

6.0 Design of Facilities

6.1. Plant Layout & Siting

The design layout of your phosgene equipment is an important factor to consider for new construction or expansions. 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 being located near populated buildings, other operations and off site populations. Consideration should also be given to occupied temporary facilities such as trailers used during construction, maintenance activities and office space.

“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 such items 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 - if an event occurred - could have impact on the phosgene equipment.

The following section on Plant Siting and Layout Guidelines 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, during the construction of new phosgene handling facilities, or significant modifications to existing facilities, facilities should also consider what secondary mitigation measures may also be necessary or appropriate to address the potential risk to local populations resulting from significant loss of 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 a large number of people through a combination of engineering controls, administrative procedures and/or distance.

- Locating phosgene generating and processing plants close together within a site to minimize the spread of phosgene-containing areas.
- 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 7 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. Wherever the selected location, having an elevated fresh air intake in the control building and maintaining the 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

layout review. This review has varied between a fairly formal process or a simple review using a series of questions or checklists. There are a number of published approaches available. Some of these include:

- American Petroleum Institute Guideline API RP 752;
- Center For Chemical Process Safety Dow FEI and CEI 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, Section 112 regulations and application guidelines.

Other considerations such as pressurized control buildings, “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 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) 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 Facility Siting Study or Screening Study?13. Were appropriate standards used to determine layout and spacing of the phosgene facilities?
14. Is there a need to examine the discharge orientation of phosgene safety relief devices (e.g., pressure safety valves; vent scrubber discharges)?
15. Are there any building air intakes positioned such that they could induce phosgene vapors?
16. Are any buildings intended to be designated as temporary safe-havens, and if so, what criteria are used (pressurized, double airlocks, etc.)?
17. Can phosgene migrate through underground sewers/ or closed drain systems?
18. Have you identified and evaluated every "low" point (e.g., sump, manhole, or other place) where phosgene vapor could collect?
19. Has the electrical area classification been considered?
20. 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?
21. Has the location of the control room and operator shelter, and degree of building airtight integrity been considered?
22. Are there overhead power lines?
23. 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?
24. Have you considered suitable distance between the phosgene facilities and the plant boundary property line (fence line)?

25. Is the property adequately fenced to prohibit access by the general public?
26. 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?
27. Is there emergency lighting for egress in the event of a power failure?
28. Is there an emergency alarm system for phosgene releases?