# Holy Beef Combos Batman!

Challenges and Solutions Dealing with Industrial Scale Food Safety Research

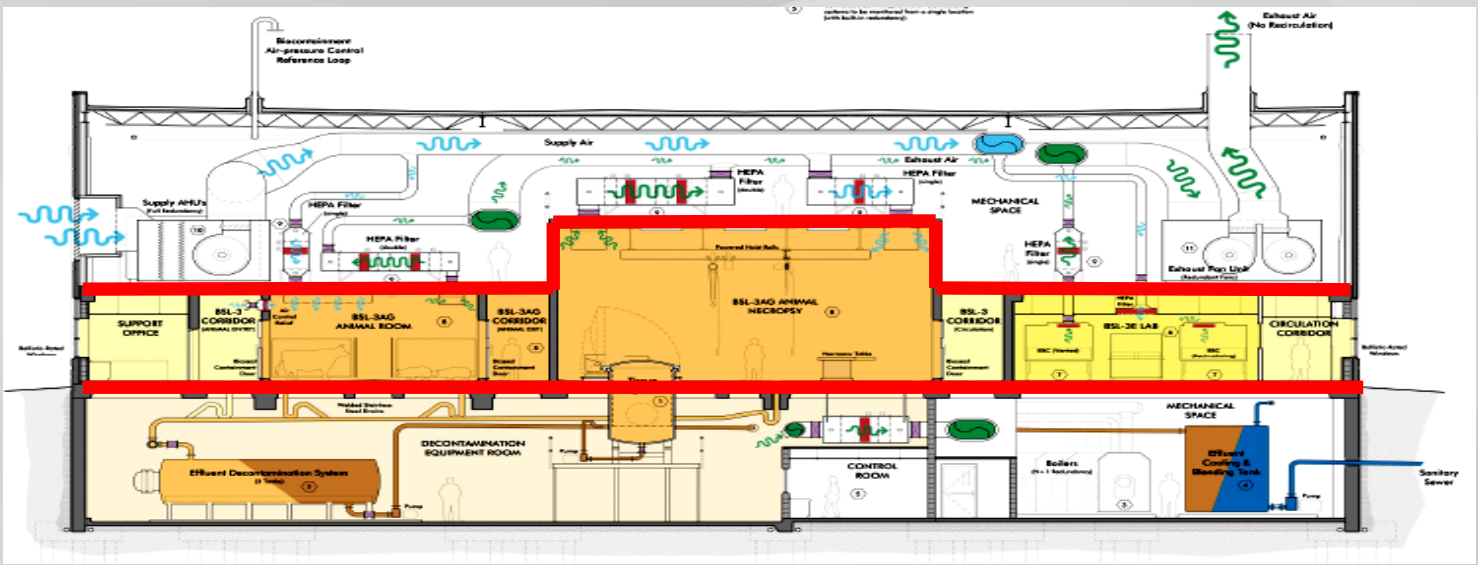
# Kansas State University's Biosecurity Research Institute (BRI)

# State-of-the-Art BSL-3 & BSL-3Ag Facility

Mechanical space (air handling)

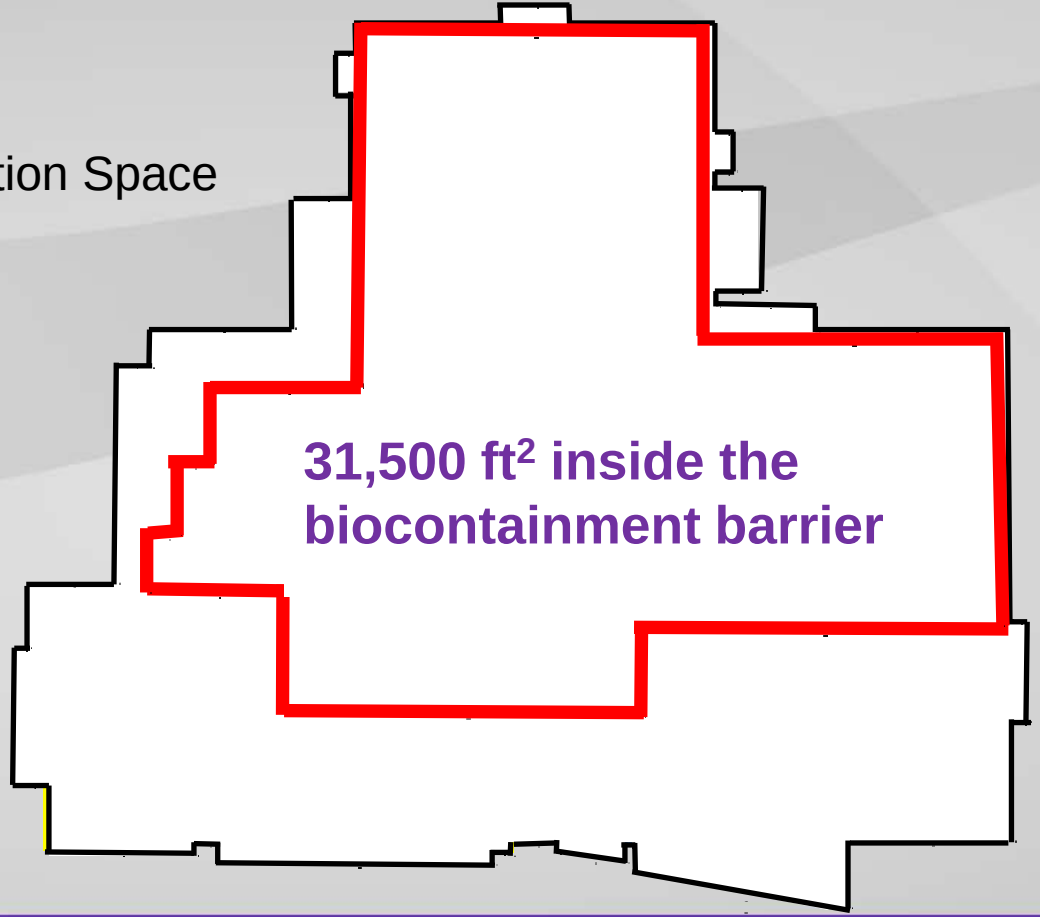
Laboratory & Administration

Mechanical Space (waste treatment)



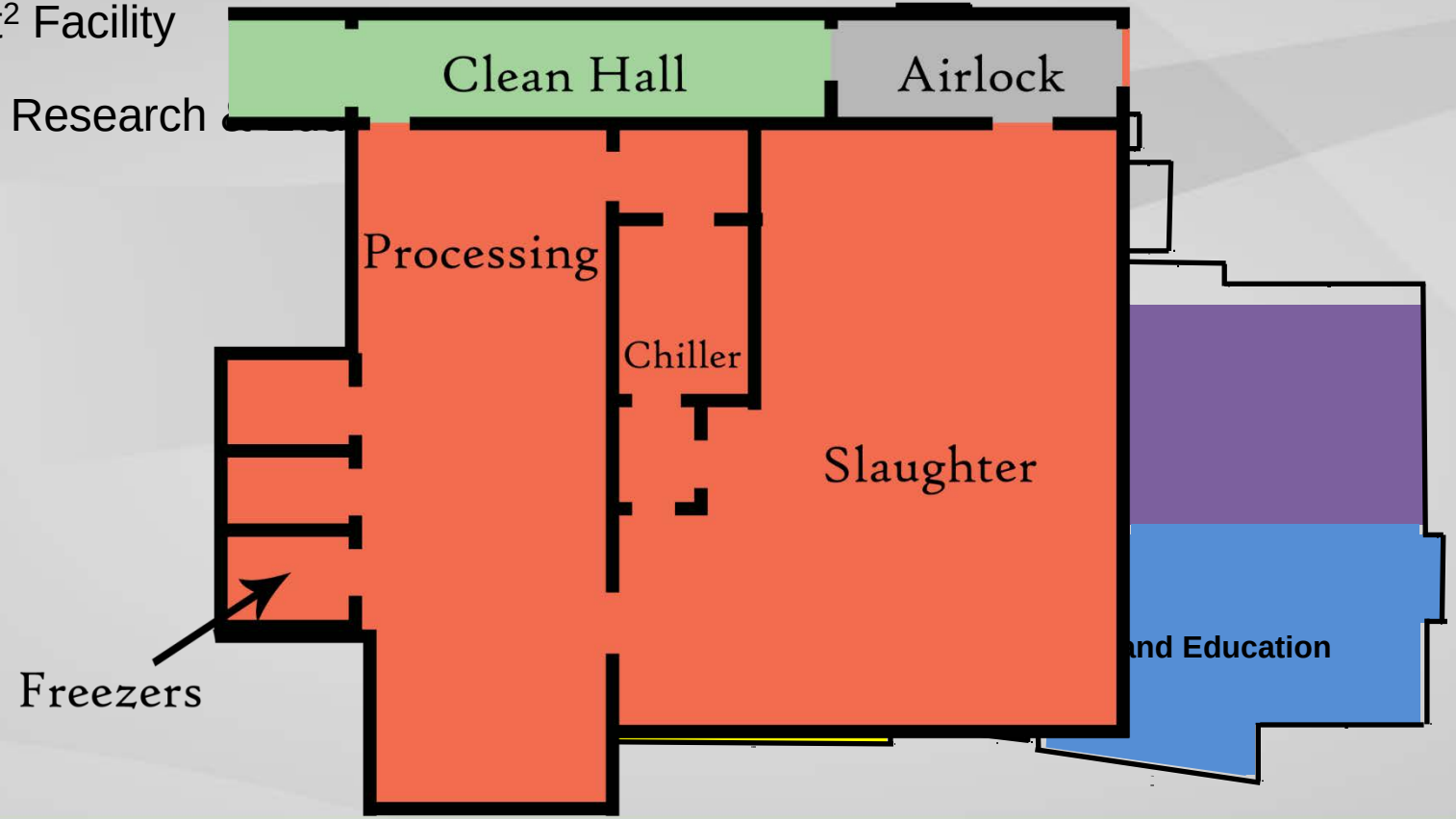
113,000 ft$^2$ Facility

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



113,000 ft$^2$ Facility

41,000 ft$^2$ Research



# Unique Slaughter/Food Processing Floor

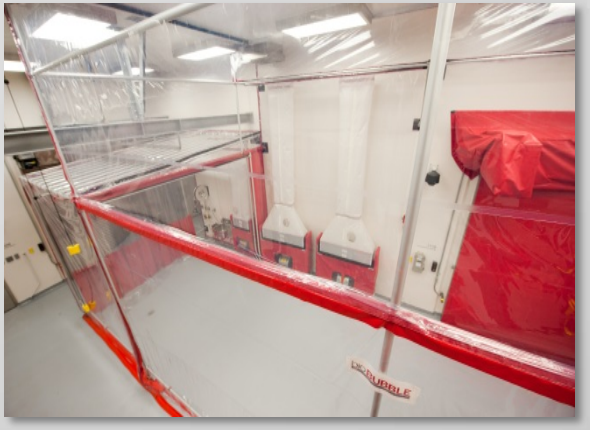
- USDA style layout
- Operate at BSL-2 or BSL-3

# Food Processing Floor

- Flexible floor configuration
- 17,769 $ft^2$ allows for industry scale food projects
  - 2 walk-in coolers
  - 1 walk-in freezer
    - 630 $ft^2$

# 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

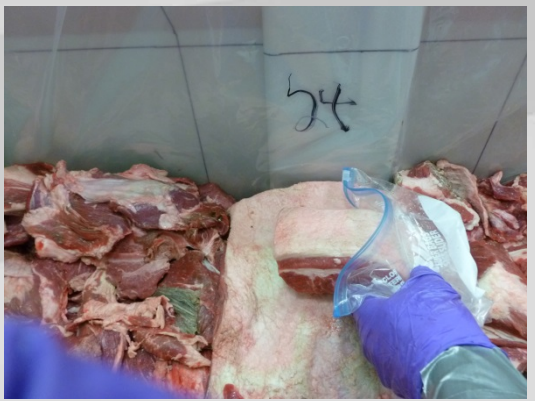
- Run 1:  Practice, no infectious agent used
- Run 2-4:  Used various serotypes of *E. coli*
- Run 5:  Combo sampling with *E. coli (*no grinding)

# 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

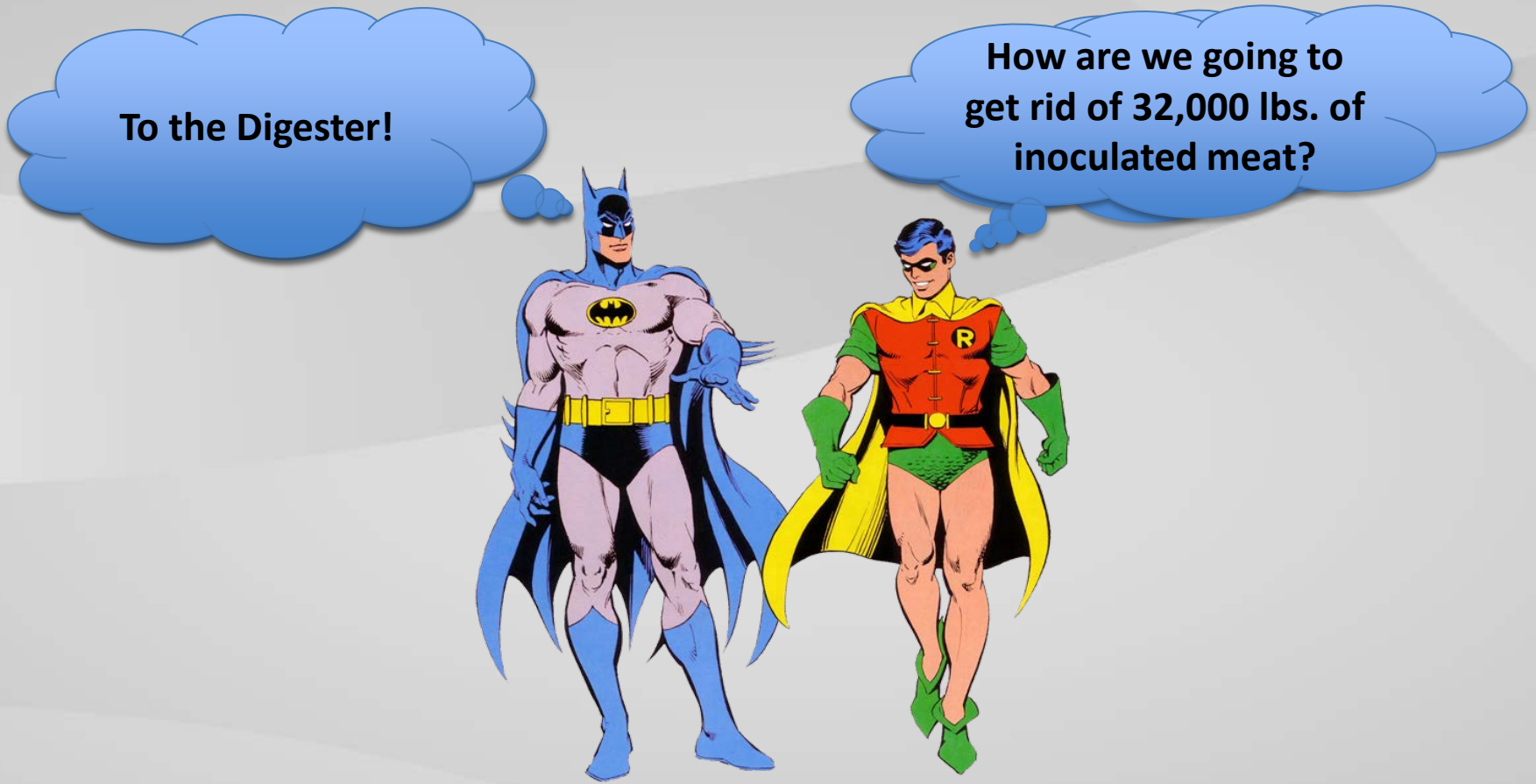


# Big Grind II: BA Sterne

- 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.

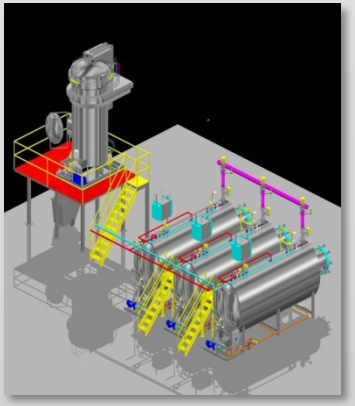
# Big Grind II: BA Sterne

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


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

# Alkaline Tissue Digester

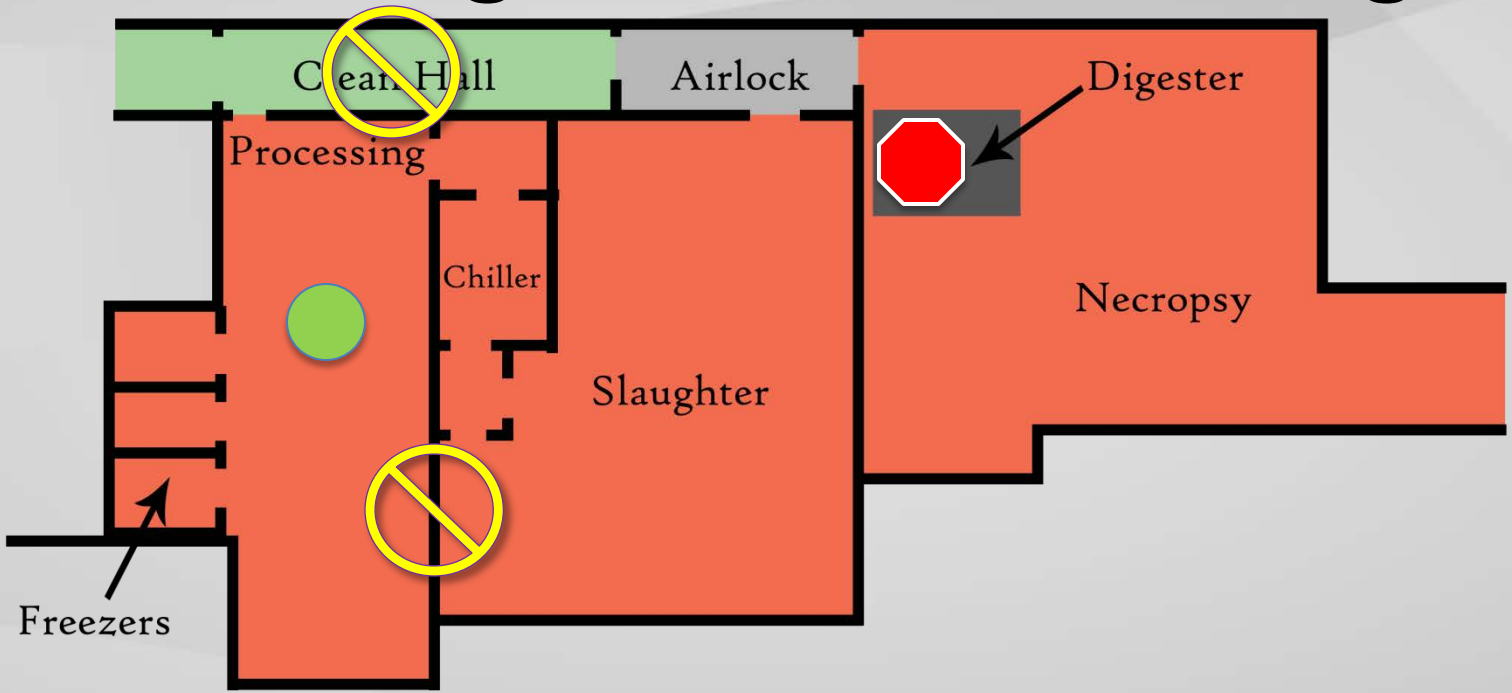
- Normally used to dispose of animal carcasses
- Located in necropsy
- 5,000 lb. capacity



# 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!

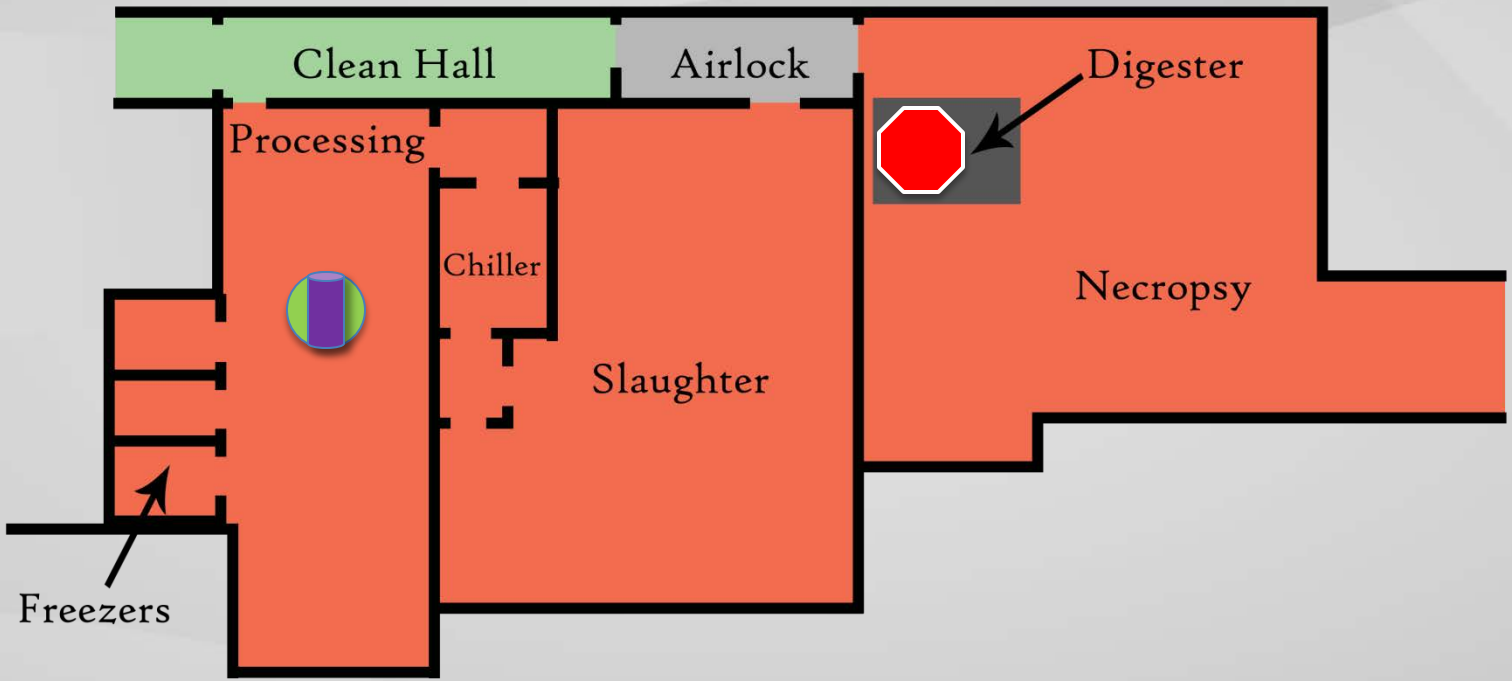
# 55 Gallon Barrels!

- 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% $H_2O$ + 20% KOH
  - Processed meat recipe = 200% $H_2O$ + 26% KOH

# Digester Solutions

- Additional steps needed before release was possible
  - Add more $H_2O$ 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

# Images Used Under Fair Use Laws

- Bat Signal Image taken from http://www.ncc.co.uk/media/bat_signal.jpg
- Batman and Robin comic image taken from http://www.ordoabwiki.org/_/rsrc/1329349397906/courses/b/batman-and-robin/batman_robin.png
- Robin image taken from http://s3.amazonaws.com/rapgenius/1374206789_grayson3.jpg
- The Joker image taken from http://fc07.deviantart.net/fs30/f/2008/074/e/8/The_Joker_by_els3bas.jpg

# QUESTIONS?