

Protecting your herd's future

Biosecurity

Why does it matter?

What can we do about it?



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Where are we going?

I. What is biosecurity and biocontainment?

II. Why is it important?

III. What can we do about it?

- Increase host resistance to infection
- Remove reservoirs of infection
- Prevent contact that causes transmission

IV. How?

1. Identify hazards
2. Assess exposure
3. Characterize risk
4. Manage risk

Involve ALL team members:

- Managers
- Employees
- Veterinarian
- Nutritionist
- AI technician
- Agronomist
- Hoof trimmer
- All other regular farm visitors



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I. Biosecurity vs. Biocontainment

Biosecurity

- **Keep things off the farm**
 - Ex – closed herd, Johne's, BLV-free herd

Biocontainment

- **Keep bugs from spreading between animal groups**
 - Ex – calf ranch with multiple sources

- **No biosecurity protocols in place:**
 - What disease(s) pose the biggest threat to your farm's future productivity?
 - Identify high risk practices occurring on your operation
- **Biosecurity protocols in place:**
 - Are they being followed?
 - Identify any weak links in your current plan
- **Implement practical solutions for risk factors on your farm!**

← Goals for today



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II. Why is biosecurity important?

- **Prevention is better for the herd**
 - Individual animal treatments are time-consuming
 - Outbreaks stress the system, are costly, and decrease production
- **Pathogens are smart!**
 - Adapt to vaccines, antibiotics, pesticides
 - Decrease load of exposure
- **Avoid chronic and incurable diseases**
 - Mycoplasma, Johne's, BVD, *Staph aureus*
- **Zoonosis**
 - Implications in public health and safety
 - Consumer trust



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II. Why is biosecurity important?

Salmonella enterica



<https://www.cdc.gov/salmonella/index.html>

- **Gram negative, intracellular bacteria**
 - Opportunistic
 - Detected on >50% of farms and 7.5% of 3,700 fecal samples (Berge et al, 2006)
 - Can survive and multiply in the environment up to 6 years (Fossler et al 2006)
- **Zoonotic – you can catch it too!**
 - Wear gloves, wash hands
 - Educate employees on importance of hygiene, clean clothes & boots



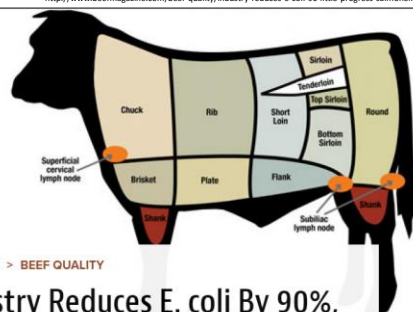
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II. *Salmonella enterica*

- **Threat to the dairy industry**
 - Makes individual animals sick - \$
 - Decreases overall production on dairy - \$\$
 - Contaminates food - \$\$\$\$
- **Manure #1 factor in spreading disease**
 - Fecal-oral transmission to calf at birth
 - Shedding cows contaminate environment
 - Spread between farms by people, animals, and trucks
 - Contaminated water and feed (Smith, 2002)

<http://www.beefmagazine.com/beef-quality/industry-reduces-e-coli-90-little-progress-salmonella>



LIVESTOCK > BEEF QUALITY

Industry Reduces E. coli By 90%,
But Little Progress With
Salmonella



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II. *Salmonella* on farms

- **Presence of calves shedding *Salmonella* not associated with herd size or production type (Fossler et al 2005)**
- **Clinical signs vary**
 - Peracute infections – sudden death
 - Acute – high fever* and scours
- **Beware of subclinical infections**
 - Carrier cows appear normal
 - Intermittent shedding in manure
 - Contaminate environment, expose other cows



Clinical

Subclinical

<https://www.istockphoto.com/photos/iceberg>



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II. *Salmonella dublin*

- **Shed in feces, urine, milk, nasal/ocular secretions**
 - Also zoonotic
 - Highly capable of becoming resistant
- **Clinical signs:**
 - Pneumonia, fever, depression in calves ~4-8 weeks old
 - Diarrhea NOT most common sign
 - Death loss 10-25%
- **Subclinical carriers shed bacteria in feces and milk**
 - Control with proper cleaning & disinfection, biocontainment plans



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II. *Salmonella* Dublin

Salmonella and Antimicrobial Use

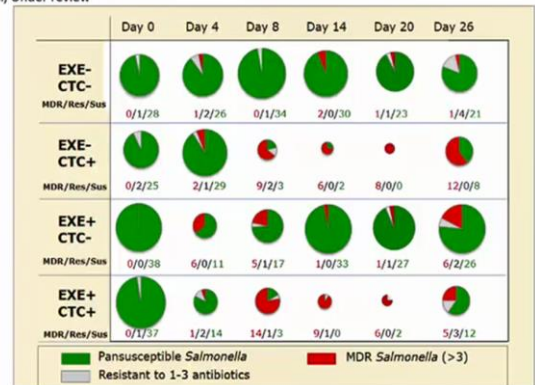
Ohta, Scott et al, Under review

• Antimicrobial resistance has changed over time

- Co-resistance to fluoroquinolones and 3rd generation cephalosporins
- Enrofloxacin is *illegal* for calves with scours

• Avoids detection by immune system

- Lives in immune cells
- Develops resistance by adopting and losing genes



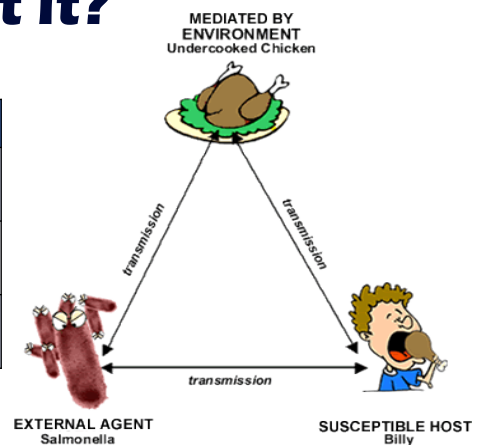
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III. What can we do about it?

Promote	Avoid
Increase host resistance to infection	Failure of passive transfer, poor nutrition, stress
Remove reservoirs of infection	Bedding build-up, sick calf in group
Prevent contact that causes disease transmission	Poor hygiene, high stocking density, grouping animals of different ages

Maunsall and Donovan, 2008



<http://www.whatifcolorado.com/scorm/coursefiles/BDIC/page3531.html>



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IV. Develop a biosecurity and biocontainment plan for *your* farm

1. Identify hazards – specific diseases that threaten your operation
2. Assess exposure – probable routes of disease contact
3. Characterize risk – exposure level to specific diseases
4. Manage risk – design, implement and monitor herd-specific biosecurity and biocontainment protocols



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1. Identify hazards

- List specific diseases considered a threat to your dairy
- List in order of potential impact
- Examples
 - Rotavirus, coronavirus, *Cryptosporidium parvum*, etc in pre-weaned calves
 - *Pasteurella multocida* pneumonia in post-weaned calves
 - BVD in heifers raised off-site
 - Zoonotic diseases – esp. young, elderly and immunocompromised
 - *Cryptosporidium parvum*, *Salmonella*, Leptospirosis, etc



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2. Assess exposure

• How do pathogens spread?

- Animal to animal
 - Fecal/oral
 - Contaminated feed or water
 - Inhalation, ingestion of manure particles
 - Nose/nose
 - Saliva and respiratory secretions
 - Other orifices – ex. teat ends, wounds
- Animal to other living things – flies, birds, rodents, people
- Animal to non-living things – boots, feeding equipment, machinery



<https://bizkenya.com/why-first-72-hours-is-critical-for-your-newborn-calf/>



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3. Characterize risk

• What is risk of exposure on your dairy?

- Focus on mitigating high-risk practices first
- Consider testing, evaluate health records

• Examples of high-risk practices

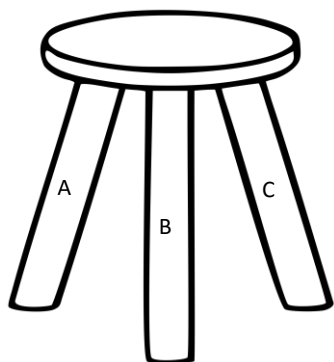
- Purchasing cattle or importing cattle from other premises
- Sick cows in maternity pen
- Comingled replacement heifers from different farms (Villaroel et al., 2007)
- Any management practices that allow for fecal contamination of feed, water and equipment



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4. Manage risk – critical control points



A. Animal health management

- i. Quarantine new stock
- ii. Manage animal movement
- iii. Vaccination programs

B. Production management

- i. Control rodents
- ii. Limit exposure to wildlife/birds
- iii. Building and equipment maintenance

C. Access management

- i. Control access of visitors
- ii. Change clothes/coveralls
- iii. Clean footwear



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A. Animal health management

i. Quarantine new, returning stock

- Known herd of origin and health status, vaccines UTD >>> sale barn

ii. Manage animal movement

- Biocontainment among groups
- Prioritize maternity pen, newborn calves, sick cows

iii. Vaccination programs

- Varying degrees of efficacy and prevention of disease
- Cannot depend on vaccines



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i. Quarantine new, returning stock

- **Only 9.6% of dairy operations quarantine upon arrival (NAHMS 2014)**
 - Risk of cows shedding of *Salmonella* decreases with closed herds
 - Only 23% of farms with additions required individual animal testing prior to entry
- **Why isolate?**
 - Allow time for highly contagious diseases to incubate and manifest
 - Time to vaccinate cattle that are not current
- **How long?**
 - Minimum of 30 days (Maunsell and Donovan, 2008)
 - 10 days to 3 weeks (Villaroel 2007)
- **Where?**
 - Separate group at least 30 feet from resident herd
 - No shared water source
 - Attended by designated employees, or handle last



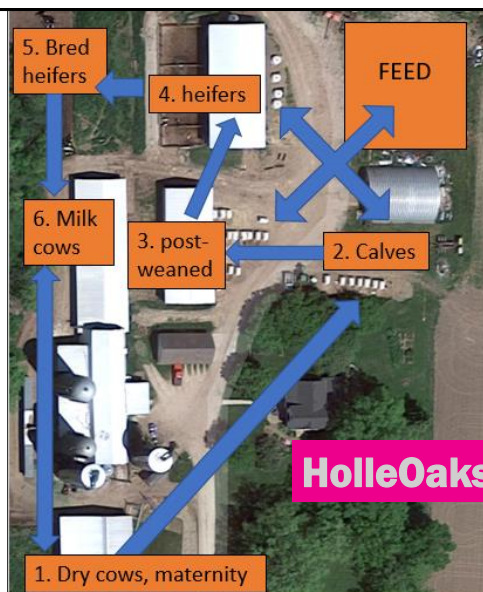
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ii. Manage animal movement

Biocontainment:

- **Unidirectional cattle flow**
- **All-in, all-out**
- **Segregate sick animals**
 - Strategy for sick cows to re-enter herd
 - Do not let sick calves fall behind



HolleOaks Dairy



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ii. Manage animal movement

Replacement heifers raised off-site

- **47% of large farms send heifers to rearing facility (NAHMS 2014)**
- **Biosecurity protocols from heifer grower followed at all source farms**
 - Provided in contract
- **Biocontainment for returning replacement heifers:**
 - Transport via clean trailer
 - Process through footbath
 - Modify existing pen to isolate x 30 days



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ii. Manage animal movement

Biocontainment – maternity & newborn calves

- Individual vs. group maternity pens
- **Clean calving environment** critical for control
 - Maternity facilities MUST be designed for easy, frequent, and effective C&D



<https://www.progressivedairy.com/topics/barns-equipment/maternity-pens-have-two-wisconsin-dairies-calving-with-ease>



<https://www.progressivedairy.com/topics/facilities-equipment/cow-comfort-at-calving>



https://flare.fulsource.com/images/items/a/273/6060-A_273x0.jpg



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ii. Manage animal movement

Biocontainment – maternity & newborn calves

- **Remove calf from dam within 10-15 minutes**

- Before attempting to stand
- Increase odds of developing diarrhea by 40% if left for >1 hour (Trotz-Williams et al., 2007)



<http://luxhomedesign.ladun.pw/wall-hay-rack-feeder>



<http://www.freudenthalmg.com/calf-care/>



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ii. Manage animal movement

Biocontainment – maternity & newborn calves

- **Colostrum**

- Administer 4 quarts of clean, high quality colostrum within 4 hours of birth
- Protection against diarrhea-causing pathogens for first 7-10 days

- **Effective cleaning and disinfecting protocols**

- Remove biofilms that promote accumulation of bacteria
- Avoid pressure-washing
- Cows shed pathogens in feces



<https://www.laffertyequipment.com/products/foamers/airless-foamers/>



<http://www.jentsfrontporch.com/2011/09/discombobulated.html>



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ii. Manage animal movement

Biocontainment – fresh cows and sick cows

- **Sick cows and maternity cows should NEVER be housed together**

- 30% of large operations and 42% of small/medium farms allowed sick or lame cows into usual calving area (NAHMS 2014)
- Pre-fresh, fresh cows and newborn calves are most susceptible to disease
- Sick cows associated with high rates of pathogen shedding (Wells, 2002)
- Using maternity area as a hospital area associated with calves shedding Salmonella (Fossler et al 2005)



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iii. Vaccination protocols

- **Vaccines help develop herd immunity**
- **Need time to develop immune response**
 - Depends on vaccine, age of animal, current immune status
 - 7-14 days at least, 4 weeks ideal
- **Not all vaccines are created equal**
- **Cannot vaccinate your way out of diseases**
- **Follow proper vaccination handling & storage guidelines**
 - Do NOT store vaccines in refrigerator door



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B. Premise management

i. Control rodents and pests

- Flies

ii. Limit exposure to wildlife/birds

iii. Building and equipment maintenance

- Feed trucks, rendering trucks and trailers
- Waterers
- Feeding equipment
- Manure storage and hauling



<http://www.victorpest.com/articles/economic-effects-of-rodent-infestation>



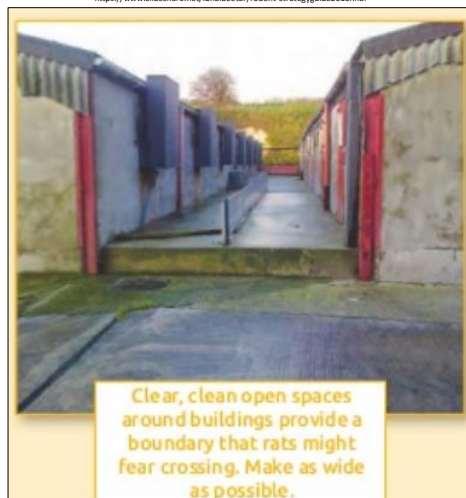
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i. Pest control

• Rodents carry diseases, fleas

- Fecal material and urine a concern
- Prevent
 - Remove sources of food and cover
 - Entry into building
- Eradicate
 - Trapping
 - Chemical control



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i. Pest control

• Flies

- Carry Salmonella in digestive tract
- Transmit pink eye, anaplasma, mastitis
- Implement multiple methods of fly control EARLY in season
- Remove fly breeding materials (Dargatz, 2002)



<https://moochthecow.com/mini-cow-pet-guide/>



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ii. Limit exposure to wildlife and birds

• Birds carry diseases, pests

- Remove nesting and roosting opportunities
- Salmonella outbreak in eggs (April 2018)
 - 200 million eggs recalled from flock in NC – management failed to address a rodent infestation



<https://farmtek.wordpress.com/2015/03/17/dealing-with-barn-birds/>

Food Safety News

Breaking news for everyone's consumption

<http://www.foodsafetynews.com/2018/05/more-illnesses-confirmed-in-salmonella-outbreak-traced-to-eggs/#.Ww5PUgwpY>

Home	Outbreaks	Food Recalls	Food Politics	Calendar	Subscribe	Directory	Media K
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More illnesses confirmed in Salmonella outbreak traced to eggs

BY CORAL BEACH | MAY 11, 2018

Additional illnesses continue to be confirmed in an outbreak of Salmonella traced to eggs from Rose Acre Farms. Nine states have reported infected people. The farm has recalled more than 207 million eggs.



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iii. Building & equipment maintenance

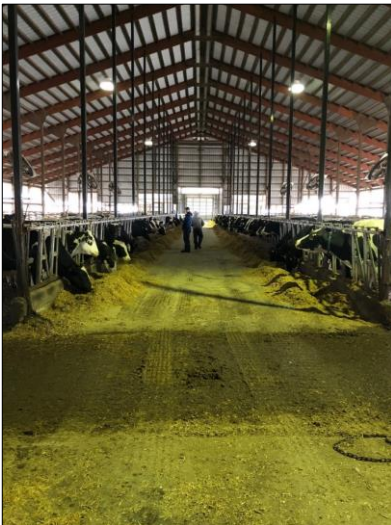
- **Minimize opportunity for fecal contamination of equipment, feed and water**
- **Separate entrance for service vehicles on farm**
 - Reduce traffic on main farm site
 - Feed and rendering trucks should never enter cattle pens
- **Manure application**
 - *Salmonella* spp, *E. coli* and Johne's bacteria isolated from soil and crop samples >3 months after manure application



<https://www.progressiveforage.com/forage-production/fertilizing/benefits-and-challenges-to-applying-manure-to-forage-crops>



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iii. Building & equipment maintenance



• Biocontainment – don't forget about water!

- Avoid direct contact between animal groups
- Salmonella (Mattick et al 2000) and Johne's (Whittington et al 2004) can survive in drinking water for months if not properly decontaminated
- **Clean your waterers!**
 - Do not share sick pen water troughs
 - Drain, scrub, clean and disinfect



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iii. Building & equipment maintenance



• Biocontainment – feeding equipment

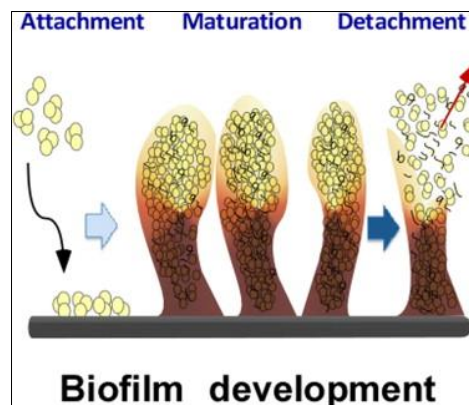
- Colostrum collection and feeding equipment
- Cows and calves can shed *Salmonella* in saliva, nasal secretions
 - Separate tools for sick vs. healthy



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Cleaning ≠ disinfection

- **Goal – cleaning protocols written and posted**
 - Read the labels
 - Know equipment to be cleaned
 - Ph paper required
 - Training
- **Know the goals of each step in C&D protocols**
 - Control biofilm
- **Low pressure foam ideal for indoor surfaces, calf pens and trailers**
 - No more aerosolizing bacteria
- **Monitor efficacy!**



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Calf-feeding equipment C & D protocol

1. **Rinse inside & outside of all calf feeding equipment with warm water**
 - 100-110F
2. **Manually wash with brush for 2-3 minutes with hot water 140-160F and chlorinated alkaline detergent**
 - pH 11-13
3. **Rinse with water 110-120F to remove soap residue**
4. **Add acid sanitizer once soap residue is gone**
 - pH 2-4
5. **Air Dry**
6. **Sanitize with 50ppm solution chlorine dioxide within 2 hours of use**



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Comparison Component	Ozone (O ³)	Hydrogen Peroxide (H ₂ O ₂)	Peroxyacetic Acid (POA)	Hypochlorous Acid (HOCl)	Chlorine (CL ₂)	Chlorine Dioxide (ClO ₂)	Quaternary Ammonium Compounds	Phenols (C ₆ H ₅ O)	Iodoph or (I ₂)
Giardia	YES	NO	NO	NO	NO	YES	NO	NO	NO
Cryptosporidium spp.	YES	NO	NO	NO	NO	YES	NO	NO	NO
Rotavirus	YES	YES	YES	YES	YES	YES	YES	YES	YES
Coronavirus	YES	YES	YES	YES	YES	YES	NO	NO	NO
Affected by pH	NO	YES	YES	YES	YES	NO	YES	YES	YES
Corrosive	YES	YES	YES	YES	YES	NO	VARIES	YES	YES
Effect on Biofilms	YES	VARIES	VARIES	NO	NO	YES	NO	VARIES	NO
EPA Approved - Water	NO	NO	NO	NO	YES	YES	NO	NO	NO
Carcinogenic	NO	NO	NO	YES	YES	NO	YES	YES	YES
Inactivated by Organic Material	NO	YES	YES	YES	YES	NO	NO	NO	YES
Use as water, sanitizer and disinfectant	NO	NO	NO	NO	YES	YES	NO	NO	NO
Commercial Brand Name	Generated by Equipment	Various	Virkon S® Oxysept 333®, Vortextx®	Chlorine and acid at a pH of 5-7 (generated)	Various (Chlorox Bleach®)	OxyMer®, Oxine®	Roccal®, Zephirin®, DiQuat®	One Stroke, Environ®, TekTrol®, Pheno-Tek II®	Various

C. Access management

i. Control access of visitors

- Help visitors to know where they can and cannot go on farm

ii. Clean clothes and coveralls

- Maternity area and calf housing – most likely places on farm to harbor multi-drug resistant Salmonella (WI DPH, 2004)

iii. Clean footwear

- Workers can transmit Salmonella, other diseases between areas on farm



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i. Control access of visitors

- **Post signs for new visitors**
- **Front-desk**
 - Sign-in
- **Involve team members**
 - Understand animal flow and biosecurity risks
 - Always start at maternity and calves!



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ii. Clean clothes and coveralls

- **This includes regular visitors and team members**
 - Especially if visiting other herds that same day
- **All employees should be provided with dedicated boots and coveralls for work**
 - Avoid risk of transmitting pathogens on clothing if working with other cattle at home
 - Biocontainment – dedicated boots and coveralls for maternity and calves



<http://www.wardrobemag.com/pink-overalls.asp>



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iii. Clean boots

- **ALL visitors must wear clean boots**
- **Insist that team members wash boots upon arrival and leaving**
- **Workers can transmit *Salmonella* between areas on farm!**



<http://www.farmbiosecurity.com.au/wp-content/uploads/2015/04/Footbath.jpg>



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Summary

What can we do about it? (Smith and Grotelueschen, 2004)

- Increase host resistance to infection
- Remove reservoirs of infection
- Prevent contact that causes transmission
- **Don't forget about health records!!!**
 - You can't evaluate if you don't record
- **Planning and implementation takes time**
 - Make sure team members understand significance
 - Train staff about zoonoses



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Credits

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Credits

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- Zoetis – SRP technology



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