Impact of Process Hardware on Pet Food Safety

Galen J. Rokey
Wenger Mfg., Inc.

PetfoodForum

WATT Petfood Industry

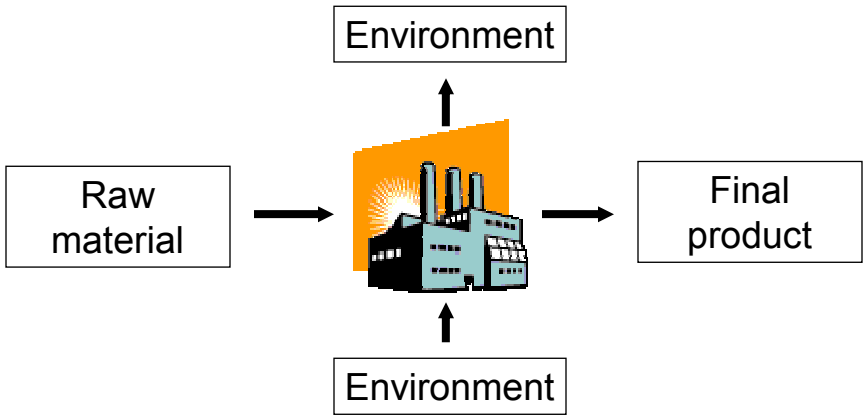
The Task Before Us

- Pet food is considered "adulterated" if it contains salmonella
- FDA – "It is the manufacturers' responsibility to produce salmonella – free feed"

PetfoodForum

WATT Petfood Industry

1) Identify Critical Areas of Impact
2) Implement Plans and Programs



PetfoodForum

WATT Petfood Industry

PetfoodForum

WATT Petfood Industry

Critical Areas of Impact

1) Raw materials
2) Plant and equipment design
3) Processing – Operating Procedures
4) Final product efficacy
5) Culture

PetfoodForum

WATT Petfood Industry

Processing Considerations
(indentifying critical control points)

1) Assume presence of salmonella in raw material (test for verification)
2) **Establish heat, shear, pressure, and time parameters for the process**
3) Monitor, control, and document critical process parameters
4) Contain / recycle under-processed material
5) Test to validate effectiveness of process
6) Release program

PetfoodForum

WATT Petfood Industry

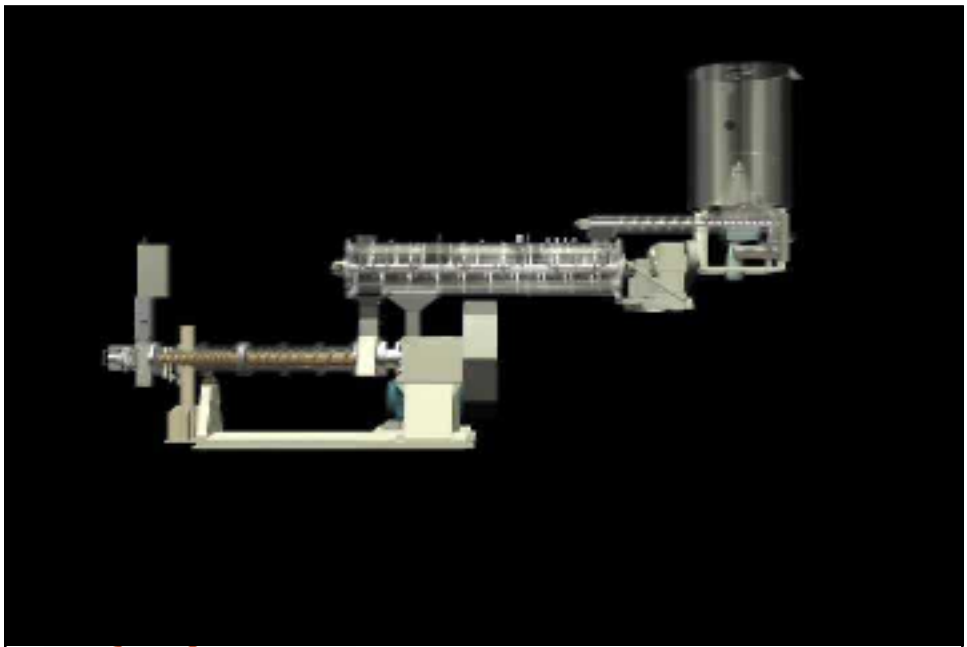
Role of Extrusion Processing

Extrusion Processing

Cook and Pasteurize

PetfoodForum

WATT Petfood Industry



PetfoodForum

WATT Petfood Industry

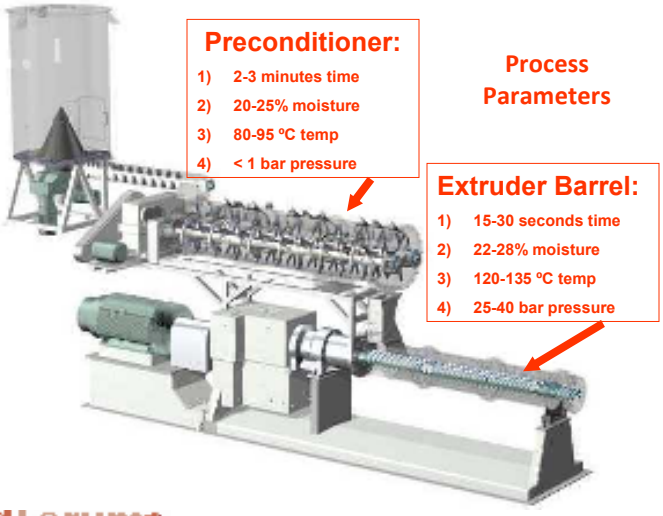
Expanded Pet Foods

PetfoodForum

WATT Petfood Industry

Critical Control Points

Preconditioner and Extrusion Process



Preconditioner:

1) 2-3 minutes time
2) 20-25% moisture
3) 80-95 ºC temp
4) < 1 bar pressure

Process Parameters

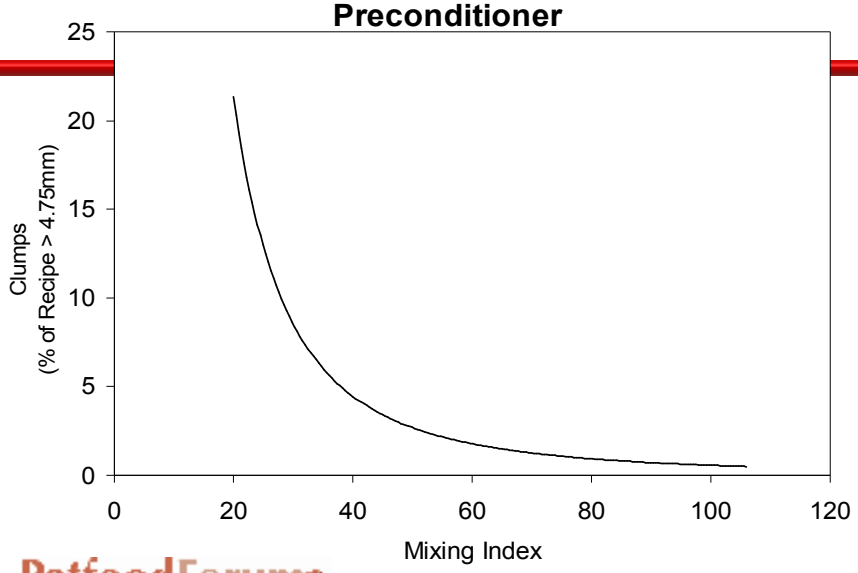
Extruder Barrel:

1) 15-30 seconds time
2) 22-28% moisture
3) 120-135 ºC temp
4) 25-40 bar pressure

PetfoodForum

WATT Petfood Industry

Mixing Index versus Particle Size Off Preconditioner



PetfoodForum

WATT Petfood Industry

Effect of Preconditioning Process on Microbial Populations

Microbe	Raw Recipe	After DDC Preconditioner
TPC (CFU/g)	240,000	9,300
Coliform	22,600	<10
Mold count	54,540	<10
Clostridium	16,000	<10
Listeria	positive	negative
Salmonella	negative	negative

PetfoodForum

WATT Petfood Industry

Preconditioned Pet Food Inoculated with 10^4 CFU *Salmonella Typhimurium* / gram

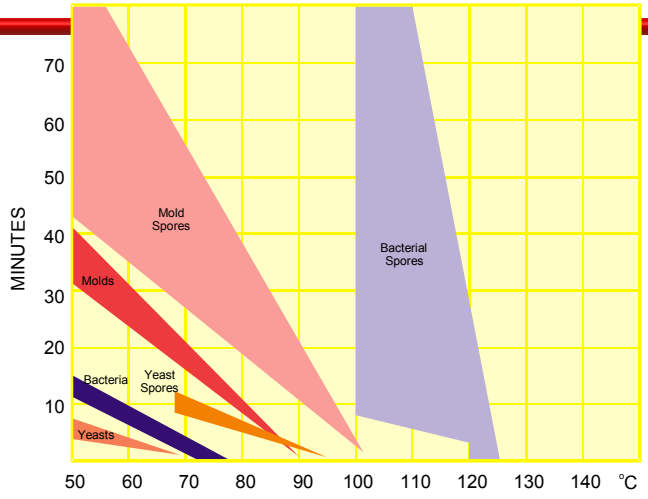
Sample	Process moisture (%)	Product temperature (°C)	Retention time (minutes)	Salmonella presence
1	17.4	82.8	3.58	Negative
2	16.5	83.3	3.05	Negative
3	22.2	82.2	2.70	Negative
4	18.8	70.0	2.20	Negative
5	15.9	70.0	1.92	Negative

Hoffmans, C.M. and Fung, D.Y.C., "Effective Method for Dry Inoculation of Bacterial Culture", Journal of Rapid Methods and Automation in Microbiology, I (1993) 287-294.

PetfoodForum

WATT Petfood Industry

Temperatures Required To Kill Various Classes of Microorganisms

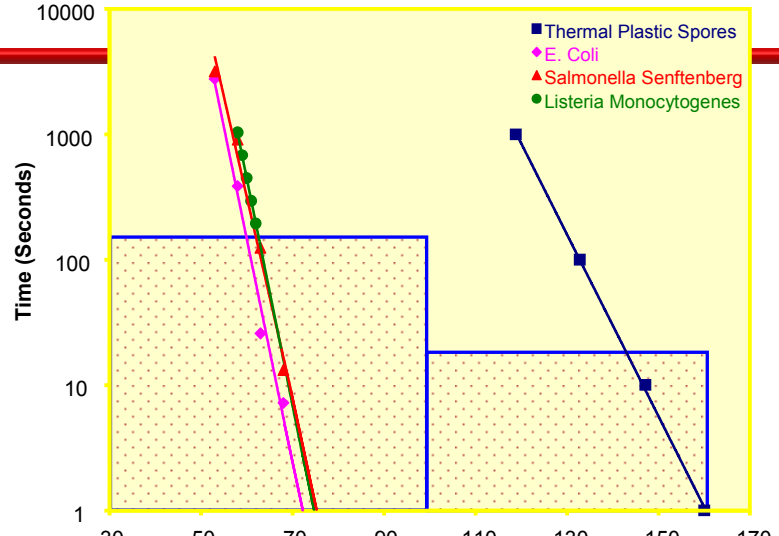


PetfoodForum

WATT Petfood Industry

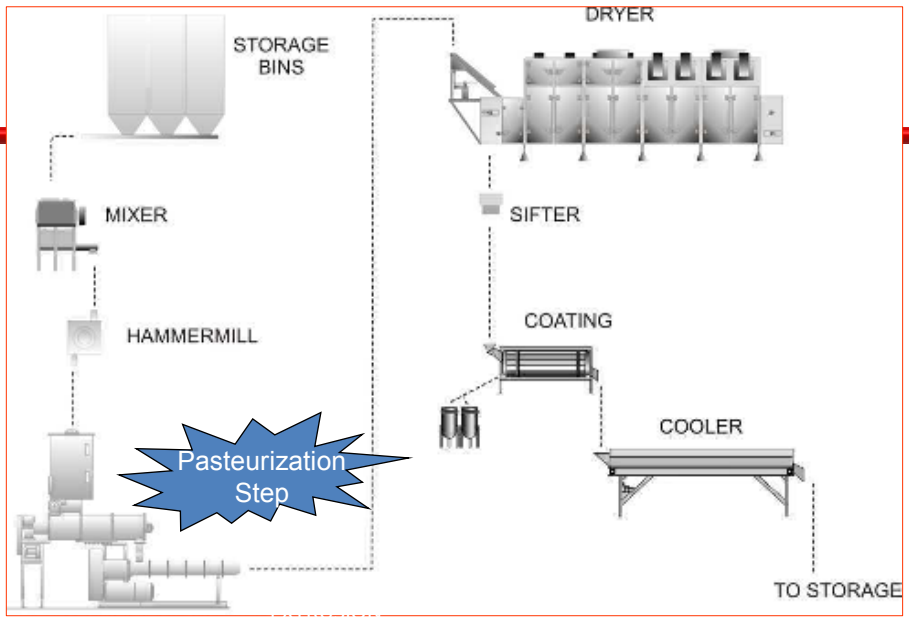
Source: 2008, January, Dr. Daniel Fung, "Synopsis of Food Microbiology" Seminar

Microbial Thermal Death Time Curves



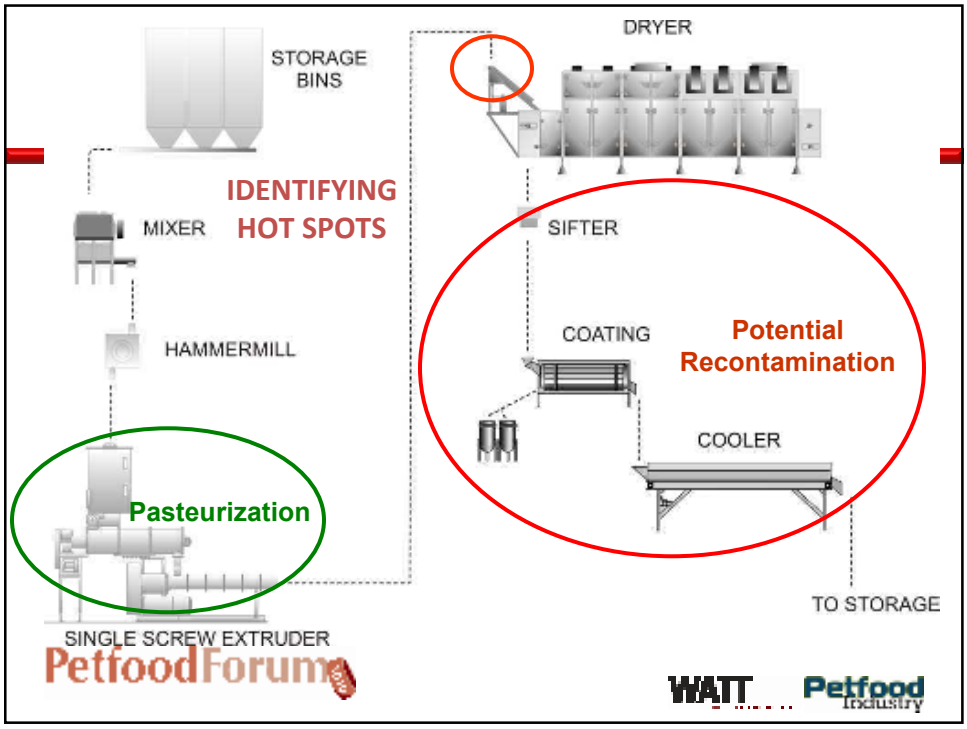
PetfoodForum

WATT Petfood Industry



PetfoodForum

WATT Petfood Industry



Pet Food Safety

1) "Critical Control Points" (preconditioning and extrusion) pasteurize product

2) **Avoid "recontamination" through:**
   a) Plant and equipment design
   b) GMP's

3) **Finished product testing** is important but can have sampling and statistical issues

PetfoodForum

WATT Petfood Industry

Seven Control Elements to Minimize Risk of Salmonella Contamination*

1) Prevent entrance or spread of Salmonella in production facility
2) Enhance hygienic practices and controls in PSCA
3) Apply hygienic design and principles to building and equipment design
4) Prevent or minimize growth of Salmonella within facility
5) Establish raw material/ingredients control program
6) Validate control measures to inactivate Salmonella
7) Establish procedures for verification of Salmonella controls and corrective actions

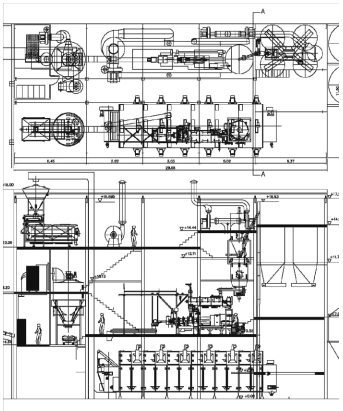
PetfoodForum

WATT Petfood Industry

*Taken from "Control of Salmonella In Low-Moisture Foods" Guidance Document from GMA

Plant and Equipment Design Considerations

1) Plant layout –vertical versus horizontal flow
2) Multiple rooms / isolation walls
3) Airflow control
4) Equipment/personnel traffic management
5) Segregate "wet" and "dry" areas
6) Plant location
7) Transitions



PetfoodForum

WATT Petfood Industry

Plant and Equipment Design Considerations (continued)

8) Minimize product and dust leakage, spillage, and accumulation
9) Easy access for inspection and cleaning
10) CIP versus COP
11) Capture/recycle under-processed material

PetfoodForum

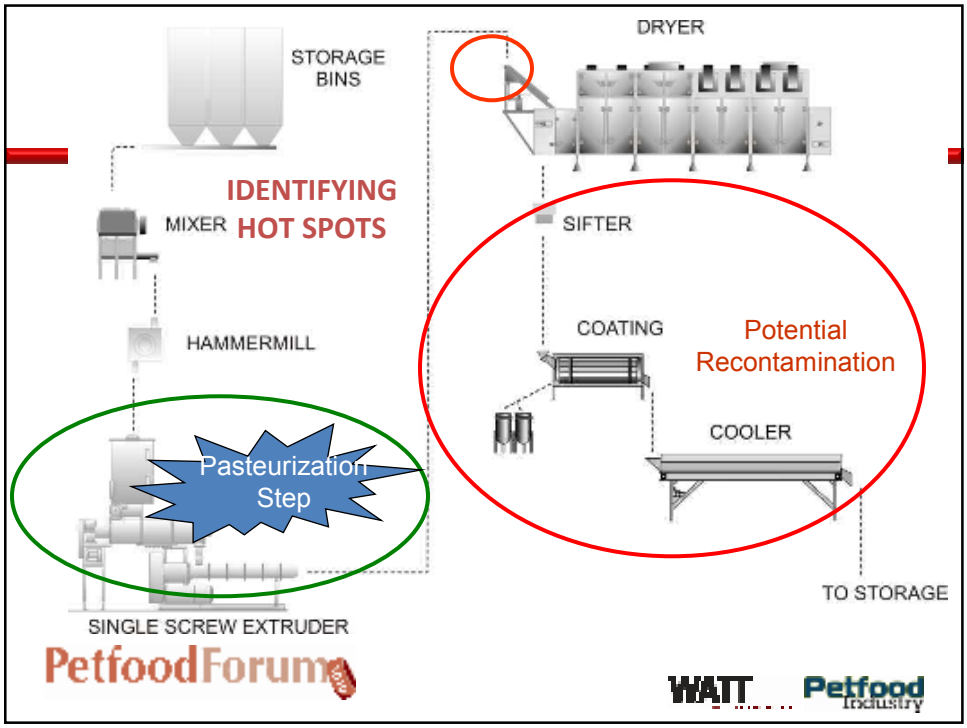
WATT Petfood Industry

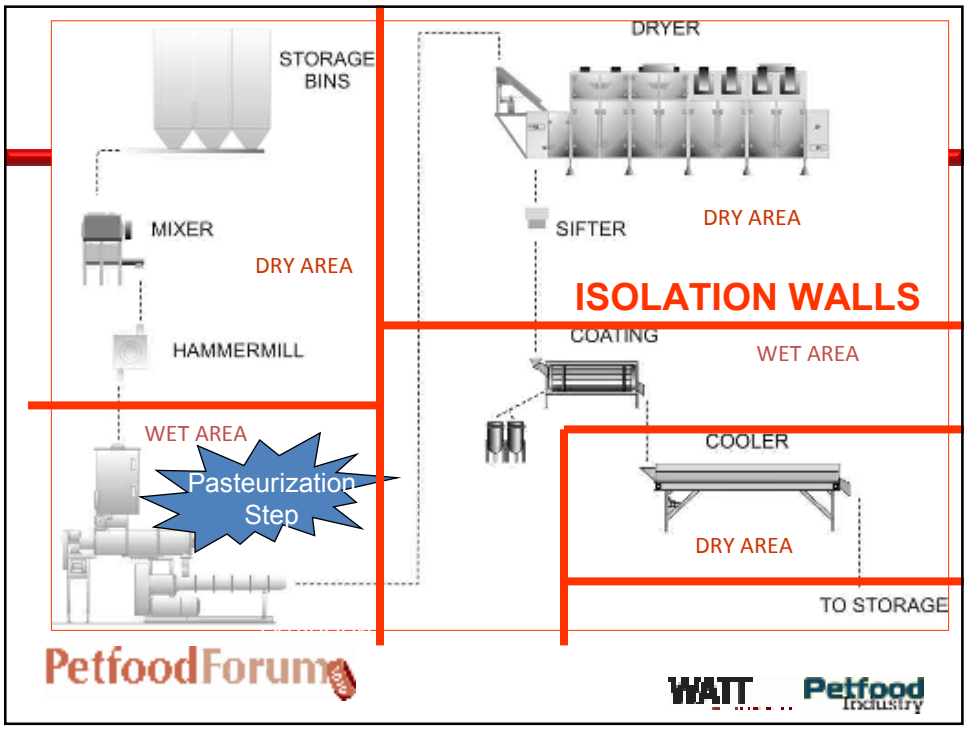
Plant and Equipment Design

1) Isolation Walls
2) Product transfer
3) Airflow control and treatment
4) Equipment design and construction
5) Closed loop systems
6) Control systems and on-line devices

PetfoodForum

WATT Petfood Industry


STORAGE BINS
DRYER
IDENTIFYING HOT SPOTS
MIXER
SIFTER
HAMMERMILL
COATING
Potential Recontamination
COOLER
Pasteurization Step
TO STORAGE
SINGLE SCREW EXTRUDER
PetfoodForum
WATT
Petfood Industry

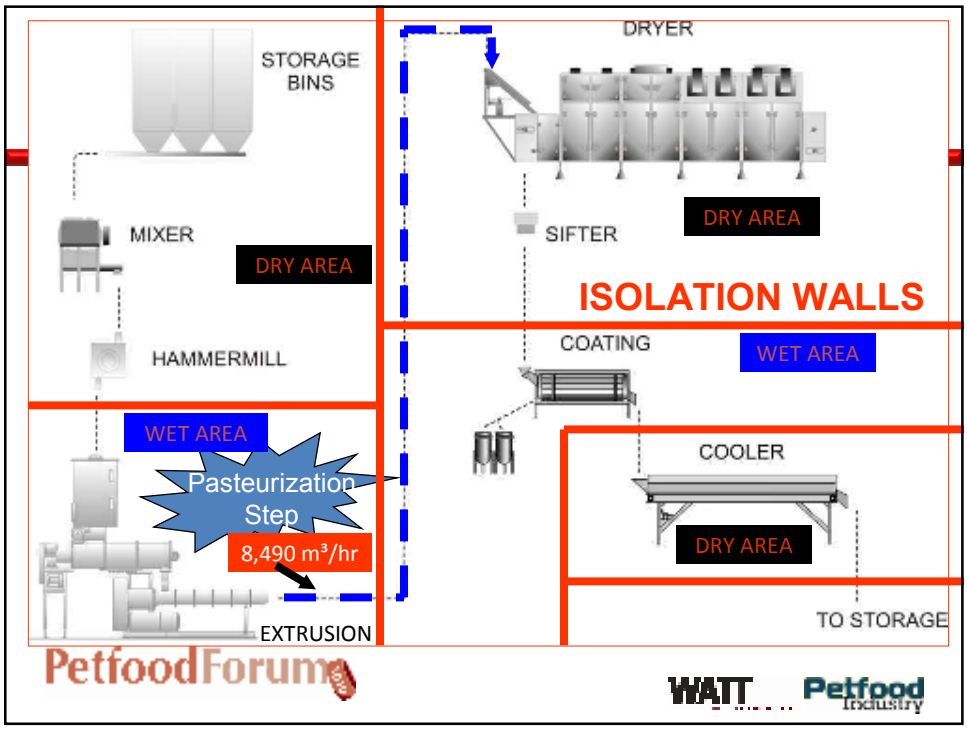

STORAGE BINS
DRYER
MIXER
DRY AREA
SIFTER
DRY AREA
ISOLATION WALLS
HAMMERMILL
COATING
WET AREA
WET AREA
COOLER
Pasteurization Step
DRY AREA
TO STORAGE
PetfoodForum
WATT
Petfood Industry

Plant and Equipment Design

1) Isolation Walls
2) Product transfer
3) Airflow control and treatment
4) Equipment design and construction
5) Closed loop systems
6) Control systems and on-line devices

PetfoodForum

WATT Petfood Industry

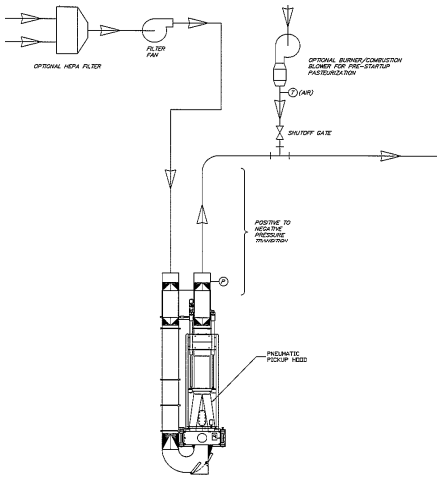


PetfoodForum

WATT Petfood Industry

Sanitary Pneumatic Conveying Systems

1) HEPA filter air intake
2) Burn-out sanitizing mode
3) Strategically located temperature sensors
4) Positive pressure at die/knife area
5) Positive pressure at sampling port



PetfoodForum

WATT Petfood Industry

Conveying Devices

1) Eliminate where possible
2) Sanitary design for minimal material buildup and ease of cleaning
3) Closed loop
4) Heated air intakes and heated transfer points

PetfoodForum

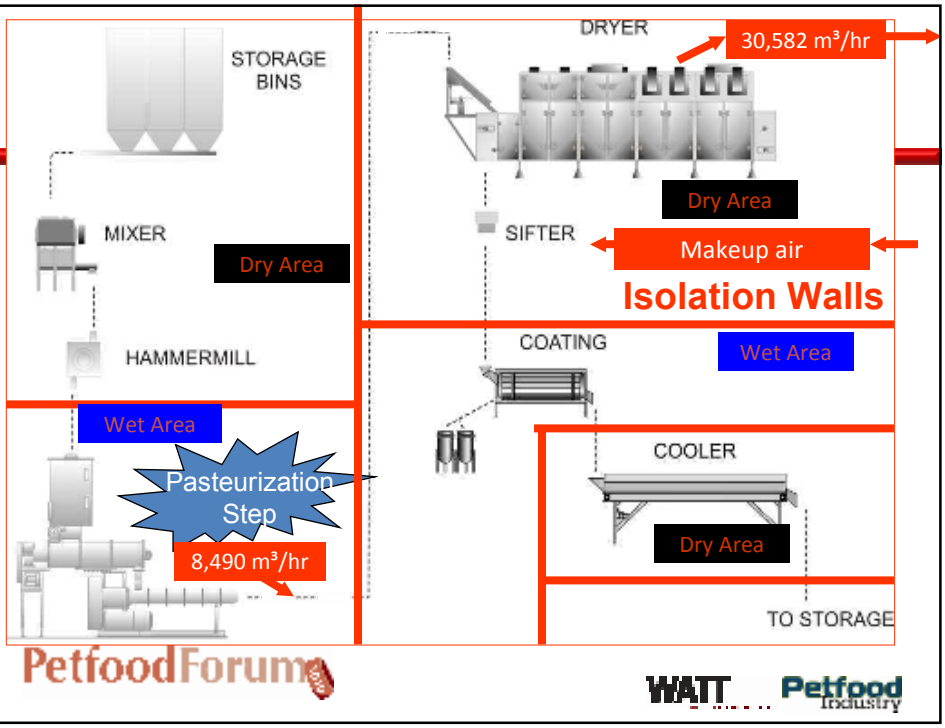
WATT Petfood Industry

Plant and Equipment Designs

1) Isolation Walls
2) Product transfer
3) Traffic and airflow control and treatment
4) Equipment design and construction
5) Closed loop systems
6) Control systems and on-line devices

PetfoodForum

WATT Petfood Industry



PetfoodForum

WATT Petfood Industry

Plant and Equipment Designs

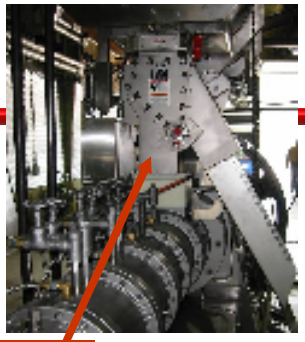
1) Isolation Walls
2) Product transfer
3) Airflow control and treatment
4) Equipment design and construction
5) Closed loop systems
6) Control systems and on-line devices

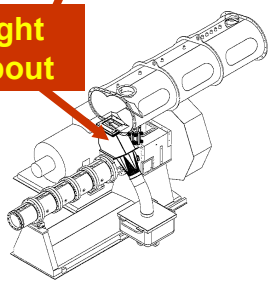
PetfoodForum

WATT Petfood Industry

Equipment Design and Construction

1) Designed to minimize dust and product buildup and accumulation
2) Easy access for inspection and cleaning
3) Designed to minimize leakage/spillage and exhaust streams
4) Systems to capture and recycle under-processed material



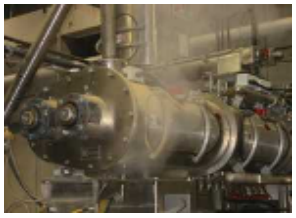


PetfoodForum

WATT Petfood Industry

Capturing and Containing Under-Processed Material to Prevent Re-Contamination

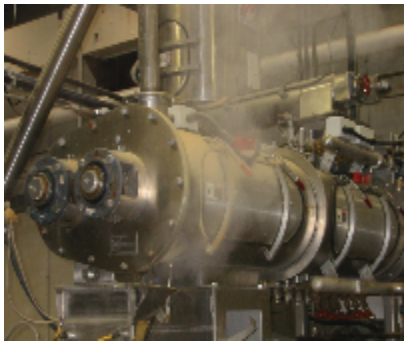
1) Preconditioner and Extruder Venting
2) Waste Recycling Systems
3) Bypass valves to prevent under-processed material going to die assembly



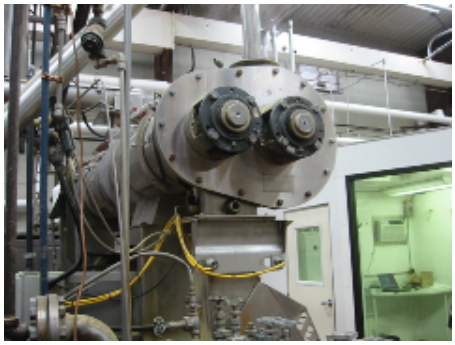
PetfoodForum

WATT Petfood Industry

Typical preconditioner venting with fugitive steam, odor, and recipe particulates



Before

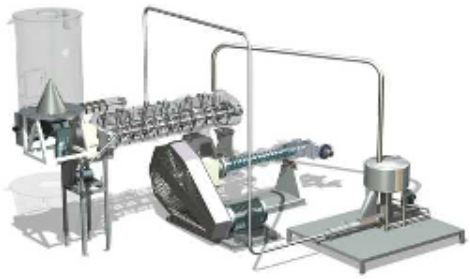


After installation of “capture system”

PetfoodForum

WATT Petfood Industry

Closed loop systems for recycling wet, under-processed material



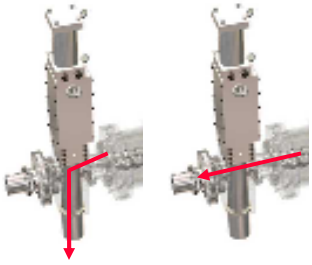
A reclamation system to recover wet, under-processed product that cannot be recycled through the dryer as dry re-work.

PetfoodForum

WATT Petfood Industry

Reducing and Containing Under-Processed Material

1) Product through extruder is by-passed with valve until target conditions are achieved
2) Accelerate product temperature rise during startup phase
3) Product diverted to “process” position (through die)



PetfoodForum

WATT Petfood Industry

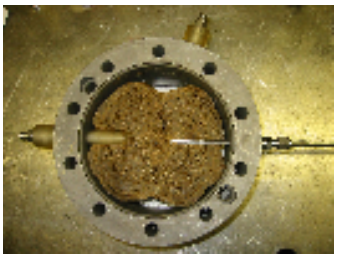
Measuring Product Temperature

-Mounting Techniques

-Temperature probe locations

-Time to reach equilibrium temperature

-Time to reach pasteurization temperature (77°C)



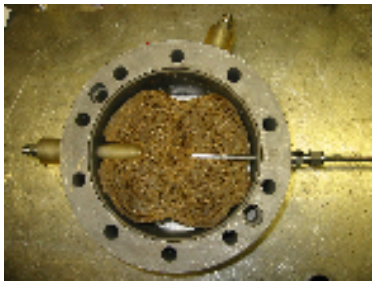
After Extruder Screw

PetfoodForum

WATT Petfood Industry

Impact of Thermocouple Location on Product Temperature Readings

% Retracted *	Product temp (C)
0	140
33.3	139
50	138
66.7	135
83.3	122
100	104



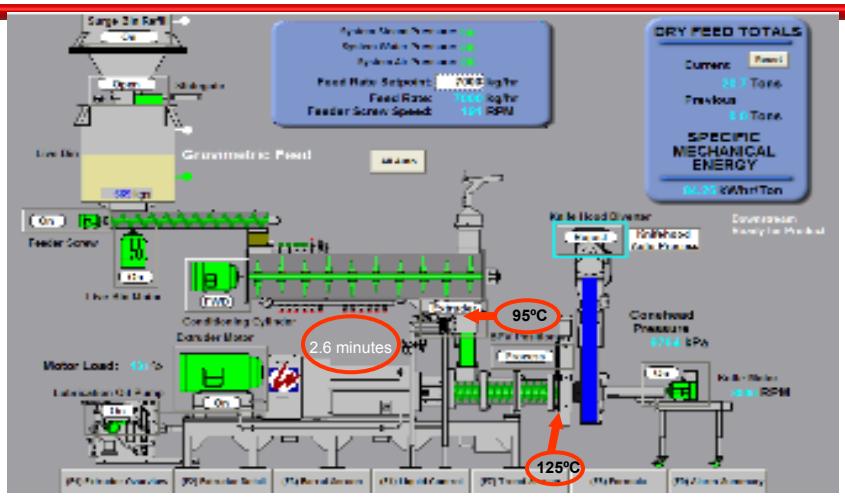
PetfoodForum

WATT Petfood Industry

* 0% retracted = center of product flow; 100% retracted = flush with sidewall

Critical Control Points

Preconditioner and Extruder Temperature Validation



PetfoodForum

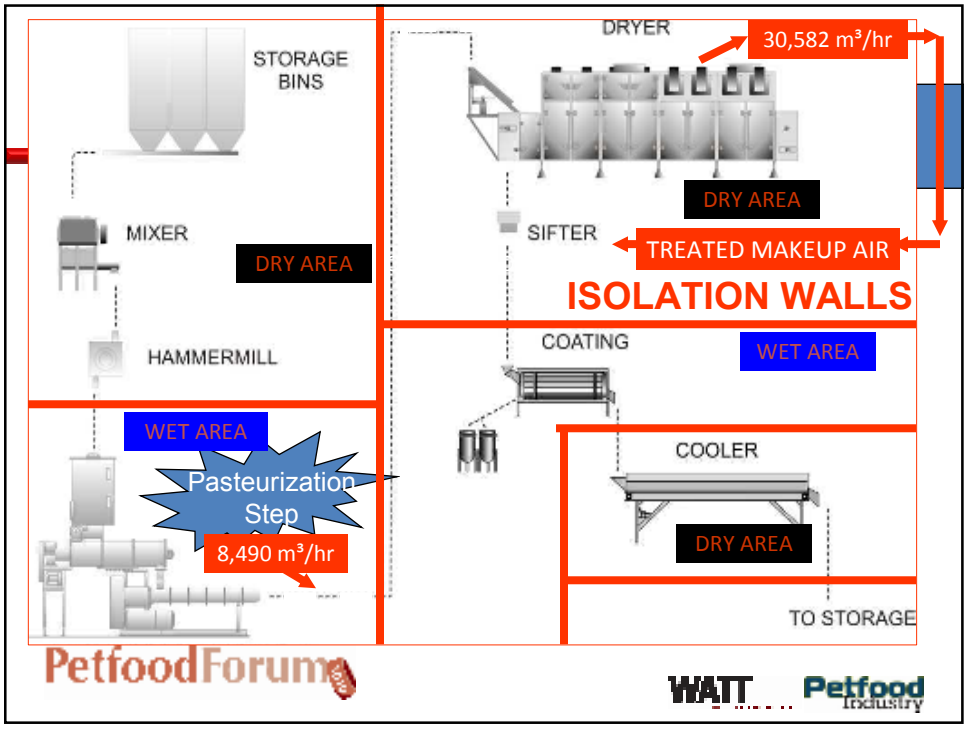
WATT Petfood Industry

Plant and Equipment Designs

1) Isolation Walls
2) Product transfer
3) Airflow control and treatment
4) Equipment design and construction
5) Closed loop systems
6) Control systems and on-line devices

PetfoodForum

WATT Petfood Industry



Plant and Equipment Designs

1) Isolation Walls
2) Product transfer
3) Airflow control and treatment
4) Equipment Design and Construction
5) Closed loop systems
6) Control systems and on-line devices for measurement of product quality

PetfoodForum

WATT Petfood Industry

Extruders and dryers are operated by computer control systems from a remote control room

Enhanced IT and the "Digital Age"

PetfoodForum

WATT Petfood Industry

Control System Trend Screens and Data Logging

PetfoodForum

WATT Petfood Industry

Product monitors and on-line devices to decouple personnel from direct product contact

from Source Technologies

1) On-line measurement of product technical qualities (bulk density, moisture, temperature, etc.)
2) Remote digital imaging

PetfoodForum

WATT Petfood Industry

The Way Forward ?

1) Supplier Quality Assurance and Certification – "Salmonella Free"
2) Pre-treatment of ingredients or groups of ingredients
3) Traceability
4) Rapid Methods
5) Adoption of existing and new technologies
6) **Plant and equipment designs**
7) **GMP's, HACCP, Food Safety Management Systems**

PetfoodForum

Hazard Analysis and Critical Control Point

WATT Petfood Industry

Thank You!

The Way to Pet Food Safety

1) Establish and maintain critical control points
2) Avoid recontamination through plant/equipment design and implementation of GMP's, HACCP, and Food Safety Management

Galen J. Rokey
Wenger Mfg. , Inc.

Tel: 785-284-2747
Fax: 785-284-3727
Email: grokey@wenger.com

PetfoodForum

WATT Petfood Industry