Holy Beef Combos Batman!

Challenges and Solutions Dealing with Industrial Scale Food Safety Research
Kansas State University’s Biosecurity Research Institute (BRI)
State-of-the-Art BSL-3 & BSL-3Ag Facility

Mechanical space (air handling)

Laboratory & Administration

Mechanical Space (waste treatment)
113,000 ft$^2$ Facility

41,000 ft$^2$ Research & Education Space

31,500 ft$^2$ inside the biocontainment barrier
Unique Slaughter/Food Processing Floor

- USDA style layout
- Operate at BSL-2 or BSL-3
Food Processing Floor

• Flexible floor configuration
• 17,769 ft² allows for industry scale food projects
  – 2 walk-in coolers
  – 1 walk-in freezer
    • 630 ft²
The bioBUBBLE

- Installed bioBUBBLE for “Big Grind I & II”
Personal Protective Equipment

- Tyvek coveralls
- Two pair of gloves
- Hard hat PAPRs
- Steel toe boots
- Ear plugs
Big Grind I: STEC

- Performed 5 runs/grinds
  - 1 per week
- Each run required 2 combos
  - 2 combos = 4000 lbs.
- Total amount of inoculated ground beef trim = 20,000 lbs.
Big Grind I: STEC

- Run 1: Practice, no infectious agent used
- Run 2-4: Used various serotypes of *E. coli*
- Run 5: Combo sampling with *E. coli* (no grinding)
Big Grind I: STEC

• Runs 2-4 had 3 separate inoculation events with various serotypes of *E. coli*
Big Grind I: STEC

- Run 5 had one inoculation event
- A piece of STEC inoculated beef trim was randomly placed in the combo
Big Grind II: BA Sterne

- Performed 3 runs/grinds
  - 1 per week
- Each run required 2 combos
  - 2 combos = 4000 lbs.
- Total amount of inoculated ground beef trim = 12,000 lbs.
Big Grind II: BA Sterne

- All 3 runs inoculated with *Bacillus anthracis* Sterne spores
- One inoculation event
  - Inoculated beef trim put into the grinder
Holy Beef Combos

32,000 lbs. of Inoculated Meat!

How are we going to get rid of 32,000 lbs. of inoculated meat?

To the Digester!
Alkaline Tissue Digester

- Normally used to dispose of animal carcasses
- Located in necropsy
- 5,000 lb. capacity
Alkaline Tissue Digester

- Denatures carcasses into amino acids, lipids, sugars, and minerals through
  - Steam
  - Heat
  - Pressure
  - High pH (KOH pH13)
Known Limiting Factors for the Digester
Known Limiting Factors for the Digester

• Releasing the material
  – MOU with the City of Manhattan
  – Coordinate with Veterinary College
  – If releasing on Friday must provide notification
How We Assumed it Was Going to Work!
55 Gallon Barrels!

- Load inoculated meat into the barrels
- Place lids on barrels to seal
- Barrels have wheels
Decontaminate the Barrels

• Use the foamer to decontaminate the outside of the barrels
Move Barrels from Processing to Necropsy
Dump the Barrels into the Digester
The Process Did Not Go Quite as Planned
Red Barrels

- Lids did not stay on
- Solution
  - Shrink wrap!
Processed Meat = Lots of Fat & Grease

• Fat and grease got stuck everywhere
• Solution
  – Spray everything down with 180°F water
  – All liquid waste goes to the EDS
A Lot of Meat

- Once filled, each barrel weighed 400-450 lbs.
- Solution
  - use the barrel dump to empty into the digester
More Fat & Grease

• Meat left behind greasy residue
  – Hard to clean barrels

• Solution
  – Lined barrels with digestible bags
    • used 2 layers for strength
Barrel Storage

• Found out we could not run the digester at full capacity

• Solution
  – Store the barrels
  – 3 walk-in coolers and 1 walk-in freezer came in handy
Digester Issues

• First digester run
  – Standard cycle
  – 4000 lbs. of processed meat

• Material solidified
  – Major issues trying to release material
Digester Issues

- 4000 lbs. of meat ≠ 4000 lbs. of animal carcass
  - Processed meat has a lot more fat than animal carcasses
Digester Solutions

• Drastically reduce the amount of processed meat loaded into the digester
  – 1000-1500 lbs. processed meat compared to 5000 lbs. of animal carcass
  – Consulted with service contractor regarding cycle modifications
Digester Solutions

• Change the chemical recipe
  – Animal carcass recipe = 150% H₂O + 20% KOH
  – Processed meat recipe = 200% H₂O + 26% KOH
Digester Solutions

• Additional steps needed before release was possible
  – Add more H$_2$O to dilute the mixture even further
  – Re-heat the digester to get the mixture back in a liquid form so it could be released
• Normal flow to city waste treatment plant
Fun Fact

• Mixing animal carcasses with processed meat helped keep contents from solidifying
Fun Fact

• Filled ~75 red 55 gallon barrels
Fun Fact

• Digested ~32,000 lbs. of inoculated processed meat
Fun Fact

• It took 16 digester runs over one year to dispose of all the processed meat
Conclusion

• Lots of pre-planning was crucial to get this project up and running
• Creative thinking and innovation was a necessity to keep this project flowing
Credits

• Mark Minihan, Animal Suite Supervisor, Kansas State University Biosecurity Research Institute
• Megan Sawyer, Lab Coordinator, Kansas State University Biosecurity Research Institute
• Megan Trapp, Lab Coordinator, Kansas State University Biosecurity Research Institute
• John Webster, Education Officer, Kansas State University Biosecurity Research Institute
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QUESTIONS?