Quality Assurance in Manufacturing
Rendered Products

A suppliers perspective!
January 29, 2016

Creating sustainable food, feed and fuel ingredients for a growing population

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Topics of Discussion

• Rendering Industry - the U.S. model
  - How Rendering is Regulated
  - Raw Materials
  - What Rendering Offers
  - Rendered Finished Products
  - Customer Expectations

• Producing Quality Ingredients
  - Prerequisite Programs
  - Preventive Controls
  - Quality Controls
How is Rendering Regulated?

- The rendering industry is heavily regulated from a number of different regulatory agencies. We are regulated by EPA, OSHA, FDA, APHIS and state regulatory agencies.
- We are audited frequently by these agencies depending on the products produced and where they are sold.
- All rendering plants are required to register according to the Bioterrorism Act.
- All facilities processing raw material from cattle origin fall under the BSE rule 21 CFR 589.2000 and 2001 which restricts the use of specific animal proteins.
- New regulations through FSMA Animal Food Rule.
Raw Materials
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Mortalities, 1.8
Retail meat, 2.9
Restaurant grease, 2.4

Beef, 18.7
Pork, 7.8
Poultry, 16.0
Other, 1.5

51.1 billion pounds total

From: A Profile of the North American Rendering Industry, Informa Economics, 2011
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Edible and Inedible Portions of Animals

% of live wt.

Cattle
- Edible: 43%
- Inedible: 57%

Poultry
- Edible: 33%
- Inedible: 67%

Swine
- Edible: 37%
- Inedible: 63%
Volume of Raw Material

- Over 150 million pounds of waste tissues daily
- Annually would fill four semi-trailers abreast, end to end, stretching from New York City to Los Angeles
What does rendering do?

- Recycles
- Kills pathogenic organisms
- Reduces volume by 60% or more
- Protects (sustains) the environment
- Recycles (captures) carbon to prevent GHG
- Recycles energy (as BTU or calories)
- Biofuel made from fats have 86% lower CO$_2$ emissions
- Provides control, verification and traceability to regulatory agencies and the public.

This is all done within hours of receiving raw materials, rather than taking weeks or months as some popular alternative methods do.
Sizing
Grinding
Heat Processing (Time x Temperature)

Press
Protein Crax

Meal (Protein) Storage/Load-out
Fat Storage/Load-out

Raw Material
Storage/Load-out

Press
Protein Crax

Meal (Protein) Storage/Load-out

Fat Storage/Load-out
Continuous Cooker

- Operating temperature at 230-300F
- Residence time 20-90 minutes
- 60% reduction in moisture
- Destroy pathogens
Continuous Cooker
Press (fat separation)

- Mechanical press
- Press fat out of the crax
- Product temperature high to press correctly
Finished Product
Rendered Finished Products

Meal

Fat
Rendered Finished Products

- Meat and Bone Meal
- Tallow
- Poultry Grease
- Recovered Cooking Oil
- Poultry Byproduct Meal
- Blood Meal
- Feather Meal
- Chicken Meal
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Finished Product Uses, x 1 billion lb.

- Feed
- Non feed & export, 4.2
- Fats, 5.1
- Proteins, 9.2

18.5 billion pounds total
64% reduction in volume

From: A Profile of the North American Rendering Industry, Informa Economics, 2011
Markets for U.S. Finished Rendered Products

Protein
- Poultry: 39%
- Pets: 31%
- Swine: 9%
- Cattle: 6%
- Export: 8%
- Fish: 3%
- Other: 4%

Fats
- Livestock: 35%
- Export: 22%
- Pet Food: 15%
- Biofuel: 10%
- Oleochemical: 9%
- Human Food: 8%
- Other: 1%

From Informa Economics. 2011. A Profile of the North American Rendering Industry
Sustaining our Planet – Meat By-Product Processing

Our industry provides a cycle of sustainability to the food industry, ensuring safety throughout the food chain.
Food Safety Controls
Customer Expectations of Renderers

• Produce safe ingredients!!!
• No foreign material or contamination -(NO metal, wood, plastic, rubber, glass, chemicals, picking fingers, rubber gloves, ear tags, leg bands or other unspecified materials!)
• Pest-free ingredients.
• Consistently meet ingredient quality and nutritional specifications.
• Sourced from traceable and sustainable raw materials.
• Fresh ingredients (Antioxidant Application)
Potential Hazards

• Food Borne Pathogens (salmonella, clostridia perfringens, E. Coli), viruses

• Chemicals – Insecticides, PCBs, Rodenticides, Fungicides, Euthanizing Agents, Toxic chemicals (anti-freeze), Heavy Metals, i.e. lead and cadmium

• Physical – metal, glass, plastic, wood, rubber

• Regulated substances – CMPAF (cattle material prohibited in animal feed; brain and spinal cord of cattle aged 30 months or older)
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FSMA (21 CFR §§ 507.14 – 507.50)

CGMP

Personnel

Plant & Grounds

Sanitation

Water supply

Equipment & utensils

Plant Operations

Holding & Distribution

Food Safety Plan

Hazard Analysis

Preventive Controls

CCPs

Process controls

Sanitation controls

Supply-Chain program

Part §507 Subpart B of the Animal Food Rule

HACCP
Raw Material → Sizing → Heat Processing (Time x Temperature)

Grinding → Protein Crax → Press

Meall (Protein) Storage/Load-out

Fat Storage/Load-out
Prerequisite Programs
Raw Material Analysis

- Quality starts with the raw material
- Analyze raw material stream for hazards likely to occur
- Why is the raw material available
- Any quality issues that should be addressed
- Is feed the best market
Raw Material Inspection GMP

• Ensure product is obtained from approved suppliers
• Inspect product for suspicious visual residues, off-odors, prohibited materials, plastic and physical hazards
• Document inspections
• Detailed protocol for situations when problems arise
CMPAF Removal and Disposal GMP

- Proper aging of cattle
- Properly removing CMPAF
- Segregating CMPAF
- Disposing of CMPAF
- Verification activities

Image courtesy of Linda A. Detwiler
Personnel Hygiene GMP

- Properly designed uniforms and PPE
- Cleanliness of uniforms and PPE
- Proper handwashing
- Removal of jewelry
- Storage of personal items
- Breakrooms and bathroom facilities
- Exclude the use of tobacco products
- Standard for employees living on livestock farms
Plant Equipment and Grounds GMP

- Plant grounds free of weeds and standing water
- Plant designed to exclude pest
- Separation of raw and finished product areas
- Dedicated equipment and tools
- Cleaning and sanitizing of tools as necessary
- Disposal areas for trash
- Keeping equipment enclosed during processing
Plant Housekeeping GMP

- Potable water
- Sanitation stations for employees working in raw material areas
- Spilled product disposed of appropriately
- Finished product areas kept dry
- Handling and holding equipment inspected prior to use
- Cleaning schedules
Pest Control GMP

- Third party pest control program
- Trash stored appropriately
- Trash disposed of properly
- Repairs made to exclude pest
- Spilled material cleaned up quickly
- Employee food excluded from facility
- Walkthrough of plant necessary
- Keeping equipment enclosed during processing
Plant Security GMP

- Perform plant security evaluations
- Protocol for visitors
- Pass cards implemented
- Security fencing
- Locked facility doors and windows
- Holding vessels secured
- Roof access secured
- Employees easy to identify
In Plant Chemical Use GMP

- Chemicals used in the facility must be approved by Product Safety Team
- Use of food grade lubricants
- Install drip pans if necessary
- Inspection of equipment for leaks
- Procedures for cleaning leaks
- Chemical storage must protect against product contamination
- Chemical storage must be identified
- Chemical storage must be secured
Metal Control GMP

- Grinding and standard processing reduce risk of food safety hazard
- Magnets are used to control metal fragments that could impact the quality of finished goods
  - Raw material magnets
  - Press magnets
  - Pre-grind magnets
  - Loadout magnets
- Cleaning and weighing of fragments
- Pull strength test
Loadout Inspection GMP

• Previous BOL
• Appropriate Previous Cargo
• Inedible stenciling
• Trailer/Tanker Inspection
• Seals
• Driver Notifications
• Management Verification
Preventive Controls
Supply Chain Program (Preventive Control)

• Relationship with suppliers
  - Understanding common handling practices
  - Clear expectations to avoid potential contamination
  - Work with supplier on improvements by giving feed back on contaminants found and the quality of raw material

• Supplier audits

• Supplier guarantees
  - CMPAF certification
  - Pesticide testing COA
  - Pathogen control certification
Cooking Process (Preventive Control)

- Operating temperature at 260F
- Residence time 20-90 minutes
-Destroy biological pathogens
Residence Time of Solid Marker in Continuous Cooker with fat added back and 31,000 lb/hr feed rate

Peak residence time was < 50 minutes.

About 10% passed through in 21 minutes

About 10% retained for 90 minutes

EU data
In addition to historical work conducted at Clemson University, microbiologist/food safety scientists at Texas Tech, Colorado State and Texas A&M Universities are studying thermal death time of pathogens in different raw material matrices to validate the cooker as a critical control point and develop models that can be used to predict log reductions under various processing conditions.

![Graph showing log cfu/g vs time (min) for 240°F Strained English Peas Clostridium sporogenes with D_{240} = 4.9 min.]

**Relative Heat Resistance**

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<th>Temperature</th>
<th>E Coli</th>
<th>Staphalococcus</th>
<th>Salmonella</th>
<th>Clostridium</th>
<th>G. Stearo thermophilus</th>
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### Avian Influenza RNA Destruction

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2012 J. of Applied Poultry Research 21:719-725

Clemson University/Animal Co-Products Research and Education Center
Cooking Process (Preventive Control)

- Established critical limits
- Monitoring
- Record keeping
- Corrective action
- Verification
  - Records
  - Temperatures
Micro Testing Programs (Verification)

- Clostridium perfringens
  - Press samples
  - Cooker verification
- Enterobacteriaceae testing
  - Loadout samples
  - Handling of product post-cooker
- Water activity testing
Pesticide and Impurity Testing Programs (Preventive Control)

- Chlorinated Pesticide Testing
  - Hold and test program
  - Fat
  - Meal cleared by testing fat

- Impurity Testing
  - Tallow
  - Anything >0.15% labeled
Recall Plan (Preventive Control)

- Establish traceability
- Plan of action
  - Corporate contact protocols
  - Defined responsibilities
  - Customer contacts
  - FDA contacts
- Mock recalls
Quality Controls
Antioxidant Application (Quality SOP)

• Established limits
• Monitoring
• Application verification
• Application calculation
• Corrective actions
• Tracing abilities
Quality Testing Programs (Quality SOP)

- Typical test capabilities:
  - Protein
  - Fat
  - Ash
  - Moisture
  - FFA
  - Peroxide Value
  - Oxidative Stability
  - Digestibility
Important Components in a Quality System
Quality System

- Training programs
- Internal auditing
- Third party verification
- Customer audits
- Realistic customer expectations
Summary

• Rendering provides essential services to society
• Rendering provides bio-nutrient transformation
• Rendering provides a safe and effective way to utilize animal byproducts and food waste
• Rendering activities are closely regulated by multiple federal and state agencies
• Rendering has implemented food safety controls for many years to reduce hazards
Thank you!