Biosecurity 101

AnS 190X

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Goals

• Discuss the foundations for biosecurity

• Provide some science behind recommendations

• Provide some resources
High Standard
Biosecurity

• Definition: The steps or process for disease prevention.
  – External – New Introductions
  – Internal – Spread within an operation

• Not all risk can be eliminated!
  – BRM – Biological Risk Management

• Work to minimize the opportunities
Bio-Exclusion Considerations

Location

Employees & Visitors

Supplies & Product Deliveries

Waste Management

Carcass Removal

Tools/Equipment

Aerosol – weather

Source: Dr. Butch Baker
BRM - Foundation

• Disease triad

Host

Environment

Agent
• Disease triad
Three basic things to consider:

1) Need to have a disease agent present
   - Live
   - Sufficient numbers

2) Need to have a susceptible host

3) The host must become exposed to the agent in sufficient numbers so as to cause disease
   - Routes of transmission
Routes of transmission

- Aerosol
- Fomite
- Oral
- Vector
- Direct contact
- Zoonotic
# PRRS transmission

<table>
<thead>
<tr>
<th>Route</th>
<th>ID&lt;sub&gt;50&lt;/sub&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>SQ (parenteral)</td>
<td>~10</td>
</tr>
<tr>
<td>Intranasal</td>
<td>~8,000</td>
</tr>
<tr>
<td>Artificial Insemination</td>
<td>~31,600</td>
</tr>
<tr>
<td>Oral</td>
<td>~158,500</td>
</tr>
<tr>
<td>Aerosol</td>
<td>??</td>
</tr>
</tbody>
</table>

Zimmerman 2005
Formula for disease

Infectious Agent (viable and dose)
+ Exposure
+ Susceptible Host

--------------------------------

Disease (acute, subacute)
Formula for disease

Infectious Agent (viable and dose) + Exposure + Susceptible Host

Disease (acute, subacute)
Aerosol Transmission
Aerosol Requirements

- Large numbers of pathogens
  - Circle → Area = π * r²
- Low temperature
- High humidity
- Low sunlight
- Short travel distance
- Low wind speeds
- Smooth topography

Gloster et al. 1981, Christensen et al 1990, Grant et al. 1994; Stärk 1999
Aerosol transmission

• Aerosol ≠ Area spread

• Aerosol = via the air
  – Agent/strain specific

• Area spread = not specific to air, but more related to location
Aerosol - Biosecurity practices

• Location
  – Low livestock density area
  – Preferably at least 2 miles from other livestock or manure spreading areas

• Ventilation
  – Proper maintenance
  – Use dust reduction protocols in confinement (1% fat in feed)
  – Maintain relative humidity <70%

• Air filtration system?
Aerosol

• Air filters

HEPA vs. MERV vs. Disposable

www.reliablefilter.com
Costs:
$250 per sow
$150 per boar
Maintenance $30 - 40/head/year
Fomites & Oral

Oral

Fomites
Fomites & Oral

Fomites are inanimate objects (not alive) that can serve as a means to transport organisms from one animal to another.
Fomites
Fumigation of all objects entering the site
People

![Man holding a pig](image)

**RESTRICTED ENTRY**

This is a BIOSECURE FACILITY

Please Comply with ALL posted Biosecurity Signs

HIGH RISK  MED RISK  LOW RISK

Help Keep Our Animals Healthy

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ISU College of Veterinary Medicine, Food Supply Veterinary Medicine
People

• How many people/vehicles enter your farm operation every month?
  – A study in 2001 reported that larger (>2,000 head) swine herds had contact with people and vehicles who had contact with other livestock facilities an average of 807 times each month.

Risk = Frequency X Consequence
People

- *E. coli* Amass et al. 2003
- FMDV Amass et al. 2003
- TGEV Alvarez et al. 2002

- Showering and putting on clean outerwear prevented transmission in **ALL** cases!
People

- Risk is the same for sow units as well as nursery and finishing sites

- Large systems implement showering at all phases
Got boots?

Help contain disease by wearing disposable boots and not crossing the LINE OF SEPARATION.
Boot Changing Stations
Boots & Coveralls
Boots & Coveralls
Hand Washing

• Hand washing decreases contamination

• Availability
  – Location
  – Fully stocked

• Gloves are not a substitute for hand washing

• Signage
## Exposure

<table>
<thead>
<tr>
<th>Variables</th>
<th>N</th>
<th>Titer ≥1:10 n (%)</th>
<th>Titer ≥1:20 n (%)</th>
<th>Bivariate OR (95% CI)</th>
<th>Multivariate OR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Swine exposure</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Swine workers who use gloves</td>
<td>34</td>
<td>12 (35.3)</td>
<td>7 (20.6)</td>
<td>21 (4.4-100.8)†</td>
<td>30.3 (3.8-243.5)†</td>
</tr>
<tr>
<td>sometimes or never</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Swine workers who use gloves</td>
<td>14</td>
<td>1 (7.1)</td>
<td>0 (0)</td>
<td>2.8 (0.2-34.2)</td>
<td>2.4 (0.1-40.9)</td>
</tr>
<tr>
<td>most of the time or always</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No swine exposed controls</td>
<td>79</td>
<td>2 (2.6)</td>
<td>1 (1.3)</td>
<td>reference</td>
<td>reference</td>
</tr>
<tr>
<td>Smoked in past year &gt;5 packs?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>14</td>
<td>4 (28.6)</td>
<td>3 (21.4)</td>
<td>4 (1.1-14.5)†</td>
<td>18.7 (2.5-141.3)†</td>
</tr>
<tr>
<td>No</td>
<td>114</td>
<td>11 (9.7)</td>
<td>5 (4.4)</td>
<td>reference</td>
<td>reference</td>
</tr>
</tbody>
</table>

*Using proportional odds model, these titers were grouped: <1:10, 1:10; >1:10
† Significant odds for increased serological response, p-value<0.05

Ramirez et al, Emerg Inf Dis 2006
Exposure

![Graph showing exposure levels to swine H1N1 virus](image_url)

- **Serological response against swine H1N1**
- **Gloves use when working with sick swine**
  - Never
  - Sometimes
  - Most of the time
  - Always
  - Control

Ramirez unpublished 2006
Vehicles

- Clean vehicles only
- Designated parking
- Proper signage
- TQA program

http://www.biosecuritycenter.org/truckwash.php
Truck wash/heat treatment
Daily Biosecurity Priorities

Photo: RB Baker
Do we know how to clean?

1. Removal of visible organic material
   - Power washing
     - Pressure vs. volume
     - Hot vs. cold

2. Disinfection

3. Drying
Disinfect

1. Read the product label
   – Wear protective gear if needed

2. Disinfect
   – Use label dilutions
   – Allow label contact times (10 minutes)

3. Final rinse (if necessary)
   – Low pressure to remove residue

4. Dry before allowing animals to return
Which one?
Disinfectant Information

www.cfsph.iastate.edu/BRM/disinfectants.htm
<table>
<thead>
<tr>
<th>Disinfectant Category</th>
<th>Alcohol</th>
<th>Aldehydes</th>
<th>Biguanides</th>
<th>Halogens: Hypochlorites</th>
<th>Halogens: Iodine Compounds</th>
<th>Oxidizing Agents</th>
<th>Phenols</th>
<th>Quaternary Ammonium Compounds (QAC)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sample Trade Names</strong></td>
<td>Ethyl alcohol</td>
<td>Isopropyl alcohol</td>
<td>Formaldehyde</td>
<td>Paraldehyde</td>
<td>Glutaraldehyde</td>
<td>Chlorhexidine</td>
<td>Novalene®</td>
<td>Chlorox®</td>
</tr>
<tr>
<td><strong>Mechanism of Action</strong></td>
<td>Precipitates proteins</td>
<td>Denatures proteins</td>
<td>Denatures proteins</td>
<td>Denatures proteins</td>
<td>Denatures proteins</td>
<td>Denatures proteins</td>
<td>Denatures proteins</td>
<td>Denatures proteins</td>
</tr>
<tr>
<td><strong>Advantages</strong></td>
<td>Fast acting</td>
<td>Leaves no residue</td>
<td>Broad spectrum</td>
<td>Broad spectrum</td>
<td>Short contact time</td>
<td>Inexpensive</td>
<td>Stable in storage</td>
<td>Relatively safe</td>
</tr>
<tr>
<td><strong>Disadvantages</strong></td>
<td>Rapid evaporation</td>
<td>Flammable</td>
<td>Carcinogenic</td>
<td>Irritation to mucous membranes and tissues</td>
<td>Only use in well ventilated areas</td>
<td>Only functions in limited pH range (5-7)</td>
<td>Toxic to fish (environmental concern)</td>
<td></td>
</tr>
<tr>
<td><strong>Protections</strong></td>
<td>Flammable</td>
<td>Carcinogenic</td>
<td>Never mix with acids; will release toxic chlorine gas</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Vesicular Broadly</strong></td>
<td>Effective</td>
<td>Effective</td>
<td>Effective</td>
<td>Effective</td>
<td>Effective</td>
<td>Effective</td>
<td>Effective</td>
<td>YES—Gram Positive Limited—Gram Negative</td>
</tr>
<tr>
<td><strong>Myobacteria</strong></td>
<td>Effective</td>
<td>Effective</td>
<td>Variable</td>
<td>Effective</td>
<td>Limited</td>
<td>Effective</td>
<td>Variable</td>
<td>Variable</td>
</tr>
<tr>
<td><strong>Enveloped Viruses</strong></td>
<td>Effective</td>
<td>Effective</td>
<td>Limited</td>
<td>Effective</td>
<td>Effective</td>
<td>Effective</td>
<td>Effective</td>
<td>Variable</td>
</tr>
<tr>
<td><strong>Non-enveloped Viruses</strong></td>
<td>Variable</td>
<td>Effective</td>
<td>Limited</td>
<td>Effective</td>
<td>Limited</td>
<td>Variable</td>
<td>Not Effective</td>
<td>Not Effective</td>
</tr>
<tr>
<td><strong>Spores</strong></td>
<td>Not Effective</td>
<td>Effective</td>
<td>Not Effective</td>
<td>Variable</td>
<td>Limited</td>
<td>Variable</td>
<td>Not Effective</td>
<td>Not Effective</td>
</tr>
<tr>
<td><strong>Fungi</strong></td>
<td>Effective</td>
<td>Effective</td>
<td>Limited</td>
<td>Effective</td>
<td>Variable</td>
<td>Effective</td>
<td>Variable</td>
<td>Variable</td>
</tr>
<tr>
<td><strong>Efficiency with Organic Matter</strong></td>
<td>Reduced</td>
<td>Reduced</td>
<td>?</td>
<td>Rapidly reduced</td>
<td>Rapidly reduced</td>
<td>Variable</td>
<td>Effective</td>
<td>Inactivated</td>
</tr>
<tr>
<td><strong>Efficiency with Hard Water</strong></td>
<td>?</td>
<td>Reduced</td>
<td>?</td>
<td>Effective</td>
<td>?</td>
<td>?</td>
<td>Effective</td>
<td>Inactivated</td>
</tr>
<tr>
<td><strong>Efficiency with Soaps/Detergents</strong></td>
<td>?</td>
<td>Reduced</td>
<td>Inactivated</td>
<td>Inactivated</td>
<td>Effective</td>
<td>?</td>
<td>Effective</td>
<td>Inactivated</td>
</tr>
</tbody>
</table>

? Information not documented

Disclaimer: Use of trade names does not in any way signify endorsement of a particular product. For additional product names, please consult the most recent Compendium of Veterinary Products.
Cleaning and disinfecting
Clean before or after livestock?

• Clean right **before** next group
  – If it’s dirty, it will stay dirty no matter how long you wait
  – Hard on equipment
  – Harder to clean
  – Environment for insects and/or rodents

• Clean right **after** this group
  – If it’s clean, it will eventually get dirty if you wait long enough
  – Easier to “re-clean” if necessary
  – Long drying time
  – Have more time to do the job right!
Hot vs. Cold water

• Cold
  – Cheaper
  – Easy to see (no fog)
  – Less sweating
  – **Laundry study** showed 160 °F was just as effective as 72 °F in reducing bacterial counts (Blaser et al, 1984)

• Hot
  – Reduction of labor time!
Monitoring

• Regular veterinary herd health visits
  – May include biosecurity audits
  – Cleaning and disinfection checks

• Cultures for specific bacterial organisms

• Testing for specific agents
  – Routine testing
  – Sentinel animals
Vectors

www.pestvictoria.com
Pest control

• Sanitation
  – Garbage
  – Feed spills
  – Manure spills
• Insecticides
• Rodent control
• Pets
  – Cats & dogs
Rodent Control

• [http://rodent.swine.unl.edu/](http://rodent.swine.unl.edu/)

• Gravel perimeter
  – 2 – 3 feet wide
  – 6 inches deep
  – ½ - 1 inch rock

• Bait stations
  – Location
  – Maintenance
    • Professionals?
    • Records
Direct contact
Animals are #1

- Know source
- Minimize sources
  - Average vs. Lowest
- Testing
- Herd health program
Summary
Biosecurity

- Most interventions are expensive
  - Transport ~$200 - $400/trailer
  - Shower system ~$5/employee/day
  - Boar Stud monitoring ~ $.80/dose
  - Multiplication ~ $25 per gilt or boar sold
  - Isolation facility/monitoring ~ $15/gilt
  - Insects and Rodents ~ $.25/pig
  - Training - ?
  - Filters – Electrostatic & other technologies?
Best Biosecurity

• Look at animals daily preferably 2x/day

• Maximize
  – Management
  – Nutrition
  – Environment
  – Health program (vaccination)

• Routes of transmission
BIOSECURITY

• THINK!!
Don’t Forget!

Risk = Frequency \times \text{Consequence}
WASH YOUR HANDS

- Wet hands and forearms with warm water
- Add at least 3-5 mls of soap (the size of an olive)
- Lather up and vigorously scrub each side of the hands beyond the wrist for 10-30 seconds, cleaning under rings and scrubbing dirty fingernails
- Rinse under warm water until no soap residue remains
- Turn off running water with a paper towel, not bare hands
- Dry hands with paper towel or hot air dryer

Center for Food Security & Public Health
Iowa State University
• General Disease Information:  
  http://www.cfsph.iastate.edu/

• General Prevention: (see left column)  
  http://www.cfsph.iastate.edu/Infection_Control/general-prevention-for-producers.php

• Disinfectant Resources:  
  http://www.cfsph.iastate.edu/Infection_Control/disinfectant-resources-for-veterinarians.php
Questions?

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