Wisconsin Association for Food Protection
Spring workshop

Proper Air Handling Equipments and Standards for Food Processing Plants

Clauger - DualTemp Companies
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Summary

1. Introduction
2. Particles found in the air
3. Definition of «contaminants»
4. Air contaminants
5. Consequences of a contamination
6. Certifications for hygienic controls
7. How to minimize the risk of contamination
8. General design ideas for a good air treatment
9. Conclusion
1- Introduction

Importance of avoiding contaminations:
- To guarantee food safety
- To guarantee the quality of the products sold on the market

Multiple families of microorganisms can be found in the air:
- Bacterias
- Fungus
- Yeasts
- Viruses

Contaminants to the food industry
Contaminants to pharmaceutical industry
These microorganisms can:
- Settle on the surface of food
- Grow, multiply
- Render food unsafe to eat

It is necessary to **control the amount of microorganisms** present in the environment
2- Particles found in the air

Mineral particles

Biological particles
  = microorganisms
2- Particles found in the air

Production of particles by a person’s activity

Number of particles per minute with size > 5µm produced by a person
A contamination occurs when there is an unwanted component present in any liquid or surface inside a protected area.

The most common microorganisms responsible for contaminations and toxi-infections are: *Salmonella, Clostridium, E.Coli, Staphylococcus, Listeria, Bacillus, Molds and Yeasts*
Contaminations are caused by:

- Physical handling
- Impure product
- Dirty facilities and tools
- **Outside air** (make-up air)

Exhaust fan located besides fresh air intake

Dirty/clogged filters
- Air conditioning system
  ➔ dispatches microorganisms
  ➔ cooling coils, drip trays and ducts help contaminants to grow and multiply

Microbial gel in drip tray
4- Air contaminants

Dust on the evaporators

Molds
5- Consequences of a contamination

There are 2 types of contaminations:

- **Non-pathogen**: product loss, profit loss
  - Altering microorganisms (molds and bacterias)
    - *Pseudomonas, Bacillus, Brochothrix, lactic bacterias*

Alteration of the visual aspect
Alteration of the flavor
Reduction of the product shelf-life
5- Consequences of a contamination

- **Pathogen**: risk of toxi-infection
  - pathogenic microorganisms (bacteria)
    - *Bacillus cereus, Listeria monocytogenes, Salmonella typhimurium, Legionella*...

Diseases
Sanitary crisis
Loss of client’s trust
Marketing disaster

Bacterias on aged meat
Mucor on cheese
The regulation has changed in the USA since 2011 when President Obama signed the **FSMA** (Food Safety Modernisation Act)

**IFS** (International Food Standards) and **BRC** (British Retail Consortium)  
*Mandatory certifications to manufacture private label products*

**ISO 22000** certifies the management of food safety  
It includes HACCP and HGP (Hygenic Good Practice) procedures

**Codex Alimentarius**  
International Food Regulation (WHO and FAO)  
It includes HACCP and Sanitary Control Plan
7- How to minimize the risk of contamination

**HACCP** Hazard Analysis Control Critical Point

- Constitution of a team
- Analysis of the risk
- Control of the KO points
- Determine the critical limits
- Follow the KO points
- Corrective/preventive solutions
- Verification
- Record-keeping
7- How to minimize the risk of contamination

5M of efficiency or Ishikawa method:
- Evaluate each process or problem in manufacturing
- Determine the root cause of inefficiency
7- How to minimize the risk of contamination

- Geographic location of the Food Plants:
  Food Plants must be located in areas away from:
  - odors
  - smoke
  - dust
  - flood-prone zones

Pathways and hallways must be designed to be easily washed and cleaned

- Hygenic environments / facilities
8- General design ideas for a good air treatment

- **Air Handling units**: located outside of the production area

Critical points in an air handling unit:
- Materials used (non-absorbant, resistant to chemicals)
- Good draining system (slops)
- Accessibility
- Minimum « dead zones »
- Good filtration

System designed to:
- Stop the dispersion of **bioaerosols**
- Prevent formation of **biofilms** (hard to clean)
8- General design ideas for a good air treatment

- **Air Handling units**: outside of the production area

  Cooling coils
  Condensates drip going towards evacuation pipe

  Access
  Doors or hatches for visual control and sampling
8- General design ideas for a good air treatment

- Air Handling units

The first source of contamination for people is water.

Contaminant → Legionella

Water must be analyzed at least 2 times a year.

- Cooling coils and drip trays
- Humidification systems: sprayed water or air washer
- Evaporative condensers (exterior but with interior possible cross-contamination)

Symptoms:
Fever 105 °F, fainting, nausea, vomiting, cough, headache

Complications:
Irreversible respiratory insufficiency, Acute renal failure

By inhalation

Bacteria:
- Multiply between 77-110 °F
- Survive between 32-140 °F
8- General design ideas for a good air treatment

- **Air Handling units**
  - Proper filtration

**Biological particles**
= microorganisms
8- General design ideas for a good air treatment

- **Air Handling units**
  - Filters
    - **ASHRAE**
      - **Gravi**: weight of dust being stopped
      - **Opa**: surface fouling → colorimetry
      - **DOP**: MPPS efficiency → number of particles

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<th>0.1 - 0.3 microns</th>
<th>0.5 - 1 microns</th>
<th>1 - 2 microns</th>
<th>2 - 5 microns</th>
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**MPPS**: Most Penetrating Particle Size
8- General design ideas for a good air treatment

- **Air Handling units**
  - **Filters**: pleated, pockets, washable, disposable, rolls, dihedron, metal frame, wood, paper...

- **NOTE**: temperature < 160°F  
  + keep dry to preserve characteristics
8- General design ideas for a good air treatment

- **Air coolers**: inside the production area (evaporators)

Critical points for an air cooler:
- Materials used (non-absorbant, resistant to chemicals)
- Good draining system (slops)
- Accessibility
- Minimum of « dead zones »

- Stainless steel 304L or 316L

  Resistant to aggressive ambiance and detergent
8- General design ideas for a good air treatment

- **Air coolers**: inside the production area

  Impossible to clean → accessibility
  Not resistant to chemicals → compatibility
8- General design ideas for a good air treatment

- **Air coolers**: inside the production area
  - Use of stainless steel
  - Coil designed to minimize the risk of contamination
  - CIP or foam gun cleaning (inside & outside)
  - Drip tray flips down or slides out for cleaning (molds & bacterial gel)
  - Motor and propeller accessible for cleaning
8- General design ideas for a good air treatment

- **Air distribution and diffusion**

  Minimize the use of galvanized ducts:
  - Almost impossible to clean
  - Bacteria nests
  - Contaminant

  Use textile ducts:
  - Light
  - Easy to remove
  - Easy to wash
8- General design ideas for a good air treatment

- **Airflow management**
  - Management of pressure cascades for environments that require dust control
  - Thermal balancing (transfer of heat / humidity)
  - Balancing of the airflows at the plant’s scale

The higher the required hygienic level

→ The higher the pressure of the area
Airflow management

To avoid a contamination
Respect a principle:

➔ MOVING FORWARD
8- General design ideas for a good air treatment

- **Airflow management**
  
  Volume of fresh air > exhaust

  Make-up air handling unit

- Small fresh air units with HEPA filtration for overpressure control
Control of contamination = addition of several factors

THE AIR TREATMENT IS ONE OF THE FACTORS

We estimate that 90% of contaminations are airborne

Controlling air contamination is complex but necessary:
- Air / compressed air
- Water / soft water
- Equipments
- Ducts
- Airflow management
THANK YOU

David Mathieu