Dairy Biological Risk Management - Key Points

March 2005

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Introduction

The dairy cattle industry has undergone dramatic changes in the last two decades. Some of these changes have included declining operation numbers, increasing herd sizes, an increase of milk production per cow, and farm specialization. This variation in economic base and production style does not end with the number of cattle raised on farm. When designing a biological risk management plan for dairies, one size does not fit all, and we will discuss different farming operations in this paper.

Importance of Dairy BRM

- Milk supplies 73% of the calcium to the U.S. food supply
- According to NAHMS, total milk production in 2001 was 165 billion pounds of milk
- As people move farther away from the farm and their food source, dairy producers have to become better promoters of their quality product
- BRM is designed to help you establish a comfort level in evaluating risk for your clients

Risk Perception

Risk perception is what those involved with the operation believe about the real and potential risks of infectious and zoonotic disease

- Influenced by past encounters, and media

Obstacles and challenges to educating about risk management may be encountered

- Negative perceptions based on perceived lack of necessity or economics

Risk Assessment

- Risk assessment deals with the likelihood of disease introduction and the estimation of potential consequences.
- Evaluate facility and identify characteristics that provide unique risks to infectious agents
- First, general herd characteristics and farm policies should be examined through a pre-farm questionnaire (see Pre-Farm Questionnaire handouts)
- The focus is on routes of transmission, not specific disease entities
- The only references made to specific diseases are for illustrative purposes only
- No specific recommendations provided as to vaccination, treatment or testing procedures

Risk Management

- The documents illustrate the best available "standard operating procedures"
- Each veterinarian should perform a thorough assessment to identify opportunities for improvement
- Management suggestions should be considered as to which ones are most practical, applicable, and economically feasible
- Tailor the BRM program for each producer based upon preferences, resources, risk perception and risk tolerance
- Some suggestions may not be feasible for a given facility; but recognizing what is optimum helps establish long term goals

Herd Characteristics

Lactating Cows

Primary animal species on any given dairy and housed in a variety of ways

Confinement facilities

- Free stall building with 2, 3, 4, or 6 rows of stalls in the barn
- One stall per animal or per 1.2 animals
- Stalls bedded with a material that does not enhance organism growth
- Stalls should be groomed to remove manure and urine buildup at every milking
- Fresh bedding added frequently
- Feed alley commonly in the center or along one side
- Automatic trough waterers in each of the pens; additional troughs in return lane(s)
- Manure removed by:
  - Manually scraping the stalls
  - Using a skid steer with a blade/rubber tire to scrape down the alleys to move it outside
  - Vacuum trucks or implements
  - Automatic scrapers run on a pulley system and scrape manure multiple times a day
  - Water flush systems use gravity flow to wash excrement into an underground storage system multiple times a day
- These facilities can be used to house thousands of cows

Dry lot facilities

- Multiple dirt lots with shade structures
- Often used in warmer climates
- Feed bunks are located on the edges of the dirt lots
- Protective covers over the feed bunks to shelter the cows and keep the feed dry
- Automatic waterers throughout the lots; more troughs in return lane(s)

- Milking parlor is a covered structure
- Lots are groomed one to multiple times per day using a tractor and drag system
- Lots will be scraped to remove top layer of dirt and excrement
- These farms can be used to house thousands of animals

Rotational grazing

- Multiple grass and forage-based pastures
- Time in between milkings
- Feed bunk may or may not be present
- Watering sources vary
  - Natural stream in the pasture
  - Automatic waterers set up near the fence lines
  - Well water
  - Multiple livestock tanks that require manual filling multiple times per day
- Cattle moved to covered milking parlor through other pastures or dirt paths
- Fencing is usually a series of high tensile wire
- Northern climates- utilized 4-5 months of the year
- Manure is allowed to remain in the pastures as a fertilizer
- These facilities are typically used for farms less than 500 cows

Tie stall/stanchion facilities

- Covered barn, often with solid walls and individual stalls for each of the cows
- Tether system is used to confine each cow to her stall
- One stall per animal
- Stalls bedded with a material that does not enhance organism growth
- Stalls groomed to remove manure and urine buildup at every milking
- Fresh bedding added frequently
- Individual mangers in front of every cow
- Drinking fountain at every stall or every other stall
- Cattle remain in their stalls for milking and the equipment is brought to them
- Manure moved with gutter system to the end of the barn where it can be piled outside or directly loaded into a manure spreader
- During good weather, cattle are often turned out into a dirt lot, cement or pasture area
- Centralized feed bunks and automatic water troughs are located near the barn
- These facilities are typically used for farms less than 150 cows.

Milking Procedures

- Milking cows, when done properly, poses very little risk to developing disease

Mechanical variables

- Milking unit should be monitored
  - Vacuum levels are set correctly

  - Pulsators are working correctly
  - Liners are changed on a set schedule
  - Automatic take-offs set appropriately
- System checks should be done at least yearly, more often if problems are noted
- Healthy teat ends (smooth, soft) function as a natural barrier to pathogen entry
- Dry, cracked, and hyperkeratotic teat ends have more potential for pathogens to enter
- Teat end damage can result from:
  - Faulty equipment (see above for checklist)
  - Changes in weather conditions (cold, wind, chapping, frostbite)
  - Inappropriate teat dips
  - Damage from other cows (suckling, stepped on)
  - Bedding type
  - Physiological differences in teat ends

Human variables

- Proper procedure should be followed time after time
- 5.5% increase in lactational yield when a standardized milking procedure used
- Milkers should wear disposable gloves
- Proper stimulation of the udder is needed for milk let down
- Milk clean, dry teats to minimize bacteria in the milk and in the milking unit

Proper milking order can minimize disease transmission

- First lactation cows should be first
- Second, older cows with low somatic cell counts (SCC) next
- Third, those with higher SCC
- Last, clinical mastitis cases

Step one- forestripping

- Physical stimulation of the teat and udder to help the cow "let down" her milk
- Allows identification of abnormalities in the fore-milk
- Decreases the risk of *Listeria monocytogenes* contamination in the milk by 2.5 times
- Evaluated for effectiveness at each facility
- Forestripping often precedes cleaning the teat ends unless there is a lot of organic debris
- Limit bacterial uptake into the teat canal

Step two- cleaning the teat ends

- Dry prep- manually wiping teats with dry towel or dry gloved hand
- Less expensive but not the best way to clean teats prior to milking
- Pre-dip the teats with disinfectant solution approved for use in dairy cattle

- Pre-dip must achieve full coverage of all sides
- Allow 15-20 seconds of contact time; 30 seconds for environmental mastitis
- Manually dry with a paper or cloth single use towel

Step three- wiping the teat

- Remove disinfectant completely and dry the teat before attaching the milking unit
- All-in-one disinfectants/pre-moistened towels
  - Good efficacy; essential the teat end is dry before the milking unit is attached
  - Air drying not always adequate
- Paper disposable towels
  - Used once and disposed of immediately
- Washable cloths
  - Laundered with detergent and/or bleach and completely dried in a hot dryer
- Pre-dips and post-dips are not currently regulated by the Food and Drug Administration
- Pre-dips focus their bactericidal activity on environmental pathogens
- Post-dips function to kill contagious pathogens
- The National Mastitis Council (NMC) publishes a report on pre- and post-dips efficacy

Step four- attaching the milking unit

- Milking units be attached within 60-90 seconds after first touching the cows teat
- Focus on milking clean, dry teats that have been properly stimulated
- Monitor the milking unit for liner slips throughout milking

Step five- removing the milking unit

- Vacuum should always be shut off prior to removing the milking unit
- Automatic take-offs should have them set for a minimum output before removing the unit
- Never milk an udder completely dry

Step six- post-dipping the cows

- After milking, dip the lower third of the teat in an antiseptic (See Teat Dip Summary)
- When temperatures drop below 10^{o}F or if wind chill is a concern, dip the teats; allow contact for 30 seconds, then wipe off excess liquid with a single use paper or cloth towel

Keep cows on their feet for 30-45 minutes by offering fresh feed immediately after milking so the keratin plug forms

Hospital Pens and Facilities

- Dedicated treatment and confinement area for lactating cows

- Facilitates re-treatment and provides isolation and protection from violative milk residues
- The area and instruments can serve as fomites
- Clean and disinfect facilities and instruments after each procedure
- Animals from the hospital pen should be considered new entries
- Pass entry procedures such as an obligatory milk culture before entry
- Dedicate pens for specific disease entities, lameness and other conditions
- Minimize hospitalized animals through the use of non-violative therapeutic agents
- Treatment with a therapeutic agent that causes residues should be done immediately, at full dose and duration, and the cow moved
- Cow movement can create immunosuppressive stress
- Pen should be cleaned, scraped, bedded deeply
- Equipment should be cleaned and sanitized prior to use in the rest of the herd
- Recently freshened cows should be not be housed with potentially infectious animals

Dry Cows

Far-off or just ending their lactation cycle

- Moved to an area that is clean and dry
- Keratin plug does not form for several days to weeks after final milking
- In a research study, 23% of all cows had open teats until six weeks after dry off
- Udders may be swollen due to milk filling the mammary glands after dry off
- An absorbent, clean bedding material (straw, kiln-dried sawdust, paper) or one that allows drainage (sand, pasture) should be provided

Pre-fresh or due to calve within 3 weeks

- First calf heifers may need to be housed separately from pre-fresh cows
- Fresh feed specially formulated for their nutrient needs so colostrum is optimal quality
- Housed in a clean, dry environment
- Clean water should be made available at all times

Calving Pens

- Well bedded, clean, draft-free, dry and free of fecal matter build up
- Upon fetal presentation, each cow or heifer should have their own calving pen
- Prior to colostrum collection, udder and teats should be washed to remove feces and debris
  - Clipping or singeing excess hair from the udder with proper restraint
- Pen should be cleaned after each calving
- Deep straw bedding (1-2 feet) helps drain away birthing materials and excrement
  - Will also inhibit the newborn calf from standing, wandering, and trying to nurse
- One teaspoon of feces has enough bacteria to establish infection in naïve calf

- The calving pen should be monitored every two hours so assistance can be given if needed
- Newborn calves should be removed promptly after birth
- Calves should be rubbed vigorously to stimulate breathing
- The newborn calf should be placed individually in a clean, dry, draft free area
- Navels can be dipped in a 7% tincture of iodine solution to facilitate umbilicus drying
- Colostrum should be fed within 6 hours after birth at >5% of calf body weight
  - Large breed calves should receive ¾ to 1 gallon in the first 6 hours after birth
  - Another ½ gallon at 12 hour intervals for the first two days of life
- Colostrum pasteurization can help control the spread of *Mycoplasma* and Johne's disease
- Esophageal feeders can be used if the calf will not nurse
  - Thoroughly wash with warm soapy water, rinse, then disinfect and hang to dry
  - Throw a plastic garbage bag over it to protect from environmental contamination

Replacement Animals

- Replacement heifers and bulls should be housed away from adult cattle
- Suited to their age, size, feed intake, and reproductive needs

Pre-Weaned (0-2 months)

- Most susceptible age group on the farm
- Should be fed/handled before older animals
- Within this group, work with the youngest animals first
- House individually
  - Minimize the risk of disease spread
  - Facilitate identification of illness
- Free access to fresh water throughout the day
- Quality milk replacer or pasteurized whole milk should be offered twice a day
- Time and temperature of the batch should be monitored on a frequent basis
- Milk bottles should be removed after nursing
- Rinse nipples and bottle with water to remove all organic material, wash in warm water (150^{o}F) with mild detergent, rinse, invert and dry completely before the next feeding
- Sanitization of the bottles may be necessary in an outbreak situation
- Clean bottles and nipples should be kept free from environmental contamination
- If calves are fed in buckets, they should be rinsed to remove the residue
- Refill it with fresh, clean water until the next milk feeding
- Grain mix should be made available by 3 days of age and freshened daily
  - Wet grain mix can serve as a breeding ground for both bacteria and insects

- Gloves, coveralls, and boots should be worn when feeding and handling neonatal calves
  - Hands should be thoroughly washed and disposable gloves worn
  - Coveralls or clothing and foot wear should be clean and free of organic matter

Calf pens or hutches with solid walls

- Decrease direct and oral contact with another calf
- Adequate shade and ventilation is necessary to avoid overheating and dehydration
- Hutches minimize the concentration of respiratory pathogens from other animals
- If the calf is allowed to exit the hutch, fencing or tethers should be used
- Calf pens or hutches must be cleaned, sanitized and disinfected between calves
  - Organic bedding removed
  - Ground/concrete/gravel under hutch or pen should remain idle with sunlight exposure
  - Time of idleness will depend on the organism and environmental survivability.
- Some killed in dry environments rather quickly (BVD)
- Others persist for longer times (cryptosporidium)
  - Weather conditions and seasonality affect persistence
- Vaccination should not be a substitute or crutch for good hygiene practices
- The “solution to pollution is dilution”

Calf pens with open sides

- House age cohorts only
- The area should be filled for a period of two weeks or less and no additional animals added
- Based on the incubation period of the typical disease organisms
- Disease spread is a little more difficult to control due to aerosolization of pathogens

Calves should have their horn buds removed less than 3 weeks of age

- Restraint is easier
- When done correctly, has minimal pain effects
- Dehorning can be done with chemical treatments and electrical dehorners
- Cordless, electrical dehorners can be used at 1-3 weeks of age
- Take less than 10 seconds of application time if done properly
- No blood to attract flies and institute larval development

Supernumerary teats should be removed at this age

- Restraint is easier

- When done correctly, has minimal pain effects
- Udder area should be clean, free of debris, and scrubbed with a surgical scrub
- Gently pull extra teat away from the udder; cut at an angle with sterilized surgical scissors
- Scissors should be cleaned and disinfected after each use
- Spray the wound with iodine or another antiseptic
- Be prepared to cauterize or tie off any blood vessels; bleeding is generally minimal

Weaned (3-8 months)

- Stressful time for animals due to change in social structure, feeding and housing
- First groupings of animals should be up to 6 head and given 25-30 sq ft per head
- Increase group sizes in increments of two's
- Proper ventilation and draft free
- Clean, dry bedding, shade, fresh feed and water are still essential
- The same basic hygiene principals apply here as above
- These animals should be fed before older animals
- Equipment used to deliver feed should be clean and free of organic matter
- Waterers should be monitored daily for functionality and cleaned when organic debris begins to accumulate
- Vaccinations are essential
    - Establish a protocol with the herd veterinarian based on endemic diseases, future breeding and transportation needs

Pre-Breeding (9-12 months)

- The same basic hygiene principles regarding feeding and watering apply here as above
- These animals should be fed before older animals, but after bred heifers
    - Bred heifers have a higher risk of disease exposure due to their pregnancy status
- Equipment used to deliver feed should be clean and free of organic matter
- Waterers should be monitored daily for functionality and cleaned whenever organic debris begins to accumulate
- Vaccinate and booster against the diseases that can be a challenge during pregnancy

Reproductive Services

Natural service

- Herd bull(s) -breeding soundness exam that includes motility testing and staining, palpation of the seminal vesicles, testes and examination of the penis for abnormalities
- All bulls should be tested for venereal diseases and BVD PI status

Artificial insemination

- Acquire semen from a reputable source
- Upon insemination, basic hygiene principles apply
  - Hands should be thoroughly washed and disposable gloves worn if possible
  - Coveralls or clothing and foot wear should be clean and free of organic matter
- Keep the pipette clean to minimize pathogen entry into the vagina
- All barriers (gloves, rectal sleeves) should be disposed of after inseminating each animal

Bred (13-22 months)

- This group of animals is more susceptible to disease than the pre-breeding animals
- Due to the in-utero calf, their immune system is compromised
- This animal is less able to fend off infection
  - She carries a naïve calf that could succumb and abort, become a stillborn, a weak calf or congenitally infected.
- The same basic hygiene principles regarding feeding and watering apply here as above
- These animals should be fed before older animals and before pre-breeding animals due to the different "at risk" conditions
- Equipment used to deliver feed should be designated for feed usage only
  - It should be thoroughly cleaned and disinfected and free of organic matter
  - This rule also applies to skid steers and front end loaders used to make the ration
- Waterers should be monitored daily for functionality and cleaned frequently
- Animals should be monitored daily for signs of illness and/or abortion
- If an animal should abort, promptly remove her, her fetus, and all other birthing material
- Personal protective equipment, especially gloves, should be worn when handling the fetus and parturient material and fluids
- The area should be cleaned and disinfected
- Heifers should be isolated from other animals; minimally exposed to older, lactating cows
- The fetus, depending on the state of degradation, may need to be submitted for diagnostics
- The cow/heifer may or may not come into her milk, depending on stage of gestation
- Milk her last and minimize contact with other animals
- Ideally she should be housed alone without direct contact to other cows/heifers
  - Housing her with hospital cows could predispose her and others to continual infection

Pre-Fresh (23-24 months)

- Heifers/cows should be moved to an area where they can be monitored multiple times a day within 3-4 weeks of their projected due date
- Nutrient and dry matter intake needs are changing
- They should be fed on a plane of nutrition targeted to produce high quality colostrum
- Grouping heifers with multiparous cows raises a few concerns

Things to consider in regards to housing related disease risk are:

- *Are the heifers from the same source as the adult cattle?* See section on newly introduced animals for recommendations to prevent disease entry and spread.
- *What is the size difference of the heifers versus cows?* Because nutrient needs are different for different sizes of animals, rations should be specially formulated.
- *What is the social difference between a heifer and cow?* Heifers are typically submissive to older individuals. Some heifers may be so intimidated that it will decrease their dry matter intake.
- *What is the prevalence of various diseases in the source adult herd?* If a heifer calves before being moved to a clean maternity area, that neonatal calf is now in a high risk area for disease exposure.
- The same basic hygiene principles regarding feeding and watering apply here as above
- These animals should be fed before older animals
- Equipment used to deliver feed would preferably be designated for feed usage only
  - It should be thoroughly cleaned and disinfected and free of organic matter
  - This rule also applies to skid steers and front end loaders used to make the ration
- Waterers should be monitored daily for functionality and cleaned frequently
- Animals should be monitored daily for signs of illness and/or abortion (see bred heifers above for managing these animals)
- Once the cow/heifer comes into their milk they should be milked as an isolation case
- These animals should be housed in a pen where they can be monitored throughout the day
- Manure management is essential; disease exposure to the newborn calf must be minimized
- Once signs of calving are present, heifers/cows should be moved to an individual calving pen that is clean, dry, and draft free (See “maternity pen” section for recommendations)

New Introductions

- Accepted risk practices need to be established
- Minimize risk by limiting the frequency and number of new introductions
- Limit purchases to a few sources with a known and trusted herd health program
- Complete herd health history should be obtained prior to introducing new animals

- Request copies of bulk tank samples, somatic cell count, DHIA reports, and vaccinations, illness and treatments records

Testing for diseases of interest should be considered

- A negative test result does not guarantee freedom from disease
- Test sensitivity, clinical appearance of the animal, history, and status of the herd of origin must be considered in light of test results

Inherent risks associated with purchasing animals of various ages

- Purchasing young animals can introduce calfhood diseases (scours, respiratory)
- Bred animals could introduce reproductive diseases
- Older animals may have chronic or latent infections
- Animals newly acquired or reintroduced should be quarantined for 21-30 days
  - Allows sufficient time to obtain negative test results if pre-entry tests are performed
- Isolation facility should be capable of preventing contact with **all** other animals
- Area should be cleaned, disinfected, allowed to dry and sit empty between uses
- Introduce animals that can be housed, fed, milked last and treated together
- Continual introductions results in social stress and repeated exposure to new pathogens
- Vaccinate newly acquired animals prior to receiving them

Animals Returning to the Farm

- Animal traffic should be minimal
- Delivery/load-out areas should be located at the perimeter of the property
- Clean and disinfect thoroughly after new cattle arrive
- All trucks and trailers used to transport animals should be cleaned and disinfected
- When animals leave the operation and then return (fairs, shows, veterinary clinic, and embryo transfer facilities) they should be handled as new introductions
- During their time off-farm, limit contact with other animals
- Do not share trailers, stalls, tack, feed or water, grooming supplies, reproductive equipment, needles and syringes, others
  - Properly clean and sterilize between animals if they must be shared
- Reproductive activity should be prohibited
- People contact should also be minimized; do not allow them to feed your animals

Human Traffic on the Dairy Farm

- Foot traffic poses a significant risk of pathogen introduction and spread
- Anyone who does not live on the facility should be required to sign a visitor's log book

  - Ask visitors about prior contact with animals on other operations
  - Those at high risk of transmitting disease need to take additional precautions
- Restricted areas need to be clearly marked so as to remind visitors not to enter
- Animal contact should be minimized
- Require all visitors to wear clean coveralls and overboots that are provided for them
- Disposable plastic overboots can be provided rather inexpensively (less than $1.00/pair)
- Boot bath can be provided at the main entrance
  - Hoses with adequate pressure must be provided so all gross debris can be cleaned off
  - Disinfectant solution used must be proper concentration, temperature, free of organic debris, and maintained

Zoonotic Disease and Health Concerns of Employees

- The average age of today's farmer is 55.3
- As people age, their reflexes and immune systems decline
  - Body less able to fight infection; CNS becomes less sensitive to immune signals
  - More than 20% of adults over age 65 with serious bacterial infection lacked a fever
- Illness may be more difficult to fight in this population, making prevention more important
- Many zoonotic diseases that this population should be aware of
  - Listeriosis, brucellosis, salmonellosis, Q fever, tularemia, botulism, staphylococcus and streptococcus infections, *E. coli*, salmonellosis, cryptosporidiosis, leptospirosis, ringworm, rabies
- Certain biological agents used for animals can pose a risk to handlers
  - Oxytocin and prostaglandins have detrimental effects on pregnancy
  - Toxic potential if accidentally injected or absorbed (detomidine, brucellosis vaccine)
  - Store products in a cabinet or refrigerator designed for that purpose; never with food for human consumption
  - Injection needle caps should never be removed by grasping with the mouth.
  - Hands should be washed after handling any biologicals.
- Wear personal protective equipment in situations that may predispose to exposure
  - Calvings, abortions, rectal or vaginal palpation, artificial insemination, milking infected animals, passing esophageal tubes or balling gloves, oral exams, necropsies, handling vaccines or antimicrobials may cause abrasions or expose mucous membranes

Other at-risk clients and their employees may include:

- Children under the age of five
  - Children who feed neonatal calves should be taught proper hygiene
    - Wash hands before and after feeding the calves
    - Wear gloves
    - Never eat or play around calf hutches
    - Wear designated calf chore clothing and take it off immediately after chores
  - Children's immunity will build up to many pathogens
    - Some will always remain a zoonotic disease threat (*E. coli*, salmonellosis, cryptosporidiosis, leptosporosis, ringworm, rabies).
- Pregnant women
- Immune compromised individuals
- Immigrant workers
  - Diseases prevalent in their native country could predispose them to zoonotic diseases
  - Ensure they have access to knowledgeable translators to ensure proper medical care
- Proper and frequent hand washing reduces risk of zoonotic disease. Technique:
  - Wet hands; Apply soap and rub hands together for at least 15 seconds; Rinse with water; and then dry hands with a single-use, disposable towel
  - Wash immediately after handling sick animals, after coming in contact with feces or urine, after using the restroom, and prior to eating
- Veterinarians need to educate their clients and their employees about zoonotic diseases

Routes of Transmission

- Dairy cattle are exposed to a variety of pathogens in their environment
- Many disease agents can survive for extended periods of time in soil, organic material
- Agents can be acquired through inhalation or aerosolization, oral consumption, direct contact, via fomites or vectors

Aerosol

- The ability of pathogens to survive and be transmitted in the air varies by organism, season, temperature, humidity and wind speed
- Pathogen concentration in the air decreases **exponentially** with distance
- Increase distance between wildlife, animals from other operations, and newly introduced
- Appropriate ventilation is extremely important in reducing airborne pathogen transmission

Calf housing areas

- Adequate ventilation, moisture control, and temperature regulation are essential
- It is recommended to maintain room air relative humidity at 50-75% to minimize condensation, dust and airborne bacteria. (MWPS 1985)

Adult dairy cattle

- Cattle should be moved slowly so as not to increase respiratory rate
- Refer to extension services, agricultural engineers and Midwest Plan Service for specific ventilation information for various types of dairy facilities

Oral

- Oral transmission can occur through contaminated feed, water, or the environment
- Things such as equipment, fencing and other objects that they can lick; contaminated mineral, sodium bicarbonate, and salt feeders; oral drenching equipment, esophageal tubes, and numerous other objects can transmit pathogens orally

Milk/Colostrum

- Test cows for diseases of concern (Johne's, salmonellosis, bovine leukosis virus, others)
  - Use colostrum from test negative animals
- Single source, dam to calf colostrum is the preferred feed source for neonatal calves
- Alternative sources should be provided from an older, healthy cow from the same herd
- Colostrum should be collected as aseptically as possible and can be frozen for up to 1 year
- To store colostrum, use 1 gallon zippered lock baggies
  - Fill it ¾ full with colostrum and lay it flat to freeze
  - Label each bag with cow's I.D. number, collection date and other pertinent info
- Should an animal test positive, her colostrum can be removed from the supply
- Do not stack colostrum bags in the freezer until they are frozen
  - Condensation accumulates; the bags will freeze together if stacked too early
- One gallon bags allow for ease of thawing; large surface area contacts warm water
- The bag also stores enough colostrum for the first feeding to a newborn calf

Colostrum pasteurization

- Minimizes the risk of disease
- Some risk of protein destruction, specifically immune globulins
  - Research is ongoing for ideal time and temperature
- Time and temperature of the batch should be monitored frequently

Milk feeding pre-weaned

- Feed only properly pasteurized whole milk or high quality milk replacer
- Milk replacer should be stored in an air-tight container
  - Keep out rodents, environmental contaminants
  - Maintain quality
- Containers used to feed milk (see fomites) must be rinsed, cleaned properly between uses

Feedstuffs

- All feeds should be evaluated for their risk of introducing and/or transmitting disease
- Feeds from outside sources must have acceptable, documented quality assurance program
- A feed sample should be collected and frozen for diagnostics if contaminated or suspected
- Prevent access to and contamination from any animals that may urinate or defecate
- Protect feed from weather to prevent spoilage and mycotoxin development
- Ensile feed and/or process properly to ensure appropriate conditions are achieved
- Due not ensile wildlife carcasses; they can contaminate the feed with botulinum toxin
- Spilled feeds should be frequently cleaned up and disposed of
  - It attracts rodents, wildlife, fosters spoilage, serves as breeding ground for pests
- New feed should not be added to or poured on top of older feed
- Maintain the face of silage stored in bunkers by removing enough each day

Feed bunk and manger management

- Feed should be made available throughout the day
- Push up feed frequently to encourage consumption
- Remove old feed to prevent proliferation of spoilage and disease organisms
  - Listeria monocytogenes and Clostridium perfringens, and mycotoxins
  - Breeding ground for flies and other pests
- Scrape feed bunks and mangers on a regular basis to remove all old feed
- Concrete feed bunks deteriorate over time
  - Plastic bunk liners, polyethylene coating, and ceramic tiles keep the surface smooth
  - Do not walk or drive through feed
- Safety passes (man-passes) should be used so personnel can enter pens easily

Pasture animals

- Avoid fertilizing with high risk materials (non-composted manure, poultry litter)
- In drier climates, drag fields to break up fecal pats
  - Organisms die more rapidly when exposed to heat, sunlight and wind

- Avoid overgrazing, which forces animals to graze closer to the ground

Supplemental hay feeding

- Use of hay rings or similar feeding methods congregates animals
- Dispersing the hay (scattering flakes or unrolling large round bales) reduces this
- Animals contaminate the hay when animals lay on it or soil it
- Prevent by frequently changing the feeding area, appropriately group age cohorts and minimize stocking density
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Wooden feed bunks

- Frequent movement of the bunk
- Minimize feed wastage
- Clean out frequently to avoid feed buildup
- Bunk liners avoid accumulation in the cracks

Water

- Milk is composed of 86% water
- Waterers should be monitored daily for functionality and cleaned frequently
- Trough type automatic waterers
  - For adult cattle, a rail should be installed two feet above the top rim of the waterer
  - For young calves, a rail can be installed at 18 inches above water trough
    - Minimizes animals from standing or defecating in the trough
- Pre-weaned calves should be offered fresh water throughout the day
- Individual water buckets should be cleaned frequently (described in the fomite section)

Natural water sources

- Convenient, reduced expense
- Less quality control; higher chance of wildlife/other animal contamination
- Protected natural sources as much as possible and monitor for problems
- Test water quality every six months; more often if there is a problem
- Monitor coliform counts, nitrates and nitrites, sediment, hardness, and other minerals

Ponds

- Consider fencing off the pond and provide limited access to limit runoff into the water
- Fecal and urine contamination is greatly reduced, as is the risk of mastitis

Streams

- Additional disease threat due to the potential contamination from upstream
- Consider restricting access of cattle to streams

Manure and Waste Management

- Waste management is important in controlling pathogens (salmonellosis, campylobacteriosis, cryptosporidiosis, giardiasis, etc)
- Dairy animals deposit between 2.0 to 2.4 cubic feet (115 pounds; 14 gallons) manure/day
- Frequently removal waste, once to several times per day
- Transport to designated storage or disposal area, out of contact with animals with designated equipment

Lagoons

- Adequate capacity to handle large precipitation without overflow
- Should an overflow occur, protect the most susceptible animals from exposure

Composting

- Great reduction in volume and water content
- Significant reduction in pathogen levels
- Takes time to complete the process
- Equipment and labor demands
- Loss of nutrients

Cropland

- Minimal risk of sustaining pathogens if waste is applied early in the growing season
- Single growing season is not sufficient to eliminate infectivity of some persistent pathogens (*Mycobacterium avium* subspecies *paratuberculosis* [Johne's], protozoal oocysts [*Eimeria* spp.] and helminth eggs)
- Do not spread manure, especially from other farms, on pastures with susceptible animals
- The survival of pathogens within manure depends on:
  - Sunlight, drying, freeze/thaw cycles, high temperature, high/low pH, exposure to oxygen, ammonia concentration numbers, types of pathogens present and the adsorption of the pathogen to soil
- Drag dry lots and pastures to break up and disperse fecal pats in drier climates
- Allow adequate time between distributing manure and returning animals to the pasture

Fecal Contamination from Other Species

- Prevent access of animals to stored feed and feeding areas
- Birds, vermin, dogs, cats, goats, sheep and horses can all introduce disease to cattle

Direct Contact

The presence of an agent or organism in the environment or within an infected animal; susceptible animal exposed when the agent directly touches open wounds, mucous membranes, or the skin through saliva, nose-to-nose contact, rubbing, or biting

- Isolate sick or newly introduced animals
  - Ideally, use a dedicated area or pen for isolation and separate milking facilities
  - Minimum- a dedicated pen within the operation
  - Fence line contact should be limited
  - Stocking density should be at the lowest acceptable level
  - Isolate until animal clears testing procedures or sufficient time to allow a disease to manifest (21-30 days is typical)
- Incoming animals should be fed last, treated last, and milked last
- All equipment should be cleaned and disinfected afterwards (see Fomite transmission)

Reproductive

Diseases spread through venereal and in-utero routes

- Venereal transmission- spread of pathogenic agents from animal to animal through coitus
- In-utero transmission- spread of pathogenic agents from dam to offspring during gestation
- Vaccination programs should only serve as an addition to proper BRM measures

Disease risks associated with coitus vary depending on the type of reproductive service. See page 14 for management recommendations related to reproduction.

- In-utero transmission can involve a chronically infected dam or exposure during a critical stage of gestation
- Test and cull strategies should be considered for certain diseases
- Test suspect animals- repeat breeders, erratic estrous cycles, animals that abort
- Test the dam and offspring of cows that are diagnosed with vertically transmitted diseases
  - This requires maintaining complete records

Fomites

- Virtually any inanimate object can serve as a fomite carrying pathogens
- Humans often play a role in facilitating fomite exposure- iatrogenic (see below)
- It is important that all fomites be recognized and handled appropriately

Milking Equipment

- One of the most significant fomites on a farm
- Every adult cow will come in contact with the milking claw and liners 2-4 times per day
- This equipment must be rinsed, washed, sanitized and disinfected between every milking, or at a minimum, once every 24 hours
- Any known diseased animals (mastitis) should be milked last in a string

Sanitizing between animals

- Some facilities have back flush systems directly installed
- Rinse bucket- removes milk residue and pathogens in the milking claw; not milk hoses
  - A stainless steel bucket with warm water and a sanitizer or disinfectant mixed at a concentration that will eliminate the target organisms
  - Milking claw is held upside down and allowed to drain out milk
  - It can then be dipped into the bucket and allowed to have appropriate contact time
  - Place the unit in the solution at an angle to allow contact with the inside of the liners
    - Placed straight in to the solution, it will act like an inverted glass
  - Claw is lifted out, allowed to drain, rinsed in a bucket of warm water to remove residue
  - Ideally, the sanitizer/disinfectant bucket should only be used once- as organic matter (milk) builds up in the bucket, the sanitizer/disinfectant becomes less effective

Teat dip cups

- Organic buildup in the cups (feces, milk, urine, bedding) deactivates the chemicals
- Must be monitored for contamination
  - Solution dumped down the drain, cup promptly rinsed, washed with detergent and warm water, and then refilled with fresh dip before using on another animal.
- Never dump remaining dip back into the original container
- After each milking, teat dip cups should all undergo a cleaning/washing procedure
- The “solution to pollution is dilution”

Towels used to wipe teats

- Single use to minimize disease exposure and spread
- Washable towels- do not overload the washing machine
  - Add detergent and/or bleach to the water before loading machine
  - Use hot water
  - Ensure adequate time for the cycle to run

  - Dry completely in a hot dryer before the next use
  - Dry towels should be stored in an area to prevent environmental contamination

Calf Equipment

Esophageal feeders- should be cleaned and disinfected between animals

- Stored in an area that does not allow contamination by flies or feces

Milk bottles- should be removed after eating

- Nipples and bottle rinsed with water, washed with detergent, rinsed again, inverted and allowed to dry completely before the next feeding
- Clean bottles and nipples should be kept free from environmental contamination

Buckets- should be rinsed after all milk is consumed to remove the residue

- Milk is an excellent nutrient source for bacterial and viral organisms

Feeder's clothes and hands

- Proper personal hygiene needs to occur before preparing milk and feeding the calf
- Hands should be thoroughly washed and disposable gloves worn if possible
- Coveralls or clothing and foot wear should be clean; free of organic matter

Calf pens or hutches

- Cleaned, sanitized and disinfected between calves
- Organic bedding should be removed
- Ground allowed to sit idle with sunlight exposure for as long as possible

Treatment Equipment

- All equipment used for treatment should be cleaned and disinfected
  - Halters, balling guns, esophageal tubes, drenching equipment, needles, syringes, IV tubing, oral and vaginal speculums, head catches, chutes
  - Anything contaminated with blood, saliva, nasal secretions, urine, feces, or come in direct contact with infected skin or tissues
- Some items may need to be disposed rather than re-used
- Store clean, dry items in drawers, plastic bags, or covered up
- Always work with sick animals after all healthy animals have been treated

Other Equipment

Waterers and drinking cups

- Organic debris can build up over time and harbor disease causing organisms

- Waterers should be monitored daily for functionality and cleaned weekly (See Oral Transmission for more detail on water quality)

Machinery- Vehicles, tractors and implements, four wheelers, others

- Used in multiple settings within an operation- can introduce contamination
- Cattle smell, lick and rub against these items
- Restrict use to designated areas, keep clean, and minimize contact with animals
- Vehicles frequently in close contact with animals should be restricted to on farm use only

Immovable objects- fences, gates, panels, buildings, others

- Potential for spreading disease when naïve animals have contact with them
- Limit access of different age groups of animals to a given area

Contaminated clothing, shoes, skin

- People need to follow proper hygiene standards
- Change clothes, clean and disinfect foot wear after being in a contaminated environment
- Avoid contact with animals after being in high risk situations (such as travel to countries with foreign animal diseases)

<u>Iatrogenic</u>
Unintentional transmission of disease by a human using a contaminated item

- Use aseptic technique in drawing medication from multi-dose bottles
- Use a new needle and syringe every time an injection has to be given
- Some products have infectious potential if injected or adsorbed via the mucous membranes
- Single use items (bST, mastitis tubes, dry cow tubes) are meant to be single use
- Mastitis tube should be used only once in one quarter, then properly disposed
    - While administering, wear gloves, wash gloved hands thoroughly with soap and warm water after treating the infected cow, and dispose of gloves before handling another animal
- The alcohol pad used to clean teat end should only be used once and on only one teat
- Following treatment, the teat should be dipped with post-dip solution
- Proper medication handling is critical as antibiotics can support growth of some organisms
- Carrier animals in the herd present a threat to disease spread
- A well designed BRM plan can minimize all risk of iatrogenic transmission

- If producers are reluctant to commit to such a plan, test for various diseases of interest and treat, cull or physically separate carrier animal(s)

Traffic

This section will discuss traffic introducing diseases onto the farm

- The "Fomite" section addressed traffic on the farm, from one group of animals to another
- Create a visitors log
  - Identifies who brings vehicles onto the operation, what vehicles, where they have been, where on the farm they go, why, and how often
  - Everyone is required to sign in and provide the above information
  - All visitors should contact the producer prior to arrival- this limits the need for people to wander around the farm
  - Allows identification of unauthorized people who may pose a threat to livestock health
- Designated parking area on the perimeter of the farm
- All visitors should be restricted to use of on farm vehicles
- Posted signage should direct milk truck drivers, feed deliveries, veterinarians, and milking equipment service and repair personnel to follow proper protocols on the dairy facility
  - These vehicles should be inspected for cleanliness and ensure their drive path does not have direct animal contact
- Feed deliveries should be made as infrequently as possible or the first delivery of the day
- A wash down facility and/or a tire washing area with an appropriate disinfectant should be made available and its use strictly enforced
  - The area should have adequate drainage
- Have a limited access area on the perimeter of the property
  - Equipment can be left for servicing here
  - Dead stock can be picked up (preferably out of sight)
  - Pallets of bagged feed or supplies can be left in protected structures
- Animal delivery/load out facilities should be placed on the perimeter of the farm
  - Gravel, asphalt or concrete surfaces and adequate drainage away from the farm
- Implementation of some of these ideas may be beyond the producers commitment
  - Facility redesign, new construction, and perceived inconvenience to visitors may discourage many producers
- For high traffic- high risk operations, or extremely valuable genetics, these options should be considered

Vector

Mechanical transmission- vector (flies) transports disease agent from the environment (contaminated feces, feed) or one animal (nasal and ocular secretions) to another

- Disease agent does not replicate or develop in/on the vector

Biological transmission- vector uptakes the agent, usually through a blood meal from an infected animal

- Disease agent replicates and/or undergoes development and then the vector regurgitates the pathogen onto or injects it into a susceptible animal (mosquitoes, ticks, lice, mites)
- The prevalence of vector-borne diseases is dependent upon:
  - Prevalence of the disease agent
  - Distribution of the vector
  - Abundance and life expectancy
  - Feeding habits
  - Vectors ability to support the pathogens' existence

<u>Eliminating the Insect</u>

- Ideal method to prevent vector transmission
- Chemical insecticides are ineffective as a sole measure
- An insecticide product must be labeled for use in lactating cattle
- Residual sprays cannot be used in the milking parlor

Methods of killing insects include:

- Direct treatment of cattle with pour-ons, ear tags or face rubs
  - To target face flies, one ear tag in each ear is recommended
  - Effective but short-lived duration
  - Insect resistance becoming a problem
- Spraying premises with knockdown insecticides
  - Effective in smaller areas; inefficient in larger areas
  - Must be used the same day they are mixed up
  - Duration short-lived (1-2 hour action)
  - Effectiveness dependent upon weather conditions (air temperature 65-90^{o}F)
- Spraying calf hutches/barns with residual sprays
  - Remain active for several days
  - Apply to shaded areas only as ultraviolet light breaks down chemicals
  - Rain will wash away spray so must be reapplied
- Biological control such as parasitic wasps which feed on fly larvae, or birds that eat insects

  - Effective but requires repeated introduction of control organism
  - Birds present their own biological disease risks such as spreading salmonellosis
  - If used in conjunction with sprays, the parasitic insect may be killed

Separating Host/Vector

- When heavily populated with insects and premise treatment is not practical
- Minimize exposure to standing water where mosquitoes lay their eggs, streams where black flies reproduce, and wooded areas heavily infested with ticks
  - Fence off these regions during insect seasons
- Confine animals to a building that can be insect-proofed or sprayed with insecticide
- Carrier animals in the herd present a threat to further spread
- Test for the various diseases of interest and treat or cull carrier animal(s)
- Physically separate carriers from susceptible animals
- Vaccination is generally considered a last resort

Breeding Area Control

- There are various diseases spread through vectors to cattle (see Vector handout)
- Each insect has a unique lifecycle that needs to be understood to implement control

Most insects can be controlled by:

- Eliminating standing water, especially wet, muddy areas (mosquitoes, flies)
  - Frequently clean around water and feed troughs
  - Drag dry lots in drier climates to spread out fecal pats in cattle congregation areas
  - Clean loafing sheds frequently
  - Use tires with holes punched or cut in half to hold down the plastic on silage piles
- Eliminating decaying organic matter on a weekly basis (flies)
  - Spoiled feed, soiled bedding, open manure piles, dead animals, etc.
- Calf hutches
  - Prompt removal (at least weekly) of organic material limits ability of insects to breed
  - Insect growth regulators in feed prior to the presence of flies prevents maturation of insect eggs laid in fecal pats (can be difficult to predict)

Summary

In summary, there are many routes of disease transmission on a dairy farm. Each has specific management protocols that can be established to minimize disease introduction and spread. It is important to assess a farm, identify areas of risk, and use the suggested management strategies to help prevent challenges in the future.

Risk Communication

- Risk communication is a two-way, interactive process
- One of the major barriers to effective risk communication is inadequate planning and preparation
- Risk management plans must be understood, supported, and adopted by every employee for effective implementation
- Educational programs should not be limited to one form
- Proper communication of the risk management plan is of utmost importance for effective infectious disease control
- When communication is effective and efficient, disease spread can often be minimized and controlled

Conclusion

Risks of disease transmission cannot be completely eliminated, but by employing some basic hygienic and biological risk management principles, these risks can be effectively managed and significantly reduced. It may take time to persuade your clients to adopt some of these principles, but the results of your efforts will reflect the efficacy of this program, and others will follow suit in time.