screening Study? Were appropriate standards used to determine layout and spacing of the phosgene facilities?
13. Is there a need to examine the discharge orientation of phosgene safety relief devices (e.g., pressure safety valves; vent scrubber discharges)?
14. Are there any building air intakes positioned such that they could induce phosgene vapors?
15. Are any buildings intended to be designated as temporary shelter in place locations (safe havens), and if so, what criteria are used (pressurized, double airlocks, etc.)?
16. Can phosgene migrate through underground sewers/ or closed drain systems?

17. Have you identified and evaluated every “low” point (e.g., sump, manhole, or other place) where phosgene vapor could collect?
18. Has the electrical area classification (Class/Division or Zone) been considered?
19. Has the drainage and run-off from deluge systems and unusual intensive rain been considered? Has pooling in curbed or diked areas also been considered?
20. Has the location of the control room and operator shelter, and degree of building airtight integrity been considered?
21. Are there overhead power lines?
22. Have you considered a controlled access area in or near the phosgene facilities and the distance (degree of separation) from uncontrolled access areas that are used by other non-phosgene unit personnel?
23. Have you considered suitable distance between the phosgene facilities and the plant boundary property line (fence line)?
24. Is the property adequately fenced to prohibit access by the general public?
25. Is the phosgene facility enclosed or open-structure construction? Will a small leak be able to dissipate or will it be contained in a building?
26. Is there emergency lighting for egress in the event of a power failure?
27. Is there an emergency alarm system for phosgene releases?
28. Have the consequences of site-specific hazards such as earthquake, hurricanes, lightning, and floods been evaluated?
29. Is there a detection system within buildings or the fresh air intake system to detect toxic material?
30. Is automatic or manual shutdown of fresh air intake systems into occupied buildings necessary?

31. Have considerations been made for equipment overpressure protection per system design in-lieu of safety relief devices (ASME VIII Ug-140)?
32. Have considerations been made regarding automatic or manual activations of mitigation systems in case of phosgene release?

## References

Guidelines for Siting and Layout of Facilities, 2<sup>nd</sup> Edition, CCPS

Guidelines for Evaluating Process Plant Buildings for External Explosions, Fires and Toxic Releases, 2<sup>nd</sup> Edition CCPS

Management of Hazards Associated with the Location of Process Plant Portable Buildings, API RP 753

Management of Hazards Associated with the Location of Process Plant Permanent Buildings, API RP 752

Dow's Fire & Explosion Index Hazard Classification Guide, 7th Edition, June 1994.

Guidelines for Safe Storage and Handling of Highly Toxic Hazardous Materials by Richard LeVine. CCPS, 1988

US EPA Risk Management Planning, Section 112 regulations and application guidelines.