AIRBORNE CONTAMINATION

AND ITS EFFECT ON THE SAFETY OF FOOD PRODUCTS

Microbial Aerosolization in Food Processing Plants & AFCO's Control Program

The air is one of the main environmental components that come in contact with food products during the many stages of storage, handling, processing and packaging. The influence of any environment on food product quality is dependent on these environmental components and the length of time the product is exposed to the environment.
One environmental component of great effect on food products' safety is the air. Food products can get contaminated with airborne microorganisms when the food is exposed to contaminated air. Usually, microbial contamination of food products due to airborne microorganisms is dependent on the microbial population in the air in contact with the product and the length of time the product is exposed to that air.

How Can the Air in Food Processing Facilities Get Contaminated?

In a food processing environment, microbial and organic particles in aerosols can be dispersed by air or water flow/splash and can originate from a variety of sources. Take for example, the ventilation systems or air handling system – droplets containing microorganisms and spores can be dispersed from condensate on the unclean cooling coils into the plant air.

Another example is microbial aerosolization that can occur during the cleaning and rinsing of floor drains, which has often been associated with microbial contamination such as Listeria monocytogenes. The use of high-pressure water (40-60 psi and higher) generates aerosols and promotes migration of L. monocytogenes from contaminated drain surfaces to food-contact surfaces and/or food products.

Additionally, washing raw food (poultry, meats, vegetables, etc.) can often result in splashing and potential pathogen transmission to nearby areas with water droplets that are capable of traveling in the air and causing microbial contamination.

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Is It True That the Air Is Capable of Carrying Microorganisms & Their Spores?

Air often contains and carries tiny organisms such as fungi, bacteria, viruses and spores due to their light weight. Current research has shown that certain groups of bacteria are capable of performing basic metabolic activity in air with high humidity. Also, studies show that groups of the small organisms can clump up, which will enhance their survival while airborne. The presence, survival and number of these microorganisms and their spores are dependent on many factors, including but not limited to the following:

- **Air Movement**
  Moving air, such as that generated by cooling fans, ceiling cooling units, blast coolers, and air handling systems, can cause microbial aerosolization due to their light weight. The faster the air moves, the higher its ability to physically detach microorganisms and their spores from their sources (e.g. contaminated surfaces of cooling coils, floors, or raw food products). The air blowing on contaminated surfaces will detach and steal some microorganisms and spores and transfer them onto non-contaminated objects or food and contaminate them. Therefore, it is of utmost importance to keep the air handling system's surfaces clean, separate raw storage areas from finished product storage areas when storing food and follow the correct way to clean floor drains when using brushes and low-pressure water.

- **Amount of Organic or Food Particles in the Air**
  In general, air that is rich in food particles (not filtered properly) can support microbial growth, however, if the air is clean and dry, airborne microorganisms will die from starvation after a couple of hours. During these two hours, if the airborne microorganisms are transferred via the air to a food product, they will continue to grow and multiply by feeding on the food; thereby contaminating the food. If the airborne microorganisms are attached to small food particles (in droplets from splashing cleaning water), they can feed on the particle and survive for a longer time in the air.

- **Humidity Level in the Air**
  Another important factor that can support microbial survival and growth in the air is humidity. The higher the humidity, the greater the possibility of microbial survival and growth in the air. Therefore, maintaining balanced air with low humidity using efficient air handling systems is critical. Keep in mind that fungi, such as yeast mold and their spores, can survive and grow in the air and on surfaces at low humidity levels and relatively high or low temperatures.

- **Negative Air Pressure in Processing**
  Negative air pressure in food processing plants draws air from outside the plant into the processing areas via gaps and crevices in the building's walls, ceiling, floors, doors, and even floor drains; especially if the drains are not equipped with a P-trap. Since most of food processing plants are located in industrial areas with heavy atmospheric pollutants, including microorganisms, food processors should ensure that these pollutants are excluded from the food they are processing. When the outside contaminated air enters the plant through the building gaps due to the negative air pressure, it will contaminate the air and the food being processed and stored inside the plant. For this reason, positive air pressure is recommended in food processing plants. With positive air pressure inside the processing area, the air is introduced to the processing areas through a filtration system that usually removes these types of pollutants, including microbial and physical contaminants.

- **Drain Back-ups**
  When floor drains are clogged due to an obstacle in the underground pipes, water level inside the clogged pipes will backup and rise until it reaches the processing area floor. During this period, the air in the drain in front of the clog will be forced upwards towards the processing area. While the water is backing up and rising in the drain, the air moving toward the processing area will carry organic droplets and microorganisms from the biofilm that covers the drain pipe to the air in the processing area. This is also called microbial aerosolization.

Remember, the impact of airborne contamination is twofold. It can affect public health with foodborne illnesses due to the possibility of consuming food that is contaminated by airborne pathogens. It can also have an economic impact, with the negative economic consequences of producing contaminated food due to microbial aerosolization, and its impact on product shelf-life and profitability. Both factors are of equal importance to food processors.

With the above in mind, air quality in food processing must include an evaluation of particle population, humidity, odor, microbial population and temperature. During the handling and processing of food products, microbial load represents the quality attribute of primary concern in the air.

Factors Contributing to Airborne Contamination

1. **Human Activities**
   Sneezing
   Coughing
   Cleaning drains with high-pressure water & wrong brushes
   Removing/rinsing biofilm using brushes & high-water pressure

2. **Plant Structure/Equipment**
   Floor drain back-up
   Negative air pressure in the plant
   Unclean air handling systems
   Ceiling cooling units and their drip-pans
   Cooling fans
   Using high water pressure for the wrong purpose
   Reconstruction and tearing down walls and ceilings
   Open doors and windows to outside during operation
   Leaky roofs, walls, doors, and windows

3. **Nature**
   Strong wind
   Storm and rain splash
   Standing water around the plant
   Plant location near a body of water (e.g. lake)

Although it might be impossible to eliminate airborne microbial contaminants from plant air, it is possible to minimize their number to an acceptable, safe level. Opportunities for preventing airborne contamination are numerous, but the complexity of each mechanism dictates the need for careful analysis in order to establish the most efficient control technique.

When it comes to air handling systems, keeping their surfaces clean is very important to establish clean air in your processing plant. Fortunately, AFCO's **EcoClear** Program is just the program for that. In addition to keeping your air handling system clean and improving your plant air quality, it will also improve the system's efficiency, reduce your energy costs, and keep your business operations running efficiently.

How Does the EcoClear Program Work?

Step 1

The air handling system's components (cooling coils, condensate drip/drain pans, fan blades, fan guards, etc.) will be deep cleaned with AFCO's cleaning products to remove any dirt and debris.

Step 2

The system's surfaces will then be sanitized with a chlorine dioxide and quat-based product. This will eliminate the spoilage and pathogenic microorganisms, such as Listeria monocytogenes, yeast, mold and their spores from the surfaces.

Step 3

The cooling coils will then be coated with an environmentally friendly, biodegradable Green screen product. This coat will last for up to 12 months and will continuously protect the cooling coils and keep their surfaces clean and free of dirt, soil and microbial contaminants, thus, maintaining the efficiency of the air handling system.

Step 4

Your AFCO Food Safety Specialist will help you maintain a clean facility with our portfolio of cleaners and sanitizers.

An Air Handling System Cleaning Will ...

- Reduce the risk of mold, spores, and pathogenic bacteria, including *Listeria monocytogenes*
- Reduce your energy cost (may qualify for energy rebates)
- Increase your airflow by up to 100%
- Restore your system temperature/humidity reliability
- Help your facility become FSMA/OSHA/EPA compliant
- Help increase the lifespan of your processing equipment

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For more information about the EcoClear program and AFCO's other Sphere of Service programs, please contact your AFCO representative:

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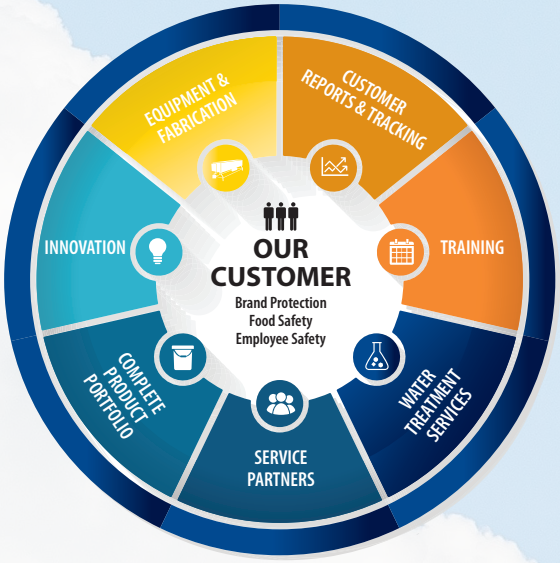
EcoClear Is an Integral Part of AFCO's Sphere of Service, Which Includes:

- Assure® Sanitation Program
- Water Treatment Services
- Equipment and Fabrication
- Online and Onsite Training
- Customer Reports and Tracking
- Smart Technology Cleaning Verification



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Infobase, My Program,
KPIs and Business Reviews,
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INNOVATION
Smart Technology
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SSOPs

COMPLETE PRODUCT PORTFOLIO
Cleaning & Sanitation Chemicals
Direct Intervention
MRO, Hand Care, JanSan
Deep Coil Cleaning

WATER TREATMENT SERVICES
Process Water, Boilers
Cooling Towers, Wastewater
Controlled Usage

SERVICE PARTNERS
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ZDL 320-237 AIRBORN CONTAMINATION 6/2021