

Austin's Top Ten Things You Need to Know About Food Plant Design

There are numerous considerations that reach beyond the plant floor.

The Austin Company's Food and Beverage Group has the experience and knowledge you need to help you realize a successful plant construction project. At The Austin Company, we understand that food plants must be designed and constructed with safety, quality, reliability and cleanliness as the guiding principles.

Here are our Top 10 Tips for Food Plant Design:

1. Choose the site for maximum benefits

Selecting the site for your new food plant is the first critical step to turn your concept into a reality. Every site will have its good points and bad points 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 that is at least 3-4 times larger than the footprint of your planned building. Waste water treatment (whether by local sewer or on-site management) should be considered. Most food plants are not strong point-sources of air contaminants, but local ordinances and restrictions should be investigated. Wetlands and abatement issues often are involved for very large sites.

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

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

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2. Manage traffic flows for efficiency and safety.

What goes on outside your plant is every bit as important as what goes on inside your plant. For most plants, the hard-surfaced areas for roadways, parking lots, storage areas and sidewalks can be up to one and one-half the area under roof. In addition, the number of inbound and outbound trucks, rail cars, parking for employee vehicles, visitor traffic, and routine deliveries makes for a very complicated flow around the outside of your facility.

It's a good idea to separate freight traffic (large trucks, railcars) from pedestrian traffic. It is preferable to have separate entrances and exits for truck traffic and employee and visitor parking, and to make sure that these access points don't cross on your site. Separate areas for visitors and small commercial deliveries also are desirable. While this may complicate your security requirements, the improvements in control and safety are well worth the effort.

Depending upon the internal configuration of your plant, shipping and receiving may be co-located or completely separate operations in your facility. In addition, routine solid waste removal and special deliveries may impact how you design and layout your dock doors. It's important to orient truck traffic for driver visibility and ease of maneuvering. It's also important to recognize that some docks may see 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 your operation, you'll want to pay special attention to how these areas interact into your overall traffic patterns.

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

3. Ensure exterior walls resist infestation and contamination

Food plants require a higher level of resistance to infestation and contamination from external sources than most other manufacturing plants. This doesn't mean that you have to design your plant like a bunker, but some common sense upgrades should be at the top of your list.

Your exterior walls should be solid and devoid of open seams and/or cracks that would allow insects or vermin to enter your facility. In the same fashion, most food plants want positive control of the airflow entering and exhausting the facility, so it's important that the exterior walls resist infiltration and exhalation of air. Doors, windows, and 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.

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If you're using pre-cast or tilt-up construction, most of these features come built in. Insulated metal buildings have slightly different requirements. An insulated metal panel (IMP) can be made more resistant to infiltration and infestation by having the top and bottom ends of the panel fitted with a welded or crimped end-cap. Caulking and sealing the seams also can be done to improve performance.

4. Choose roof designs that support energy efficiency

The roof does a lot more than just keep the rain and elements out of your building. It is under continuous exposure to the sun during daylight hours, and an improperly insulated roof can add a tremendous heat load to your building. Additionally, a poorly insulated roof can prove to 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 putting money into a good roof system has an immediate payback for energy efficiency. In addition, newer roof designs can incorporate reflective and absorbent areas to help balance heat loads in the building.

Finally, some newer "green designs" take advantage of the large, exposed areas of the roof to install solar collection schemes that can heat water. Some plants have installed roof "gardens" to help reduce heat load and to reduce water runoff.

5. Use walls and finishes that control contaminants

Food production has to occur in a safe, clean environment. While it may be possible to have these conditions at the initial startup, keeping your plant clean will be a constant chore during the life of the manufacturing cycle. A good plant design will take into consideration the location and barrier properties of internal walls to facilitate sanitation, provide climate control within the plant, and reduce cross-contamination across production areas.

The interior walls should be designed and located to help you separate parts of your process from each other. If your raw materials pose cross contamination hazards (for example, raw meats) it's important that you clearly separate them from finished materials. If your product contains a known allergen, walls can serve as both a physical barrier and a means to control airborne cross-contamination. If you have an existing HACCP plan, this can be a good starting point for identifying where you'll need isolation and separation in your new plant.

The other part of interior wall selection is the finish. Regardless of whether the area is wet or dry, it's always a good idea to have relatively smooth, impervious surfaces. Wet areas should be resistant to moisture and the cleaning chemicals typically used. Dry areas should minimize the

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opportunity for dust and stray product to collect on surfaces. It's a good idea to have a sanitation plan in mind when you begin selection of the types of walls and finishes that you'll be using.

6. Install durable wall and ceiling materials.

Time and exposure are the enemies of any facility. As your facility ages, surfaces become scarred and abraded, paint and finishes peel and flake, and it becomes harder to keep clean. Your ceilings have 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 they age, the ceiling surface breaks down and fine particles of insulating material can fall into your 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 your 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 mechanical/electrical systems to maintain sanitation

Your food plant will have a variety of process and utility equipment. Much of the utility equipment may be conventional, off-the-shelf hardware that will be located in areas away from the production environment. But that there are precautions you can take to help keep your 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. Your water chillers, storage, and mixing equipment should be placed in curbed areas to control migration of spills or leakage, especially if you frequently drain and re-charge these systems. Wash down areas also need to be protected by curbs or by drains to control water migration.

Your systems will have many utility connections and drops. In general, routing of utility lines should minimize horizontal runs over production areas. The "utilidor" concept is a great idea for main utility runs. A utilidor is essentially an enclosed corridor that is used both for personnel movement within the plant and the routing of main utility lines.

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8. Use the environment to lower utility costs

You should take advantage of environmental conditions to help manage your 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 your overall operating expenses.

While natural lighting may not be sufficient for year-round operations, taking advantage of it by designing in high windows and skylights will go a long way to helping with your energy bills.

Landscaping your grounds and using pervious concrete surfaces helps manage site runoff and reduces your storm water loads. At sufficient distance from the building, properly selected trees can provide some shade and cooling, plus 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 waste water discharges, using gravity instead of pumps.

9. Choose well-designed, cleanable process equipment

Several organizations like the American Institute of Baking (AIB) and the 3-A Sanitary Standards Institute (3-A) provide sanitation guidelines for process equipment in terms of fabrication and final performance requirements. Discuss these standards with your equipment vendors to ensure that your process equipment will be designed for sanitation ease and completeness.

In the long run, well-designed and easy-to-operate equipment results in better performance and operator satisfaction. And a satisfied equipment operator can be your best asset for developing an efficient and sanitary process operation.

Your 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, plus an area to properly dispose of it and to clean the collection systems is an absolute must in a well-designed plant.

10. Train employees on sanitation practices

Ultimately, your employees are responsible for maintaining efficient and sanitary operations. The design of your plant should accommodate their efforts as much as possible. For example, if you follow a team-based workgroup management approach, it's critical that your plant layout facilitate visual and verbal communication among team members.

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Training your employees on proper sanitation and methods is just as critical as training them on safe operations and equipment. This course 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 make sure the chances are minimized. Finally, stress the importance of a HACCP and strong QC/QA program in plant operation.

Our Capabilities

The Austin Food and Beverage Group provides guidance, expertise and experience in Master Planning which extends well beyond the brief information provided here in our Top Ten list. Should your future plans include upgrading an existing facility or site location and planning for a new facility, please contact us at one of our offices below to find out how we can help you evaluate and improve your bottom- line.

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