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PROCESS COOLING
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THINK POSITIVE

Positive airflow can help controlling air quality in food processing plants.

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The goals of today's food processing facilities are simple: maximize production capacities and profit potential while supplying safe products to consumers. However, recent product recalls and illnesses linked to unsafe food products have created several challenges for the entire food industry. Government regulations and programs such as Hazard Analysis and Critical Control Points (HACCP) and the Food Safety Modernization Act (FSMA) are designed to help ensure that food processing plants are following the necessary guidelines to provide consumers with the safest products possible.

One key ingredient that is often overlooked is a plant's total air balance as related to positive room pressure. Many plants are aware that they may have unwanted condensation issues in a specific part of their plant, but they may not be aware of the origination of the problem. The integrity of safe food products can be related to proper airflow, room pressurization, balance and maintaining appropriate room conditions.

No matter what the cause, processing plants are focused on avoiding the possibility of their products being exposed to and affected by dangerous microorganisms. Airborne bacteria such as *listeriosis*, *salmonella* and *E. coli* can be transferred from one room to another as these particles can

Airflow vs. Product Flow in Process Applications

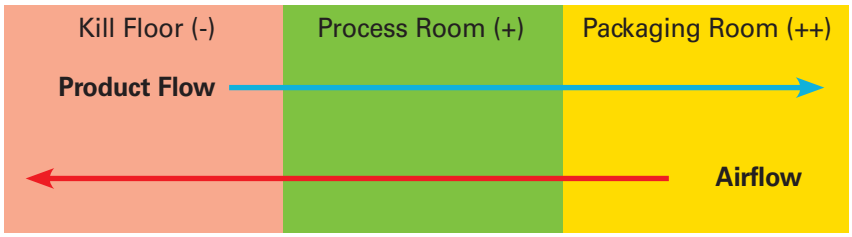

Figure 1. To effectively establish room pressure, an air balance should be performed on the entire facility. Some rooms will need to be negative, some will be neutral and still others will be positive.

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Types of Filters for Process Applications

Type of Filter	Prefilter	Intermediate	Final	HEPA
MERV Rating	8	11	14	16+
Dust Spot Efficiency	30 Percent at 1 µm	65 Percent at 1 µm	95 Percent at 1 µm	99.9 Percent at 0.3 µm
Depth	2 or 4" Throwaway	6 or 12" Cartridge	12" Cartridge	12" Cartridge

Figure 2. The amount of filtration is determined by the application.

be picked up in the airstream and deposited elsewhere through the plant. For example, most meat processing plants perform a variety of operations from slaughtering livestock to preparing ready-to-eat products. While the manner in which the rooms are operated may be very different, they all have one thing in common: any moisture that drips from the ceiling with the potential to contaminate the open product below is strictly prohibited. Controlling the air within the entire processing plant is a critical consideration when remodeling an existing plant or building a new facility.

There are five basic principles related to air quality that should be implemented when designing a sanitary food processing facility.

1. Temperature

Usually temperature is the first detail to be established during design phase. While most meat processing rooms are required to operate under 50˚F (10˚C), several end-users are designing rooms between 35 and 40˚F (1.6 and 4.4˚C). The intent for these lower temperatures is to minimize microbial growth which, in turn, increases shelf life and overall product quality. Whether processing meats, dairy, vegetables, beverages, etc., each process room has predetermined temperature needs.

2. Humidity

Humidity relates to the moisture content in the air. As room temperatures are reduced, the relative humidity increases. Know each room's target relative humidity. It is not uncommon for 38˚F (3.3˚C) processing rooms to be at or above 85 percent relative humidity. In contrast, 38˚F (3.3˚C) packaging rooms are usually in the 65 to 75 percent range.

3. Air Changes

This term refers to the amount of time required to circulate the entire volume of air through a specific room. For identically sized rooms, colder rooms will require a more aggressive air change as compared to warmer rooms. Also, after a sanitation cycle, quicker air changes will reduce the time required to dry the process room.

4. Pressurization

Pressurization is the amount of air pressure in a room relative to adjacent rooms. To effectively establish room pressure, an air balance should be performed on the entire facility. Each processing plant will have different zones with varying amounts of pressure requirements. Some rooms will need to be negative, some will be neutral and still others will be positive. Pressurization requires the introduction of outside air to the plant. Because the room pressure is determined by the amount of outside air, special consideration should be given to not overpressurize the room.

Conditioning the outside air requires either mechanical cooling or heating the air before it enters the space. In both cases, excessive outside air will result in higher energy costs. In addition, when outside air is being supplied to a process room, the discussion of dew points is of great importance. If the outside air is not cooled below the dew point of the room, the formation of condensation is likely to occur. This condensation usually forms on the ceiling of the room because air exiting the supply grill or diffuser makes contact with the ceiling, which is at a lower dew point than the supply air.

As mentioned before, some areas are designed to operate under negative room pressure, relative to other parts of the building. An example would be a kill floor. The odors, bacteria and heat loads associated with kill floors should not be allowed to migrate though the plant. Since these rooms are under less pressure, air from other areas of the plant will be drawn into them. The air that enters from adjacent areas does not create ceiling condensation in the kill floor because the entering air is below the dew point of the kill floor. However, processing and packaging rooms will respond in a very different manner. Because these rooms are designed to operate at much lower temperatures (36 to 40˚F or 2.2 to 4.4˚C) they also have lower dew points. If warmer air from a surrounding room is allowed to enter these rooms, the result will be the formation of condensation on equipment, walls and ceilings (figure 1).

5. Filtration

The outside air that is used to balance the air pressure in the plant not only needs to be cooled or heated, but filtered as well. If the fresh air is not filtered, harmful bacteria will be allowed to enter the facility. The amount of filtration is determined by the application. Less critical rooms may usually only require a 2" prefilter with a MERV rating of 8. However, packaging rooms and ready-to-eat areas will use a combination of prefilters and final filters with MERV ratings of 16. Specific requirements may vary at each facility (figure 2).

In conclusion, the way in which meat plant facilities operate has changed dramatically over the last 20 years. New plants are being designed to maximize production and old plants are being renovated. Proper airflow has been recognized as a key component to a successful building design. **PC**

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