

10 Things to Know About Food Plant Design

Considerations That Reach Beyond the Plant Floor

Food processing and consumer products facilities require reliability and flexibility to ensure consistent, high quality, and high-volume product output. The Austin Company has extensive knowledge and experience delivering successful plant construction projects, where complex processes are designed and built with the utmost efficiency and precision. We help clients plan, design and construct food plants with safety, quality, reliability and cleanliness as the guiding principles.

Following are *10 Things to Know About Food Plant Design – Considerations That Reach Beyond the Plant Floor*.

1. Maximize Site Location

Selecting the site for a new food plant is the first critical step in turning concept into reality. Every site will have pros and cons, and the challenge is to strike a balance among competing needs. Site requirements can be broadly broken down into three categories: physical, logistical and labor.

A good **physical** site will generally be flat with ample access to electrical, gas and water sources. A good rule of thumb is to have a site at least three-to-four times larger than the footprint of the planned building. Wastewater treatment, whether by local sewer or on-site management, should be considered. Most food plants are not significant sources of air contaminants, but local ordinances and restrictions should be investigated. Wetlands and abatement issues are often also considerations for very large sites.

The **logistics** of the site can be substantially more complicated than knowing whether there is a major highway or rail line nearby. Today's manufacturing is driven by the logic of the supply chain. Choose a site location that provides access to inbound raw materials, as well as close access to end user markets. Generally, inbound raw materials are delivered in bulk or in high-density shipments, while final product may have a lower freight density. Siting the manufacturing plant to balance the cost of inbound and outbound freight, plus the availability of required transportation services, such as reefer trailers, is key.

The availability of **labor** that meets operational requirements also is a critical factor in site location. Depending on required skill level, the availability of technical training schools and colleges in a community may influence location decisions. In order to attract the required workforce, the site should be accessible to sufficient pool of desired workers. If the workforce will rely heavily on public transportation, proximity to these services is essential. On the other hand, if most employees will drive to work, determine whether the chosen site will facilitate intended traffic volumes and parking.

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2. Manage Traffic Flows

What happens outside the plant is every bit as important as what happens inside the plant. For most plants, the hard-surfaced areas for roadways, parking lots, storage areas and sidewalks can cover up to one-and-a-half times the area under roof. The area required to accommodate inbound and outbound trucks, rail cars, employee parking, visitor traffic and routine deliveries, creates a complicated flow around the facility's exterior.

For safety, it is wise to separate freight traffic, such as large trucks and railcars, from pedestrian traffic. Also, it is preferable to provide separate entrances and exits for truck traffic versus employee and visitor parking, and ensure that these access points don't cross on site. Separate areas for visitors and small commercial deliveries also are desirable. While this may complicate security requirements, the improvements in control and safety are worth the effort.

Depending upon the internal configuration of the plant, shipping and receiving may be co-located or completely separate operations in the facility. In addition, routine solid waste removal and special deliveries may influence design and layout of dock doors. It is important to orient truck traffic for driver visibility and ease of maneuvering. In addition, recognize that some docks may have higher usage than others, so these should be assigned better access to the general flow paths. Finally, if on-site trailer storage or queuing of inbound loads is part of the operation, pay special attention to how these areas interact with overall traffic patterns.

By their nature, the operations involved in receiving, unloading and transporting materials into and out of the facility often result in spills and generate refuse. Arranging traffic patterns can be an asset in maintaining the appearance of the site.

3. Protect Against Infestation and Contamination

Food plants require a higher level of resistance to infestation and contamination from external sources than most other manufacturing plants. This does not mean that the plant should be designed like a bunker, but some common sense upgrades should be at the top of the list.

Exterior walls should be solid and devoid of open seams or cracks that would allow insects or vermin to enter the facility. In the same fashion, most food plants want positive control of the airflow entering and exhausting the facility, so it is important that the exterior walls resist infiltration and exhalation of air. Doors, windows, roof and foundation attachment points should all be designed to resist infiltration. Leakage will always occur, but reducing it to a minimum saves operating costs over time.

Pre-cast or tilt-up construction provides most of these features built-in. Insulated metal buildings have slightly different requirements. An insulated metal panel (IMP) can be made

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more resistant to infiltration and infestation by fitting the top and bottom ends of the panel with a welded or crimped end-cap. Caulking and sealing the seams can also improve performance.

4. Choose Energy Efficient Roof Designs

The roof does much more than keep the rain and elements out of the building. While under continuous exposure to the sun during daylight hours, an improperly insulated roof can add a tremendous heat load to the building. Additionally, a poorly insulated roof can be a source of energy inefficiency for plants requiring climate control.

For most plants, the roof area is considerably larger than the area of the exterior walls, so investing in a high quality roof system has an immediate payback for energy efficiency. In addition, newer roof designs incorporate reflective and absorbent areas to help balance heat loads in the building.

Newer green designs take advantage of the large, exposed areas of the roof to install solar collection systems that can heat water. Some plants have installed rooftop gardens to help reduce heat load and reduce water runoff.

5. Control Contaminants with Walls and Finishes

Food production must occur in a safe, clean environment. While it is possible to create these conditions at the initial startup, keeping the plant clean is a continuous process throughout the life of the manufacturing cycle. Sanitary plant design will consider both the location and barrier properties of internal walls to facilitate sanitation, provide climate control within the plant, and reduce cross-contamination across production areas.

Interior walls should be designed and located to help separate process areas from each other. If raw materials pose cross-contamination hazards (for example, raw meats), it is important to clearly separate them from finished materials. If a product contains a known allergen, walls can serve as both a physical barrier and a means to control airborne cross-contamination. An existing HACCP plan is a good starting point for identifying where isolation and separation are needed in the new plant.

The other aspect of interior wall selection is the finish. Regardless of whether the area is wet or dry, it is beneficial to have relatively smooth, impervious surfaces. Wet areas should be resistant to moisture and the cleaning chemicals typically used. Dry areas should minimize the opportunity for dust and stray product to collect on surfaces. It is a good idea to have a sanitation plan in mind when selecting the types of walls and finishes that will be used.

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6. Install Durable Wall and Ceiling Materials

Time and exposure are the enemies of any facility. As a facility ages, surfaces become scarred and abraded, paint and finishes peel and flake, and it becomes harder to keep clean. Ceilings become degraded, too, from exposure to heat, moisture and concentrations of airborne contaminants. As these surfaces break down, the chance of product contamination increases. This is especially true of insulated ceilings. As it ages, the ceiling surface breaks down and fine particles of insulating material can fall into process areas.

Selecting durable wall and ceiling materials is an absolute must for good food plant design. Where paints are used, they should form a tight bond with the substrate and resist peeling and flaking. Hard surfaces should resist cracking and flaking, too. Ceiling materials should be resistant to extremes of temperature and moisture, as well as offer good chemical resistance to substances that might become airborne from process operations. Insulating materials should be immobilized wherever possible. Solid insulation, rather than soft, friable materials, should be considered. Even solid insulation needs to have a good system of providing protection against mechanical damage.

7. Design Systems to Maintain Sanitation

Food plants have a variety of process and utility equipment. Much of the utility equipment may be conventional, off-the-shelf hardware, located in areas away from the production environment. There are still precautions, however, to help keep the food plant clean.

For example, all floor-mounted panels and substations should be placed on housekeeping pads. If these are along the wall, the backs of the units should be sealed with caulk to prevent infestation or entrapment of materials. Water chillers, storage and mixing equipment should be placed in curbed areas to control migration of spills or leakage, especially if these systems are frequently drained and re-charged. Curbs or drains to control water migration also must protect wash down areas.

Plant systems will have many utility connections and drops. In general, routing of utility lines should minimize horizontal runs over production areas. The “utilidor” concept works well for main utility runs. A utilidor is an enclosed corridor that is used both for personnel movement within the plant and the routing of main utility lines.

8. Lower Utility Costs with the Environment

Take advantage of environmental conditions to help manage utility costs. For example, southern exposures let in sunlight and warmth in the winter; northern exposures will see less heat gain. Taking advantage of these factors can substantially improve overall operating costs.

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Natural lighting may not be sufficient for year-round operations, but take advantage of what sunlight is available by designing in high windows and skylights. These go a long way to help lower energy bills.

Landscaping grounds and using pervious concrete surfaces helps manage site runoff and reduces storm water loads. At sufficient distance from the building, properly selected trees can provide some shade and cooling, and provide an attractive area for employees to gather.

The natural topography of the site can be used to support drainage and management of storm runoff and wastewater discharges, using gravity instead of pumps.

9. Choose Well-Designed, Cleanable Process Equipment

Several organizations, such as the [American Institute of Baking](#) (AIB) and the [3-A Sanitary Standards Institute](#), provide sanitation guidelines for process equipment in terms of fabrication and final performance requirements. Discuss these standards with equipment vendors to ensure that process equipment is designed for sanitation ease and thoroughness.

In the end, well-designed and easy-to-operate equipment results in better performance and operator satisfaction. A satisfied equipment operator can be a great asset for developing an efficient and sanitary process operation.

Plant design should pay particular attention to points where large amounts of refuse or product waste may be generated. A plan for collecting and containing this material, with an area to properly dispose of it and to clean the collection systems, is required in a well-designed plant.

10. Train Employees on Sanitation Practices

Ultimately, employees are responsible for maintaining efficient and sanitary operations. The design of the plant should accommodate their efforts as much as possible. For example, with a team-based workgroup management approach, it is critical that the plant layout facilitates visual and verbal communication among team members.

Training employees on proper sanitation methods is just as critical as training them on safe operations and equipment. In addition, trainers themselves should receive training up-front, so that their training efforts are more effective. This should begin with a basic understanding of what contaminants are and what the consequences of producing contaminated product can be. Next, discuss how to prevent contamination and to ensure the risks are minimized. Finally, stress the importance of a HACCP and strong QA/QC program in plant operation.

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About The Austin Company

The Austin Company has been recognized as an innovative leader in the food, beverage and consumer products industries since the early 1900's. Over 135 years and hundreds of projects later, that innovation continues as Austin designs and builds sustainable and efficient facilities for processing, product development and distribution. Our global experience includes production and packaging plants, automated distribution and bulk storage warehouses, research laboratories, and operations centers.

Austin has extensive experience providing site location, architectural design, engineering and construction services around existing operations, so clients experience little to no down time or lost production during facility expansion, construction or relocation.

Contact one of our Senior Directors of Project Planning below to learn how Austin can help you maximize the return on your next facility project.

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