Food safety, sanitation, and pest management programs

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What is Food?

• Articles consumed by humans and animals
• Includes chewing gum and drinking water
What is Wholesome Food?

• Nutritionally balanced
• Food without defects
What is Safe Food?

• Food that does not cause injury or harm when consumed by humans or animals

• Trust is placed in food manufacturer to produce safe food

• Consumers are unaware of dangers with food!
Adulterated Food

- Food containing poisonous or deleterious substances
  - Basis for HACCP
- Food containing added poisonous or deleterious substances (safe vs unsafe levels)
- Food containing filth from animal or vegetable matter
- Food prepared under unsanitary conditions
  - Basis for Good Manufacturing Practices (GMPs)
Before You Do Anything: Identify Hazards

- **Hazards:**
  
  a. Physical - peeling paint, rust, glass, metal, wood or plastic
  
  b. Chemical - grease, lubricants, pesticides, allergens, condensation
  
  c. Biological - insects, microorganisms, rodents, birds, and their by-products
Sanitation

• All of the things a company does to eliminate physical, chemical, and biological hazards
• Includes company’s multifaceted programs
• Includes compliance with food laws/regulations
• Includes people
• Includes preventive programs with less emphasis on corrective programs
Basic Programs

PREREQUISITE PROGRAMS

HACCP

- Hazard Analysis
- Establishing Critical Control Points
- Establishing Critical Limits
- Establishing Monitoring Procedures
- Corrective Actions
- Verification
- Documentation

Recall/Traceability
Preventive Maintenance Programs
Employee Training/Education
Supplier Certifications
GMPs

“A systematic approach to the identification, evaluation, and control of food safety hazards”

http://www.fda.gov/food/foodsafety/HazardAnalysisCriticalControlPointsHACCP/ucm114868.htm
### Example of a Flow Diagram for the Production of Frozen Cooked Beef Patties

1. Receiving (Beef)
   ↓
2. Grinding
   ↓
3. Mixing
   ↓
4. Forming
   ↓
5. Cooking
   ↓
6. Freezing
   ↓
7. Boxing
   ↓
8. Distributing
   ↓
9. Reheating
   ↓
10. Serving

Control point Vs
Critical control point
Food Safety Modernization Act (FSMA)

• Low threshold to trigger food safety violations
  – Serious adverse health consequences or death to animals or humans (SAHCODAH)
  – Presumptive vs credible evidence

• Hazard analysis and preventive controls
  – Hazard analysis risk-based preventive controls (HARPC)

• Foreign supplier verification program

• Increased inspections of domestic and foreign facilities

• Inspection of records
The Road to Food Safety

- Sanitation outdoors
- Sanitation indoors
- Inspections
- Pest management
- Other food safety programs
Sanitation Outdoors
Birds have formed nests and are reproducing here because of the protection afforded by the Helios board.

This board should be removed and placed above the roof with structures that do not offer a site for birds to build nests or roost.
Nearby fields could be a source of rodents
Eliminate unsanitary conditions outdoors
Is this a trash compactor? If so, it should be placed far away from building on a concrete pad.

Place metal flashing all around as shown to deter rodents; no Gaps between metal and concrete.

Have sliding doors; make sure there is a mesh to the outside.

The small arrows show ledges that should be fixed by pouring concrete at 45 degree angle.
Where two pieces of metal or plastic-metal come together, have a seal to close openings.
Remove wire fence and replace with a compound wall that 6-8 feet high.

Remove vegetation, and level the area and also pour concrete between wall and the channel for water.

Cover the water channel with metal mesh to exclude rodent access to water; inspect and treat with a disinfectant if needed.
Pest Entry Points

- No open doors
- Screen windows
- Seal entry points
High risk area for microorganisms and rodents
Rodent burrow
Standing water is indicative of grading/damage

Stranded water can cause contamination problems. What are pallets doing outside?
Places such as these need to be repaired to prevent standing water.
Good grading
Rodent bait stations

Have a 2 ft vegetation-free barrier zone
Unused equipment outdoors
Plastic pallets
Pest highways
Pigeon

Fecal contamination

Gaps at the beam-wall interface
Seal all junctions with silicone or durable sealant throughout bin as indicated by black arrows.

Keep all unused equipment in a separate room on shelves; if equipment cannot be reused, discard it.
Clean and keep this wall in good repair

Enclose cables

All arrows show ledges that need to be removed; Modified (45 degree poured concrete; Or have spikes to exclude birds

These cables can be runways for rodents
Avoid exposed areas
Avoid this ledge; site for birds to land

Repair all damaged areas indicated with arrows

Make sure there are no gaps underneath this door

Rodent trap needed on right side

Photo 1
Improper garbage disposal promotes pest activity

Keep dumpster on a concrete pad.
Weekly garbage disposal.
A better design is needed to remove rocks; use of precleaners a must

The use of a screen (not good) over grates is unnecessary: this area requires a better design to exclude rocks; or use precleaners prior to dumping
Ceiling gaps allow bird entry; remove flat surfaces above to prevent bird landing while grain is being dumped in pit

Need better walls that prevent dust adhesion
Have proper storage of these equipment
Preferably in a storage shed on shelves
Clean flour residue prior to storage
Have proper storage of these equipment
Preferably in a storage shed on shelves
Clean flour residue prior to storage
Reduce bird pressure outdoors
Lighting

- Place lights away from buildings
- High pressure sodium lights near buildings
- No lights near doors and windows
A good pest exclusion practice
Trucks need a special truck maintenance program
Transport vehicles

- Inbound inspection
- Seals in place
- Trailers/cars clean
Sanitation Indoors
Very clean area. Seal bases of equipment to floor

Also clean tops of equipment on a regular schedule
Seal all gaps with an epoxy sealant
Insects coming from raw grain (auger from bins a likely source).

Three different species seen here.
Bird fecal material in production area

This may result in failing grade

Grooves trap dust
Clean and spray if unable to replace
Inspect the area holding wires for dust accumulation and insects.
Clean up dust on equipment
Figure out where the dust is coming from
Poor Sanitation
Spillage

Prevent unsanitary conditions
Clean augers regularly
No duct tape
Do not use tape; find permanent solutions
Seal bases of all equipment

Check areas indicated by red arrows for product accumulation and clean as needed
Remove tape and seal (find a permanent solution)
Seal openings between floors
Equipment

• What type of product is produced?- dry, wet, caustic, acidic, or perishable
• Right equipment selection
• Wet or dry cleaned, manual, COP, CIP, vacuum, air
Equipment

• Is there a cross-functional member equipment review/approval program?
• No unprotected glass
• Ceilings/overheads- no ledges, false ceiling trap
• Food contact surfaces-corrosion resistant, non-porous, non-absorbent, and non-puddling
Equipment

• Easy, quick disassembly and accessible
• Micro/allergen cleanable and verifiable
• No hollow areas
Sanitary Design Aspects
Employees need uniforms and should never wear shorts and tennis shoes.
They should also wear hair nets and steel-toe boots
Improve pallet spacing for good inspection

Enough to inspect

Keep pallets away from walls
Floor should be smooth and free of cracks
Save new bags separately from old bags
All plant areas should be well lit
Flat surfaces accumulate dust

Clean or avoid flat surfaces
Discard unused equipment
Tight seals around loading dock doors
Good to have color coded tools

Replace them properly against the wall
Check vacuum cleaners weekly for cleanliness.

Place in designated area and not on production floor.
MISSION

ZERO LEAKAGE

ZERO DUCT TAPE

MINIMUM TEMPORARY MAINTENANCE
5S Program

Sort, Set in order, Shine, Standardize, Sustain
Master Sanitation/Cleaning Schedules

- Daily versus non-daily; weekly, monthly, quarterly, semi-annual and annual
- Only way you can answer question: “when was the last time this was cleaned?”
- Leave no space blank
- Keep it simple
- Floor drains
- Evaluate and determine economic benefits
## Rate Mill Infestation by Location for Sanitation

**Probability of infestation or product loss**

<table>
<thead>
<tr>
<th>Cleaning frequency</th>
<th>Severe</th>
<th>High</th>
<th>Moderate</th>
<th>Low</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daily</td>
<td>Production Areas; receiving</td>
<td>Floors</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weekly</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monthly</td>
<td></td>
<td>Spouts; conditioner</td>
<td>Bathrooms</td>
<td></td>
</tr>
<tr>
<td>Yearly</td>
<td></td>
<td></td>
<td>Building exterior</td>
<td></td>
</tr>
</tbody>
</table>
Preventive Maintenance and Work Orders

• Simple and documented

• Filters, sifters, strainers, lubricants, magnets and metal detectors
People, Equipment and Training

• Proper people doing the proper job with the proper equipment and documented training
• Money driven but be careful how you phrase message to employees (motivation)
Inspections

- Vehicles
- Pallets
- Used equipment
- Live plants in offices
- Food prep.; receiving
- Grain products
- Spillage on drums
- Mill for sanitation issues
Inspections

• Not a waste of time; must know plant inside and out
• Multidisciplinary in membership team, cross-train, rotate, document deficiencies observe for proper follow up
• Close the loop; not just a “list” creator; understand reasons for problems
Inspections

• Develop checklists

• Take corrective action/develop a preventive solution

• No third party inspector should inspect your plant and find an un-inspected area by the team
Pest Management
Pests associated with facilities

Invertebrate pests:
- Stored-product insects
- Filth flies
- Cockroaches
- Mites

Vertebrate pests:
- Birds
- Rats and mice (rodents)
Why are Pests Present?

- Food
- Shelter
- Moisture
Stored-grain insect management with insecticides

• Clean empty bins and apply an insecticide
  – Kills live insects present

• Clean grain (if possible)

• Apply an insecticide to grain as it is being loaded into a bin
  – Protects grain from infestation
<table>
<thead>
<tr>
<th>Product</th>
<th>Active ingredient</th>
<th>Rate (mg[AI]/kg)</th>
<th>Site treated</th>
<th>Grain type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storcide II</td>
<td>Chlorpyrifos-methyl + deltamethrin</td>
<td>3.0 + 0.5</td>
<td>Empty bins, warehouses, stored grain</td>
<td>Wheat, barley, rice, oats, sorghum</td>
</tr>
<tr>
<td>Tempo SC Ultra</td>
<td>β-cyfluthrin</td>
<td>0.01 or 0.02 g/m²</td>
<td>Empty bins</td>
<td></td>
</tr>
<tr>
<td>Actellic 5E</td>
<td>Pirimiphos-methyl</td>
<td>6 - 8</td>
<td>Stored grain</td>
<td>Corn, sorghum</td>
</tr>
<tr>
<td>Centynal</td>
<td>Deltamethrin</td>
<td>0.5</td>
<td>Empty bins, warehouses, stored grain</td>
<td>Wheat, barley, rice, oats, sorghum, corn, rye</td>
</tr>
<tr>
<td>Evercide</td>
<td>Esfenvalerate</td>
<td></td>
<td>Surfaces</td>
<td></td>
</tr>
<tr>
<td>Diasource, Dryacide, Protect-It</td>
<td>Diatomaceous earth (silicon dioxide)</td>
<td>500 - 1000</td>
<td>Empty bins, stored grain</td>
<td>Wheat, barley, rice, oats, sorghum, corn, peas</td>
</tr>
<tr>
<td>Diacon-IGR</td>
<td>S-methoprene</td>
<td>1, 2.5 or 5</td>
<td>Empty bins, stored grain</td>
<td>All stored grains, spices, seeds</td>
</tr>
<tr>
<td>Spinosad (Sensat)</td>
<td>Spinosyns A + D</td>
<td>1</td>
<td>Stored grain</td>
<td>All stored grains, including wheat</td>
</tr>
</tbody>
</table>
Calibration is essential
Chemicals applied to grain do not kill insects developing inside.
Grain chiller
Fumigation of Grain

Gas monitoring and personal protective equipment are essential.
Aluminum Phosphide
Different formulations for different uses

- Tablets
  - 3 g, releases 1 g of phosphine
- Pellets
  - 0.6 g, releases 0.2 g of phosphine
- Sachets
  - 34 g, releases 11 g of phosphine
- Linear gas generation until 80%, then the generation becomes nonlinear
- Gas release differences among formulations
  - Pellets > tablets > sachets
Phosphine Can be Used to Treat Commodities in Various Storage Structures
Whole Building Treatments with Fumigants

Methyl bromide

Sulfuryl fluoride
Gas Concentration: MB1

- HLT ≈ 111 hr
- HLT ≈ 16.4 hr
- HLT ≈ 10.2 hr
Heat treatment: Raising the ambient air temperature to 122-140°F (50-60°C), and maintaining these temperatures for 24-36 hours once a year.
Red flour beetle adult and young larval survival as a function of temperature

Aug 31-Sep 2, 2007

n = 10 HOBOs
Crack/crevice spraying

http://pesticidepics.org/
Aerosols (fogging)

Kill exposed insects
How are packages improved?

- Better seals and closures
- Overwraps
- Odor barriers
- Modified atmospheres ($N_2$)
- Repellent materials
- Oxygen scavengers
- Liners
- Membranes
- Insecticide treated bags (Provisiongard)

http://www.pvgard.com/
Glues

- Hot melt is better than cold melt for insect resistance because of flowability.
- Low temp hot melts are safer because they melt at 250ºC compared to 350ºC.
- Complete coverage is essential for infestation control.
Modified Atmospheres (Nitrogen) for control of raw materials, finished products, or stored grain
Treatment graphic:

Black line: inlet temperature
Blue line: room temperature
Red line: O2 concentration
Pink line: set point temperature
Terminal in Thessaloniki
Rats and Mice

- Family Muridae has 500 species
- Rats and mice of SE Asia include:
  - Rice field rat, *Rattus argentiventer*
  - The black rat, *Rattus rattus diardii*
  - The wood rat, *Rattus tiomanicus*
  - The Norway rat, *Rattus norvegicus*
  - Little Malay rat, *Rattus exulans*
  - Greater bandicoot rat, *Bandicota indica*
  - House mouse, *Mus musculus* (several subspecies)
- Pelage: Vibrissae (long stiff hairs). Guard hairs
  - Protect from cold; tactile feedback; wetness; defense

*www.irri.org/irrc/rodents/index.asp*
Rodent Baits

WeatherBlok® XT
RODENTICIDE

Made with TALON® Rodenticide

Kills warfarin-resistant Norway Rats and Brown Rats with first dead rodents appearing in 4 to 7 days after treatment begins.

Keep Out of Reach of Children
CAUTION

ACTIVE INGREDIENT:
Brodifacoum
3-[3-[(4-bromo-1,1’-biphenyl)-4-y]-1,2,3,4-tetrahydro-1-naphthalenyl]-4-
hydroxy-2H-1-benzopyran-2-one

INERT INGREDIENTS

TOTAL

EPA Reg. No. 10182-339
EPA Est. No. 61282-WI-1

Net Contents: 20 lbs

See side panel for exposure and first aid information.
Bait Boxes
Bait Stations

buffer zone
Baits - Pellets
Liquid Baits

Liqua-Tox II®
Mix contents of pouch with 1 quart of water.
Kills Rats & Mice

ACTIVE INGREDIENT:
Sodium Salt of Diphenichlor (2-Phenylnalane-1,3-indandione)

INERT INGREDIENTS

TOTAL

KEEP OUT OF REACH OF CHILDREN
CAUTION
(See back panel for additional precautionary statements.)

PRECAUTIONARY STATEMENTS
HAZARDS TO HUMANS & DOMESTIC ANIMALS
CAUTION: Keep away from humans, domestic animals and pets. If swallowed, this material may reduce the clotting ability of the blood and cause bleeding. Exposure during pregnancy should be avoided. Avoid contact with skin, eyes, or clothing.

STATEMENT OF PRACTICAL TREATMENT
IF SWALLOWED: Call a physician or Poison Control Center immediately. Drink 1 or 2 glasses of water and induce vomiting by touching back of throat with finger. Do not induce vomiting or give anything by mouth to an unconscious person.
IF IN EYES: Flush eyes with plenty of water. Call a physician if irritation persists.
IF ON SKIN: Wash with plenty of soap and water.
NOTE TO PHYSICIAN: If ingested, administer Vitamin K intramuscularly or orally as indicated in Table of dosages. Do not administer in excess dosages.

ENVIRONMENTAL HAZARDS
Keep out of lakes, streams, or ponds. Do not contaminate water by cleaning of equipment or disposal of wastes.

NET CONTENTS: 1.68 fl. oz. (49.68 ml)

Mfg. by:
Bell Laboratories, Inc.
Madison, WI 53704 U.S.A.

EPA Est. No. 12455-WI-1
EPA Reg. No. 12455-61

APPLICATION DIRECTIONS
RATS: Place bait in bait stations located as suitable devices (suitable baits are available in the market).

CUT HERE
Netting to Exclude Birds
Repellents
Tactile Deterrents

- Spikes
- Coils
- Ledge Wires
Exclusion tactics
Traps
Traps and Mechanical Devices
Total Number of Male Moths Captured Before and After Heat Treatments
(KSU Pilot Flour Mill, June 23-December 23, 1999)

Day of the year, 1999

Total number of moths/160 traps

0 50 100 150 200 250 300 350 400

Total number of moths/160 traps

Day of the year, 1999
A=Wild bird food   B=Small animal food  C=Cat and dog food
D=Food bar table

A=Wild bird food   B=Small animal food  C=Cat and dog food
D=Food bar table
Indianmeal Moths in a Retail Store

Sequential contour maps

Before sanitation

After sanitation before Tempo

After Tempo
Scope of Pest Management Services

• Know your pests
• Know your facility
• Know how sanitation is related to pest activity
• Inspect and monitor pests
• Pest management service provider is NOT a magician
• Get yourself trained and become familiar with sanitation and pest management
Other Food Protection Programs

- Guard services program
- Outside contractor policy
- Chemical control program
- Visitor entry policy
- Employee locker inspection policy
- Facility water control program
- Uniform policy
• Tour group policy
• Mail handling policy
• Human resource program
• Fences and gates
• Employee parking
• Exterior lighting
• Access control
• Intrusion detection systems
• Emergency response teams
• Government, customer, third party inspections
• Work place violence
• Registration of food facilities
• Maintenance and inspection of records
Organization

- Clearly defined charts
- Clear lines of responsibilities/Accountability
- Trained Staff
- Open Communication
- Team Effort
Thank You