



Controlling Airborne Microbial Contamination

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Introduction

There are many factors that can contribute to microbial loads of the in-plant environment. Several pathways can lead to the introduction of pathogenic and spoilage organisms on products (1). Areas of potential hazards must be identified and addressed. Simple precautionary measures can be taken to prevent points of concern from becoming contamination problems. Such precautionary measures such as Standard Operating Procedures (SOPs) are part of a comprehensive Hazard Analysis Critical Control Points (HACCP) plan.

Contamination of meat by microorganisms is a major public health and economic problem in the meat industry (1). Contamination can occur at various points during the slaughter process, cold storage, and processing of meat animals (2). Research (3, 4, 5) has shown that microbial contamination of the air in processing facilities is a concern. Organisms can use air as a transport medium to either contaminate product surfaces directly, or to contaminate contact surfaces (4). With air being considered a potential source of contamination of product (6), avenues which can allow the air inside the facility to become contaminated must be controlled. Simple practices such as keeping doors closed or controlling employee traffic can be essential in controlling air contamination.

In conducting a hazard analysis of a processing facility, the tendency is to focus on sources of microbial contamination that are visible: cutting tables, processing equipment, floor drains, cooling units, and personnel equipment and clothing. Bacteria and molds, while not necessarily capable of becoming airborne, can attach to dirt and dust particles or moisture droplets and disperse throughout the air in the processing area. In fact, some have suggested that the use of high-pressure water may actually just move the contamination around. Researchers have shown that *Listeria monocytogenes* can survive for as long as 3.5 hours in an aerosol, like that created by washing with high-pressure water (7). Obviously this is critical when product is exposed to air and especially when the product is fully-cooked, ready-to-eat. Therefore it is important to consider all factors in the processing area that may contribute to cross-contamination and consider air as a potential source of contamination.

Factors that may be pertinent to the processing environment may include, but are not limited to:

Open Doors: Doors should remain closed as much as possible. This will prevent entrance of excess outside air and fluctuation of ambient temperature and humidity. A major cause of open doors is increased employee traffic.

Employee Traffic: The area of highest employee traffic is the point at which the most people are moving in and out of the room during the day (8). People carry a number of microorganisms on their person. The movement of personnel is associated with higher contamination levels (6).

HVAC Fan Operation: HVAC fan operation causes increased air flow. Air flow will affect air contamination and, in the absence of walls, corners, or other means of separation, microorganisms may be moved by the air flow into clean areas (6). Usually, HVAC fan operation is triggered by a rise in temperature. Research (1) has indicated that the use of air filtration units installed into the HVAC system can reduce the amount of airborne bacteria.

Ambient Humidity: Extrinsic factors such as humidity and temperature affect the growth of microorganisms (8). Increased humidity increases the likelihood of survival of microorganisms in the air. Humidity can increase in the processing facility from the entrance of outside or warm air into a much cooler environment and vice versa. Both of which can be controlled in the processing facility by keeping doors closed and limiting employee traffic.

Ambient Temperature: In general, microbes usually grow best at temperatures above that typical of refrigeration (~45°F). Therefore

maintaining cool temperatures is very important. Temperature within the facility can be maintained by the same means as humidity. Likewise, increase in ambient temperature also heightens the survival of microbes in the air.

Research (8) has shown that these factors account for most of the variation in microbial contamination of product by means of airborne microbes. In fact, the environmental conditions outlined here could be responsible for 1/5 of the change in air microbes and 1/3 of the change in contamination of fully-cooked meat products. Therefore, if these factors are not controlled, it can lead to other factors affecting microbial survival in air. Such factors include: time of year, time of day, outside temperature, and outside humidity.

Checklist of Potential Hazards for Airborne Contaminants

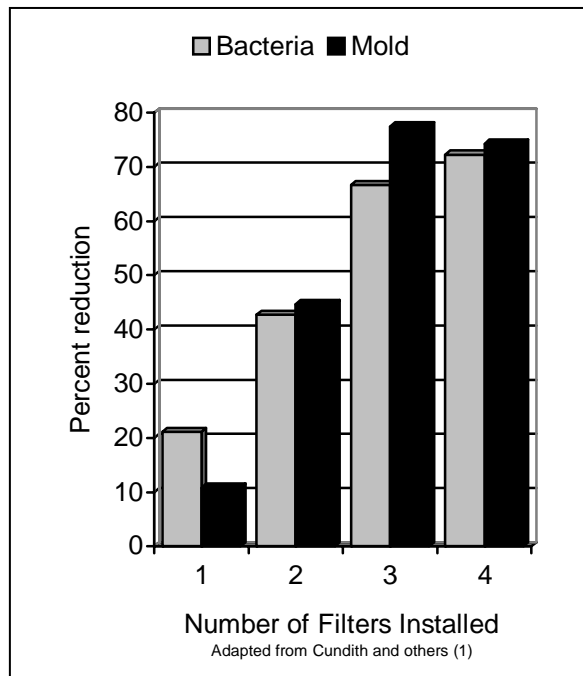
- Open Doors
- HVAC Fan Operation
- Employee Traffic
- Ambient Temperature
- Ambient Humidity
- Time of Year
- Time of Day
- Outside Temperature
- Outside Humidity

Processors can prevent the emergence of other factors which may or may not be controllable by controlling known factors. Practices as simple as closing doors and limiting employee traffic are effective means to ensure limited air contamination within the facility.

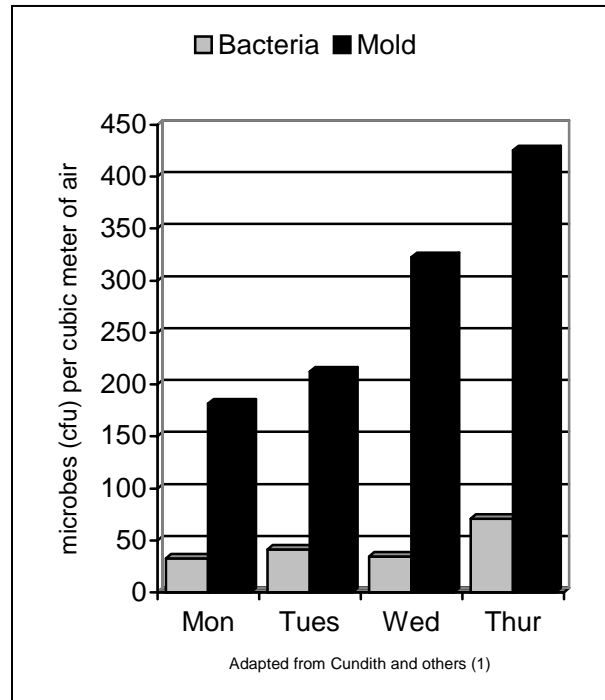
Control Measures

The simplest, most straight-forward method of controlling processing room air conditions is to make sure that all HVAC units are in good working order and consistently maintaining temperature. Additionally, doors to processing rooms should be kept closed at all times to reduce the chance of cross contamination and to assist the cooling units in maintaining temperature. If possible traffic should be routed around the processing area instead of through it to reduce contamination and keep doors closed as much as possible.

Research has shown that the installation of recirculating air filtration units are helpful in reducing the amount of bacteria and molds floating around in the air (see table below).



It has also been shown that as the day progresses, the amount of air contamination increases. In fact, as the week progresses, there is an increase in the overall contamination of air with bacteria and mold (see table below). Therefore, it is imperative that a good SSOP be established and measures be



taken to guard against this potential source of contamination. Whenever possible product and equipment should be covered to prevent these contaminants from settling and contaminating. As the research (8) has pointed out, airborne microorganisms are not a direct source of contamination, but appears to re-contaminate equipment and non-contact surfaces, which in turn can contaminate the product.

References

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