**Process Design - PhaseO/Phasel**

 Equipment list with approximate dimensions and motor horsepower.

 Process flowsheets or preliminary P&ID's showing relative elevations.

 Off-site requirements - buildings, tank farms, diked areas, railroads, cooling towers, storage areas, etc.

 Hazard considerations.

 Process buildings and/or structure requirements: open/closed.

 Future expansion considerations.

**Safety Considerations**

Safety and protection of human lives must be the paramount concern in the preparation of layouts. The following considerations are by no means totally inclusive; they are only those that would have a substantial impact on the plant dimensions and capital cost:

 For adequate fire protection, any part of the plant should be accessible from at least two directions.

 Process units handling flammables should be separated to minimize possible spread of fires.

 All areas protected with sprinkler or deluge systems must be contained with provisions for rapid drainage to large remote reservoirs.

 Process vessels with substantial inventories of flammable liquids must be located at grade.

 Hammable materials must he stored outside in diked areas and away from process units and other active areas, control room office change rooms, etc.

 Equipment subject to explosion hazard must be set away from occupied buildings and areas.

 All operating areas must have at least two means of access and exit. On elevated areas, at least one should be a stairway.

**Maintenance Considerations**

A plant that can not be maintained properly will deteriorate gradually and eventually become inoperable. Good plant maintenance ability is the result of well-thought-out layouts. The following guidelines affect plant dimensions and must be kept in mind when developing layouts:

 All equipment should be accessible by either crane or lift truck.

 Space for maintenance and dismantling must be provided around compressors.

 Bundle removal space must be allowed for shell-and-tube exchangers.

 Sufficient suction head must be allowed for pumps handling hot liquids.

**Recommended minimum clearances**

***General***

 Property Line: All process units and auxiliary buildings, except the front office and the guard house, must be at least 30 ft. from the property line.

 Primary Roads: Width 30 ft.; headroom 22 ft.; distance from buildings and process areas 10 ft.

 Secondary Roads: Width 20 ft.; headroom 20 ft.; distance from buildings and process areas 5 ft.

 Pump Access Aisleways: Width 12 ft.; headroom 12 ft.

 Process Areas Main Walkways: Width 10 ft.; headroom 8 ft.

 Process Areas Service Walkways: Width 4 ft.; headroom 7 ft.

 Stairs: Width 3 ft.

 Railroads: Headroom 24 ft.; clearance from track centerline to obstructions 10 ft.

 Main Pipe Racks: Headroom 22 ft.

 Secondary Pipe Racks: Headroom 15 ft.

 Floor Elevations: The vertical distance between operating levels must be no less than the height of the tallest process vessel plus 8 ft. or the tallest tank plus 6 ft.

***Around Hazardous Areas***

 Flare stacks 100 ft.

 Cooling towers 100 ft.

 Medium flammability liquid storage 50 ft.

 High flammability liquid storage 100 ft.

 Explosion potential 100 ft.

***Around Process Equipment***

- Tank Farms:

1. Between tanks1/2 dia.

2. From tank to dike wall 5 ft.

3. Access around diked area 10 ft.

4. Dike capacity Largest tank plus 10%

- Around Compressors 10 ft.

- Between Adjacent Vertical Vessels:

1. 3 ft. dia. 4 ft.

2. ft. dia. 6 ft.

3. Over 6 ft. dia. 10ft.

- Between Adjacent Horizontal Vessels:

1. Up to 10 ft. dia. 4 ft.

2. More than 10 ft. dia. 8 ft.

- Between Horizontal Heat Exchangers 4 ft.

- Between Vertical Heat Exchangers 2 ft.

- Around Fired Heaters 50 ft.

**Miscellaneous equipment dimensions**

***Pumps:***

1. Up to 3 HP 1 ft. x 3 ft.

2. 10 HP 1.5 ft. x 4 ft.

3. 30 HP 2 ft. x 5 ft.

4. 75 HP 2 ft. x 6 ft.

5. 200 HP 3 ft. x 7 ft.

***Compressors:***

1. Up to 50 HP 3 ft. x 6 ft.

2. 100 HP 4 ft x 8 ft.

3. 250 HP 6 fix 12 ft.

4. 500 HP 6 ft. x 16 ft.

5. 1000 HP 6 ft. x 20 ft.