

# **Establishment Design and Construction Guidebook**

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## **OVERVIEW**

This Guidebook is intended for use by meat and poultry establishments in considering decisions about design and construction of their facilities, as well as the selection of equipment to be used in their operations. The material that forms the basis for this Guidebook is drawn principally from technical knowledge and experience used by the Food Safety and Inspection Service in making its prior approval decisions about the acceptability of facilities and equipment.

The Agency is no longer making these prior approval decisions for inspected establishments; however, the technical considerations on which those decisions were based may be of interest to establishments in the future. That is the material which is reflected in this Guidebook.



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## **Chapter 1            LOCATION**

Selecting the location for your establishment is an important factor in providing a sanitary environment for producing meat and poultry products. When selecting a location, you will need to consider the physical environment of the site, accessibility, separation of your premises from other businesses, common areas shared by you and other establishments, and whether or not you will conduct uninspected businesses such as retail stores or custom slaughter on or near your premises. This chapter provides guidelines you may wish to consider when you select a location for your establishment.

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### **1.     Site**

The size of the site should allow for all buildings, parking lots, access roads, and future expansion. This site should be large enough to accommodate a potable water supply for your processing needs, and a sewage system that can efficiently handle liquid waste and processing water created by your establishment. In addition, potential building locations should be evaluated for sanitation hazards. In determining that possibility, consider the following guidelines:

- To the extent possible, establishments should be located in areas free of industries that attract vermin such as sanitary landfills and junk yards.
- To the extent possible, establishments should be located in areas free of odors and airborne particulate matter that may be produced by neighboring industries or other outside sources, such as oil refineries, trash dumps, chemical plants, sewage disposal plants, dyeworks, and paper pulpmills.
- The prevailing winds are an important factor in site determination because substances emanating from distant sources may be a problem if the winds carry them to the establishment site.

### **2.     Separation of Official and Non-Official Establishments**

Sometimes an establishment is located next to or in the same building as other businesses which are not under FSIS inspection. In those circumstances, you should take great care to keep product from becoming contaminated from the operation of the adjoining businesses.

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## Chapter 2

## LAYOUT

One of the most important decisions you make in building or modifying an establishment is how you plan the layout of your building, including the placement of rooms and equipment, product flow and people traffic patterns. Not only does a poorly designed establishment affect your productivity, but it may result in congested operations that can lead to unsanitary conditions. This chapter provides guidelines that you may wish to consider in planning any modifications to your existing establishment or in building a new one.

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### 1. Flow of Operations

The direction in and means by which product moves or flows within a plant is an important but often neglected consideration that can have enormous influence on sanitation and the safety of finished products. From a product flow standpoint, all raw meat and poultry products ought to be considered as potentially microbiologically contaminated and handled accordingly. Product being processed should flow progressively from highest potential exposure to contamination to the least potential exposure to contamination, with intervening processes designed to remove or otherwise reduce the contaminants whenever possible. The flow of air and people should be just the opposite, moving from the cleanest areas progressively toward less clean areas.

When designing product flow, consider the following:

- Moving product from raw to final cooked product areas to systematically reduce the risks of contamination along the way.
- Locating trash dumpsters and receptacles so that they do not create a risk of product contamination.
- Selecting rooms large enough to permit the installation of all necessary equipment with space for establishment operations and inspection.
- Locating people passageways to provide maximum clearance to products, work areas, and production equipment.
- Keeping truckways unobstructed.

## **2. People Traffic Flow**

Inadequate control of the flow of people through product operational areas is one of the most serious risks for product contamination. People can act as carriers and bring from the outside contaminants such as dirt, debris, and vermin which are ideal vectors for microbiological growth and which can both directly and indirectly contaminate product. Ways in which you can reduce and control the flow of people include the following:

- Establishment design should not require personnel not routinely assigned to specific work areas to be routed through those work areas. For example, personnel working the live animal areas should not be required to travel through cooked product areas to use welfare rooms.
- Welfare rooms, such as toilet rooms, dressing (locker) rooms, and cafeterias, should be designed to minimize contamination because of the traffic patterns of the people.

## **3. Separation of Raw and Ready-to-Eat Product**

Cross contamination of ready-to-eat product by raw products may occur if the layout does not provide for separation of these products. To prevent cross contamination in the preparation of products, the following are guidelines for you to consider:

- Exposed cooked product areas should be physically separated from other areas of the establishment. Non-pedestrian passage openings may be present for the transfer of product or supplies.
- A ventilation system should be used to direct air flow away from exposed cooked product areas.
- Environmental control equipment such as fans and evaporator condensation pans should not be located above the product.
- Welfare rooms, dry storage, maintenance, box/carton make up, packaging, and palletizing areas should be separate, but adjacent to, the exposed cooked product rooms.
- Cooked product should be covered in rigid containers to protect it from contamination while in storage.
- Separate coolers and/or freezers should be available to use for exposed cooked product.
- All cooking apparatuses for exposed products should have separate entry and exit portals.
- No cooked product wash or reconditioning sinks should be used.

#### **4. Perishable Product Rooms**

Special care should be taken in perishable product rooms to inhibit growth of microorganisms in operations which could contaminate product. In addition, care should be taken to prevent contamination from other operations such as where raw ingredients are prepared. Non-meat or non-poultry ingredients should be prepared in a room or rooms separate from meat or poultry processing rooms. For example, preparation of raw vegetables for use in product should be performed in a room separate from meat or poultry processing rooms.

#### **5. Edible and Inedible Products Rooms and Areas**

Edible product can be easily contaminated by contact with inedible products, grease or sewage from inedible product areas. In order to prevent this contamination from occurring, consider the following in the placement of these rooms:

- The flow of inedible and condemned product should be designed so that it does not come into contact with edible product.
- An inedible products department should be separate and distinct from the areas used for edible products. Inedible product rooms, grease interceptors, and sewage treatment equipment must be located away from edible product rooms.
- Hooded, closed chutes that lead directly from the slaughter room to the inedible handling room are designed to prevent objectionable odors produced by inedible and condemned products from entering edible products rooms.
- If rendering facilities are not available at the establishment, watertight storage facilities should be provided to hold these products before their removal to the rendering plant. These storage facilities should be separate and apart from edible product rooms, and constructed to prevent unsanitary conditions including attraction or harborage for vermin.
- Areas for inedible trucks should be paved and enclosed for ease of cleaning and to control odors and vermin.
- Where necessary, the boiler room should be a separate room to prevent dirt and objectionable odors entering from it into product processing and storage areas.

#### **6. Byproducts for Use in Animal, Pet, or Fish Food**

Establishments that process byproducts into animal, pet, or fish food should provide rooms for decharacterizing, chilling, packaging, or otherwise preparing the byproducts. Consider the following when designing and constructing these rooms:

- Byproducts to be used as animal, pet, or fish food should be stored separately to prevent cross contamination and commingling with edible products.

## **7. Coolers and Freezers**

Coolers and freezers should be large enough to properly refrigerate and store product. Product should be stored in a manner that will preclude conditions which may lead to contamination of product. The following guidelines will assist you in preventing conditions which could lead to contamination of your product:

- Coolers and freezers, including doors, should be constructed of materials that can be readily and thoroughly cleaned, durable, rigid, impervious to moisture, non-toxic, and non-corrosive. Freezer doors should be constructed and installed to prevent accumulation of frost.
- Coolers and freezers should be equipped with floor racks, pallets or other means to ensure protection of product from floor contamination.

## **8. Dry Storage**

Packaging materials and ingredients should be stored to preclude conditions which may lead to contamination of product. The following are guidelines which may assist you in the planning of your dry storage area:

- Dry storage materials should be stored in a room dedicated to dry storage only.
- The dry storage area should be constructed so that racks can be spaced away from the walls and passageways maintained between rows. This facilitates cleaning of the area. In addition, the construction should allow for all meat or poultry ingredients and/or packaging materials to be stored in closed containers on racks or pallets.

## **9. Incubation Room for Canned Products**

A room or incubator for incubating samples of fully processed canned meat or poultry must be provided in all establishments conducting regular canning operations. Consider the following guidelines when building this room:

- An accurate time/temperature recorder must be provided. To prevent temperature variations, a means for air circulation should be provided.
- Shelves should be provided to hold canned product. The shelves should be made of expanded metal or heavy gauge wire mesh and be removable for cleaning.
- The floor in the room should be pitched to a floor drain equipped with a removable screw-plug.

- The door of the room should be equipped for sealing by the inspector, if necessary.

## **10. Vehicular Areas Outside the Building**

Special care should be given in the design of vehicular areas outside your building, not only to provide room for trucks and other vehicles to operate without damaging your building, but to prevent unsanitary conditions which might contaminate product in your establishment. You should consider the following in designing your vehicular areas:

- Areas outside the building where vehicles are loaded or unloaded should be paved with concrete or a similar hard surface. Hard surface areas allow these areas to be kept clean and eliminate the potential for water puddles or dust.
- Areas outside the building where vehicles are loaded or unloaded should be drained. Drainage from the loading docks should be confined to the immediate area of the dock.
- The vehicular areas should be large enough to accommodate the turning radius of the largest trucks or shipping vehicles used by the establishment.
- The vehicular areas adjacent to the establishment should have hose connections for cleaning.

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## **Chapter 3**

## **WELFARE FACILITIES FOR ESTABLISHMENT EMPLOYEES**

One source of potential contamination of product is cross contamination from employee welfare facilities. In designing and locating employee facilities, great care should be given to preventing overcrowding and congestion and to providing enough handwash sinks and toilets for your employees. The chapter provides additional guidelines that you may wish to consider in making any modifications to or building any welfare facilities for your employees.

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### **1. Dressing (Locker) Rooms**

Dressing rooms must be provided for employees. In addition to privacy considerations, these dressing rooms should be located where they will not be a potential source of cross contamination of product. Consider the following guidelines for these dressing rooms:

- Dressing rooms should be separate from rooms or compartments where product is prepared, stored, or handled.
- Dressing rooms should be separated from the toilet area.
- Separate dressing rooms should be provided for each sex if both sexes are employed by the establishment.
- Dressing rooms should be lighted as well as processing areas.
- Separate dressing rooms for raw product employees and other processing employees will help prevent cross contamination of product.
- Receptacles for soiled clothing should be provided adjacent to employees' dressing rooms.

### **2. Lockers**

Lockers should be provided for employees' clothing and personal items. To prevent unsanitary conditions, consider the following guidelines when choosing the type of lockers and the arrangement and locations for them:

- To prevent the potential for cross contamination, the location of lockers should be separate from rooms or compartments where product is prepared, stored, or handled.
- Lockers should be large enough to store a change of clothing and other personal items.
- For ease of cleaning, lockers should be constructed of materials that are rigid, durable, non-corrosive, easily cleaned and inspected, impervious to moisture, a light, solid color, a smooth texture, and have sloping tops.
- Lockers should either be installed with enough space underneath to make the floor easily cleanable, or they should be sealed to the floor.

### **3. Drinking Fountains**

Sanitary drinking water fountains should be provided. Consider the following guidelines when installing drinking water fountains:

- Drinking water fountains should be provided at convenient locations throughout the establishment to minimize the distance that employees need to travel to reach a fountain. This is especially important in preventing cross-contamination from employees working in raw or inedible areas and traveling to processing areas to use a fountain. Consider the following locations for placing drinking fountains:
  - welfare areas including cafeterias and dressing (locker) rooms
  - inspectors' offices
  - edible product areas including kill floor, deboning, and cut-up areas
  - inedible product areas
  - immediately outside freezers and coolers
  - storage areas
- Drinking water fountains should be connected to the potable water supply and either directly connected to the underfloor drainage system or should discharge through an air gap to a hub drain.
- Drinking water fountains should be other than hand operated, and if placed as part of a handwash sink, should be located high enough to avoid splash from the sink.

#### **4. Toilet Rooms**

Toilet rooms can easily become a source of potential contamination of product. Care should be taken in the design of these rooms, their location in the establishment's layout, and to the number of toilets provided. Consider the following guidelines:

- Toilet rooms need to be separated from the rooms and compartments in which products are prepared, stored, or handled.
- Toilet rooms that open directly into rooms where meat products are exposed should have self-closing doors and should be ventilated to the outside of the building.
- Toilet rooms should be arranged so they are entered through an intervening dressing room or vestibule and not directly from a production or storage room.

#### **5. Eating Rooms and Areas**

To prevent employees from contaminating products or contaminating their food with microorganisms from the raw products or from their working environment consider the following:

- Separate eating rooms or areas should be provided for employees.

#### **6. Handwash Sinks**

One of the most important steps you can take to prevent cross contamination of product by your employees is to provide conveniently located handwash sinks. Handwash sinks are needed in toilet rooms, dressing (locker) rooms, and production rooms. Consider the following guidelines when making decisions as to where you need a handwash sink:

- Handwash sinks should have knee or foot pedals. There should be hot and cold running water, soap, and single use towels.
- Handwash sinks in welfare areas should have a combination mixing faucet delivering both hot and cold water with a faucet high enough above the rim of the bowl to enable the washing of arms as well as hands.

#### **7. Ventilation**

In designing your welfare rooms, such as toilet and dressing rooms, care should be taken to make sure that they are ventilated to prevent odors from entering production areas. Consider the following guidelines:

- Welfare rooms that are not air conditioned should be mechanically ventilated through an exhaust fan taking air to the outside. Airflow from welfare rooms should be released outside the establishment.
- Toilet and dressing rooms that are located where no natural ventilation is available should be equipped with an exhaust fan (activated by a common switch with the lighting in the area) and a duct leading to the outside. Doors to dressing and toilet rooms ventilated in this manner should have a louvered section about 12 inches by 12 inches minimum in the lower panel to facilitate airflow.

## **8. Employees Working in Inedible Product Area**

Association of employees working in inedible product areas with other employees through common welfare rooms increases the risk of cross-contamination of product. To minimize this risk to product, consider the following guidelines:

- Separate welfare rooms should be provided for employees working with raw products, finished products, the kill floor, and those working in other areas of the plant.

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## **Chapter 4            CONSTRUCTION**

A frequently overlooked area of construction design is the selection of appropriate construction materials for the establishment. This chapter provides guidelines for construction and the selection of construction materials that you may wish to consider when making modifications to your current establishment or building a new one.

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### **1. Building Construction Materials for Rooms (Finished Surfaces)**

Production and storage areas need to be constructed with materials that are easily cleaned. Product in production and storage areas is at risk for contamination from indirect contact with materials used for construction of the building. Building construction materials in production and storage areas must be:

- Rigid and durable.
- Non-toxic and non-corrosive.
- Impervious to moisture.
- A light, solid color such as white.
- Smooth or textured with an easily cleaned, open pattern, for example, a pattern where the veins and depressed areas are continuous or have an outlet and are not enclosed.

In addition, consider the following guidelines for selecting construction materials:

- In non-production and non-storage areas, building construction materials should also be easy to clean.
- Special consideration should be given before using wood as a construction material.
  - Wood can absorb not only water but other substances, including chemicals that create a risk for contamination of meat or poultry products.
  - Wood is easily damaged and may create wood particles (splinters) that contaminate meat or poultry products.

- If wood is used as a construction material in exposed product areas of the official establishment, it is recommended that the wood be milled smooth and completely sealed with a coating to prevent the wood from adulterating meat or poultry product. The coating should be easy to clean, rigid, impervious to moisture, non-toxic, and non-corrosive.
- The use of hot linseed oil to treat or coat wood in exposed product areas is not recommended because it promotes the growth of molds and fungi.

## **2. Floors**

In addition to any obvious debris on a floor, product can become contaminated by the flooring or microorganisms living in debris in tiny crevices in the floor. In order to avoid these sources of contamination, consider the following guidelines when selecting and installing flooring in your establishment:

- Floors in areas where product is handled or stored should be constructed of durable, easily cleanable materials, and be impervious to moisture. Commonly used materials are concrete, quarry tile, brick, and synthetic material.
- Floors should be installed and maintained to reduce the likelihood of cracks, depressions, or other low areas that would accumulate moisture and be difficult to clean.
- Floors where operations are conducted should have a slip-resistant surface. Good results are obtained by using brick or concrete floors with a finish that is slightly rough.
- Floors should be sloped from the walls to the drain to avoid puddles or depressions where water can stand.

## **3. Coving/Curbs**

Coving is used at the wall-floor juncture, column (post)-floor juncture, and equipment support-floor juncture to provide a smooth transition for ease of cleaning and inspection. Consider the following guidelines when using coving or curbs:

- Coving in production and storage areas should include the following criteria:
  - All seams should be tight-fitting and sealed to eliminate cracks and crevices which may shelter insects, vermin, and microorganisms.
  - The coving should eliminate any sharp angles that allow the accumulation of materials.

- Curbs should be provided to protect walls and wall finishes. Curbs should be high enough to protect the walls from pallets, trucks, or containers used in the establishment. Coving should be provided at the base of the curb.

#### **4. Stairs**

In selecting stairs, consider the following:

- Stairs should have solid treads, closed risers, and side curbs of similar material.

#### **5. Catwalks and Access Platforms**

When installing catwalks and access platforms, consider the following guidelines:

- Catwalks and access platforms in edible product handling departments should be constructed of materials that meet the same guidelines as flooring.
- Open grating should not be used for the flooring of catwalks and access platforms inside the establishment, particularly in production areas. Dirt and other debris from shoe soles can be scraped off by the grating and contaminate product, packaging materials, and equipment.
- Catwalks and access platforms should not be installed over production lines and processing equipment.

#### **6. Interior Walls Including Posts and Partitions**

To prevent product from becoming contaminated by contact with interior walls, care needs to be taken in selection of materials for the finished surface of walls. Consider the following when selecting a finish:

- Interior walls in areas where product is stored or handled, should be finished with materials that are easy to clean and impervious to moisture. Examples of such materials are glazed brick, glazed tile, smooth concrete, and fiberglass reinforced plastic (FRP).
- Walls should have a smooth texture.
- Fasteners for wall covering materials should be solid, smooth headed, and not have recesses which allow the collection of foreign material.

## **7. Ceilings**

Ceilings in areas where product is stored or handled should be constructed to prevent the collection of dirt or dust that might sift through from the areas above or fall from overhead collecting surfaces onto equipment or exposed products. Therefore, it is recommended that ceilings and overhead structures be maintained free of sealing paint or plaster, dust, condensate, leaks, and other materials or defects. In addition, ceilings in areas where product is stored or handled should be constructed and finished with materials that can be thoroughly cleaned and are moisture resistant. Examples of such materials are smooth concrete and fiberglass reinforced plastic.

## **8. Windows and Skylights**

Windows (and skylights) can be a potential source of product contamination by dirt, water, debris, or broken glass. Consider the following when selecting and installing windows:

- All outside windows, except for those in receiving and feed rooms, should have protection to exclude insects, birds, and other vermin.
- Window ledges should be sloped about 45 degrees to prevent the accumulation of dirt, water, or debris.
- To avoid damage to window glass from impact of hand trucks and similar equipment, the sills should be at least 3 feet above the floor.
- Windows that are installed in walls in exposed product rooms should have panes of acrylic, polycarbonate plastic, or other shatterproof material.

## **9. Doorways and Doors (General)**

Doors allow the movement of product and people, but also present a barrier to contamination such as dirt, insects, and other vermin as well as the microbiological hazards that they carry. The door type, construction material, and location are all important considerations when doors are installed in the establishment. Doors are important in maintaining sanitary conditions, especially in production and storage areas. In production and storage, consider the following guidelines for door characteristics:

- They are impervious to moisture.
- They are tight fitting to minimize air exchange and to prevent the entry of insects and vermin into the establishments.
- They are self-closing wherever needed in the establishment, especially in areas where toilet rooms open directly into rooms containing exposed products.
- They are high and wide enough to allow the movement of exposed product through the doorways without it coming into contact with the door or jamb.

- They are rigid and durable, and the junctions at jambs, walls, and floors are sealed to eliminate all cracks and crevices for debris, insects, and dirt to collect.
- Doors that open directly to the outside of the building from production rooms should have an intervening closed space, such as a vestibule or enclosed lock, to prevent the direct assess of contaminants and microbial organisms to areas inside the establishment.

## 10. Types of Doors

In selecting a type of door for your establishment, you need to consider the location of the door and whether or not product will be traveling through it. The following guidelines for different types of doors may be useful to you when selecting a door:

- The horizontal double-swinging, impact door is a bi-parting, inflexible panel door with plastic windows (vision panels) that swings in on the horizontal plane. If you select this door, consider the following:
  - This door may be useful in rooms with dimensions that would not permit the use of a roll-up, vertical sliding or horizontal sliding door.
  - Because this door must be manually opened, the door can be damaged creating sanitation and maintenance problems.
- The horizontal sliding door (manual and automatic) is a single or bi-parting, inflexible door that moves only in the horizontal plane. If you select this door, consider the following:
  - This door may be useful in rooms with dimensions that would not permit the use of a roll-up or vertical sliding door.
  - The automatic opening option is recommended not only for sanitation reasons, but it also prevents damage.
- The vertical sliding door (manual or automatic) is a single, inflexible panel door that moves only in the vertical plane. If you select this door, consider the following:
  - This door may be useful in rooms with dimensions that would not permit the use of a roll-up or horizontal sliding door.
  - The automatic opening option is recommended not only for sanitation reasons, but it also prevents damage.
- The overhead garage-type door (manual or automatic) is a hinged, multi-paneled door that moves from the vertical to the horizontal plane. If you select this door, consider the following:

- This door may be an excellent choice for sheds or buildings used to store equipment, such as a lawn mower, that is used for the outside maintenance of the establishment's property.
- It is recommended that these types of doors not be used in exposed product areas or areas subject to wet clean-up because they have spaces between the panels that could allow meat and fat, as well as other contaminants to collect.
- The roll-up door (manual or automatic) is a single flexible panel door that moves only in the vertical plane and when open, coils tightly onto a drum assembly. If you select this door, consider the following:
  - This door can be an excellent alternative where space for opening a door is limited.
- The air curtain or air door uses a layer of air generated by mechanical fans to separate two rooms or areas. If you select this door, consider the following:
  - This door needs to be carefully installed and maintained to be effective.
  - If an air imbalance (pressure imbalance) develops at the door opening, the separation effect may be diminished or eliminated. Air imbalance can occur due to air flow changes from any other openings in the rooms, especially other doors.
  - The movement of the air can stir up contaminants, such as dirt and dust, if the area around the door is not kept clean.

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## Chapter 5

## LIGHTING, VENTILATION, REFRIGERATION, AND EQUIPMENT

Controlling the manufacturing environment is important in maintaining a sanitary environment in meat and poultry operations. This chapter provides guidelines concerning lighting, ventilation, refrigeration, and equipment for meat and poultry establishments that you should consider in building or modifying an establishment.

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### 1. Lighting

Well-distributed, good-quality artificial lighting is needed at all places where natural light is unavailable or insufficient. Lighting is critical to maintaining a sanitary environment for slaughter and processing operations. Without adequate lighting, unsanitary conditions are often difficult to see and correct. When selecting and installing lighting systems, consider the following requirements:

- Light fixtures in rooms where exposed meat or poultry is handled should ensure maximum safety by preventing contamination of products with broken glass. Fixtures should be easily cleaned to prevent the collection of dirt/debris on lamp surfaces.
- Lighting must be intense enough to allow both the establishment and inspection personnel to see unsanitary conditions and product contamination. The intensity of lighting is measured in foot candles. The charts on the following pages provide recommendations for minimum foot candles for artificial lighting:

MEAT ESTABLISHMENTS		
■ GUIDELINES FOR MINIMUM LIGHTING INTENSITY		
AREA	30 FT. CANDLES	50 FT. CANDLES
General lighting (in areas where animals are killed, eviscerated, and products are processed or packaged)	■	
Offal cooler	■	
Carcass coolers	■	
Freezers	■	
Dry storage	■	
Antemortem inspection	■	
Suspect pen inspection area		■
Inspection stations		■
Establishment quality control inspection areas		■
Reconditioning and re-inspection areas		■
All other areas	■	

**POULTRY ESTABLISHMENTS**

■ **GUIDELINES FOR MINIMUM LIGHTING INTENSITY**

AREA	30 FT. CANDLES	50 FT. CANDLES	200 FT. CANDLES
Antemortem inspection	■		
Inspection station (traditional)		■	
Inspection station (NELS/SIS/NTI)			■
Pre and post chill inspection areas			■
Reconditioning and re-inspection areas			■
Establishment quality control inspection areas			■
All other areas	■		

## **2. Ventilation**

There should be enough ventilation for all areas of the establishment including workrooms, processing, packaging, and welfare rooms to ensure sanitary conditions. A good ventilation system is important to the production of wholesome meat and poultry products. Without controlling the quality of the air coming into the establishment, products may become contaminated with dust, insects, odors, or condensation. When designing your ventilation systems, you should consider the following guidelines:

- The ventilation system should be designed so that turbulence is avoided. The longer the distance the air has to flow, the greater the resistance the air encounters not only from static air, but from solid objects such as walls, equipment, people, and product.
- The ventilation system should be designed with the size of the establishment in mind. The larger the facility, the greater the volume of air that must be moved.
- The ventilation system should be designed to compensate for changes in outside temperature and humidity that cause condensation problems within the establishment.
- Screens and filters should be used where needed to prevent product contamination from dust, odors, and insects.
- Mechanical ventilation should be used to provide fresh air to areas where natural ventilation is inadequate.
- Ventilation should prevent vapor formation, such as steam or fog, that would affect sanitation or interfere with the inspector's ability to perform required duties.
- The ventilation system should be designed to prevent air flow from holding pens, restrooms, boiler rooms, and other areas of possible contamination into the processing rooms.

## **3. Equipment (General Design and Construction)**

Equipment materials should comply with 21 CFR, Parts 170-190 of the Food and Drug Administration (FDA) regulations for direct food contact.

Equipment and utensils used for handling and preparing edible product or ingredient in any official establishment should be easily cleaned, and not be a source of contamination. Consider the following guidelines when selecting equipment:

- All direct product contact surfaces should be smooth; maintained free of pits, cracks, crevices and scale; corrosion and abrasion resistant; non-absorbent; shatterproof; nontoxic; and not capable of migrating into food products.

- Equipment should not be painted on areas in or above the direct product contact area.
- Construction materials that are sources of contamination include cadmium, antimony, or lead as plating or the plated base material, lead exceeding 5 percent in an alloy, and enamelware and porcelain used for handling and processing product.
- Equipment should be designed and installed in such a way that foreign materials such as lubricants, heat exchanger media, condensate, cleaning solutions, sanitizers, and other nonfood materials do not contaminate food products.
- Equipment is self-draining or designed to be evacuated of water.
- All product contact surfaces allow contact with cleaning solutions and rinse water.
- Clean-in-place (CIP) systems should have sanitation procedures that are as complete and effective as those for cleaning and sanitizing disassembled equipment. To remove all organic and inorganic residues, CIP systems should meet the following criteria:
  - Cleaning and sanitizing solutions and rinse water should contact all interior surfaces of the system.
  - The system should be self-draining, with no low or sagging areas.
  - The pipe interiors should be highly polished (120-180 grit) stainless steel for easy inspection.
  - Easily removable elbows with quick-disconnect mechanisms should be installed at each change of direction. Elbows should be short enough to permit verification that the interior has been cleaned.

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## Chapter 6

## WATER SUPPLY

The water supply should be ample, clean, and potable with adequate pressure and facilities for distribution and protection against contamination and pollution.

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### 1. Potable Water

An adequate supply of fresh clean water is of primary importance in plant operations. The first requirement is that the water supply to the plant be potable, or safe for human consumption and food processing. The plant water supply must meet the potability standards in the *National Primary Drinking Water Regulations* issued by the Environmental Protection Agency (EPA).

### 2. Backflow

Public health officials have long been concerned about cross-connections that may permit backflow in potable water supply distribution systems. Cross connections may appear in many forms and in unsuspected places. Reversal of pressure and flow in the water system may be unpredictable. Plumbing cross-connections between a potable and non-potable water supply may constitute a serious public health hazard. There are numerous cases where cross-connections have been responsible for contamination of potable water and have resulted in the spread of disease. These concerns, as they relate to meat and poultry plants, deserve special attention. The problem is continual as potable water and piping systems are installed, repaired, replaced, or extended.

Two basic types of hazard may be created in piping systems: the *solid pipe* with valved connections and the *submerged inlet*. The solid pipe connection is often installed to supply an auxiliary piping system from the potable source. It is a direct connection of one pipe to another pipe or receptacle. Solid pipe connections may be made accidentally to waste disposal lines when it is incorrectly assumed that the flow will always be in one direction. An example would be connecting a line carrying used, non-potable cooking water from a water jacket or condenser directly to a waste line without an air gap. "Backflow" will occur with a submerged inlet if the pressure differential is reversed without an air gap. Submerged inlets are created when the outflow end of a potable water line is covered with water or other liquid. The other liquid may not be potable. Submerged inlets could be created by a hose lying in a pool or puddle of water on the floor.

Once a cross-connection exists, any situation that causes a pressure differential with the potable line can result in contamination of the entire water distribution system and potable water supply. This is called **backflow** and can be produced under a variety of circumstances as illustrated below:

- **Backsiphonage** is one form of backflow. It is caused by negative pressure in the delivery pipes of a potable water supply and results in fluid flow in the reverse direction. It may also be caused by atmospheric pressure exerted on a pollutant liquid source that forces the pollutant into a potable water supply system that is under vacuum. The action in this case is the common siphon phenomenon. The negative pressure differential that will begin the siphoning action is a potential occurrence in any supply line.
- **Differential pressure backflow** refers to a reversed flow because of backpressure other than siphonic action. Any interconnected fluid systems in which the pressure in one exceeds the pressure of the other may cause flow from one to the other because of the differential. This type of backflow is of concern in buildings where two or more piping systems are maintained. The potable water supply is usually under pressure from the city water main. Occasionally, a booster pump is used. The auxiliary system often is pressurized by a centrifugal pump, although backpressure may be caused by gas or steam pressure from a boiler. A reversal in differential pressure may occur when pressure in the potable system drops below that in the system to which the potable water is connected. The best method of preventing this type of backflow is the complete separation of the two systems and/or an air gap. Other safety methods involve the installation of mechanical backflow prevention devices. All methods require regular scheduled inspection and maintenance to ensure ongoing effectiveness of installed devices.

Some areas where you should consider providing some form of protection from backflow and backsiphonage include the following:

- Water supply to pens for wash down or livestock watering.
- Water supply to compressor cooling systems, cooling towers, and boiler rooms.
- Water supply to cleanup systems, clean-in-place (CIP) systems, etc.
- Water supply to hose connections.

Various mechanical antibackflow devices are available to prevent backflow into a potable water supply system. Generally, the selection of the type and number of fail-safe devices should be based upon the degree of hazard from contamination. Additional considerations include piping size, location, and the need to test periodically the backflow devices to ensure proper operations.

There are six basic types of devices that can be used to correct cross-connections:

- Air gap
- Barometric loops
- Vacuum breakers – both atmospheric and pressure type
- Double check valves with intermediate atmosphere vent
- Double check valve assemblies
- Reduced pressure principal backflow preventers
- Specific requirements concerning backflow can be found in local building and board of health codes.

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## Chapter 7

## GENERAL PLUMBING FACILITIES

One of the most important factors to consider in the design and modification of establishments is the plumbing system. If the plumbing system is not properly installed, contamination of products can occur from flooding, backsiphonage, stoppages, and cross-connections with the potable water system. This chapter provides guidelines concerning the plumbing facilities in meat and poultry establishments. For additional information on the design and modification of plumbing facilities, consult the National Plumbing Code.

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### 1. Hose Connections and Hoses

Hose connections with steam and water mixing valves or hot water connections should be conveniently located throughout the establishment for cleaning purposes. Hose connections are important in promoting routine cleaning of the establishment. Consider the following guidelines when determining the number and location of hose connections, and storage of hoses:

- The number of hose connections depends on the number of drains.
- If a shut-off nozzle is provided on the hose after the hot and cold water mixing valve, the vacuum breaker at the hose connection to the mixing valve will not work. Vacuum breakers should be installed on the hot and cold water supplies prior to the mixing valve to prevent such problems.
- Hose connections should be provided with vacuum breakers to prevent backsiphonage.

### 2. Establishment Drainage System

There should be efficient drainage and plumbing systems for the prompt removal of liquid and suspended solid wastes from the processing environment. Consider the following guidelines when designing or modifying your drainage system:

- All plumbing should be sized, installed and maintained in accordance with applicable state and local plumbing codes, ordinances, and regulations.
- Drainage lines should be located so that if leakage occurs, it will not affect product or equipment.

### **3. Floor Drains**

All parts of floors where operations are conducted should be well drained. There are two basic types of drains: point drains and trench drains. Point drains, the most commonly used drain in most areas, are located in strategic points in the room with the floor sloped toward the drain. The waste water flows over the surface of the floor until it reaches and is carried away by the drain. Trench drains involve a trough or trench that collects the waste from a larger area and directs the flow to a drain opening. The flooring is sloped toward the trench.

In a typical plant, one four-inch drainage inlet is provided for each 400 square feet of floor space. A slope of about one-quarter inch per foot to drainage inlets is generally adequate to ensure proper flow with no puddling. In dry production areas where only a limited amount of water is discharged on to the floor, an adequate slope may be about one-eighth inch per foot. It is important that floors slope uniformly to drains with no low spots to collect liquid.

- The location of floor drains depends upon many factors such as the type of task conducted in the space, the geometric shape of the area drained, truck traffic patterns, and equipment locations.
- There are special drainage considerations in areas where there is a high volume of water usage. The water in trench drains should flow in the opposite direction of the product flow, for example, from the poultry evisceration to the picking areas.
- All parts of floors where wet operations or where floors are to be frequently hosed down should be pitched to floor or trench drains.
- Floor drains should not be located under equipment because it makes them inaccessible for cleaning.
- Rooms without floor drains such as dry storage, large finished product coolers, and distribution warehouses may prefer to use mechanical cleaning machines instead of installing drains. Examples of such cleaning devices are floor scrubbers and dry/wet vacuum machines.

### **4. Trap Seals**

Each floor drain should be equipped with a deep seal trap and vented properly to the outside. The purpose of such traps is to seal off the drainage system so that foul odors (sewer gases) cannot enter the plant. Effectiveness of the trap depends upon enough water remaining to constitute a seal. As water flows through the trap and down the drainpipe, suction is created that will pull the water out of the trap and break the seal unless the suction is broken by venting the drainpipe on the effluent side of the trap to the outside air. The seal can also be broken by evaporation of trapped water. This is not a problem in frequently used drains, but does occur where drains are seldom used.

## **5. Drainage Lines**

All drainage lines must comply with local code requirements. They should be installed and maintained to be leakproof. To prevent drainage lines from becoming entrances for rats and mice, all lines must be equipped with effective rodent screens. Secure drain covers, in addition to keeping out pests, also serve to prevent blockage of the traps and drainage lines with product scraps or other material too large to flow freely.

## **6. Cleanouts**

Cleanouts should be installed in the drainage system to prevent sewer blockages. Consider the following guidelines when installing cleanouts:

- Cleanouts should be located so they are readily accessible, and can be used without constituting a threat of contamination to edible products.
- To help avoid water puddling, cleanouts should be located on the “high lines” of floor slopes and away from traffic patterns.



























































