Raw Milk Risk Management
Overview

- About Raw Milk Institute
- Raw milk opposition
- Raw milk benefits and risks
- RAWMI method for low-risk raw milk
- Grass-to-glass risk management
  - Small-scale raw milk production
  - Large-scale raw milk production
  - Grass
  - Cows
  - Milking
  - Management
  - Glass
- Raw milk testing
- Raw milk lessons learned
- How and why to become RAWMI LISTED
About Raw Milk Institute

- Non-profit 501c3, founded in 2011
- Mission - To improve the safety and quality of raw milk and raw milk products through:
  - Farmer training and mentoring
  - Establishing raw milk guidelines and standards
  - Educating consumers about health benefits of raw milk
  - Collecting data for raw milk research

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About Raw Milk Institute (cont.)

- RAWMI has trained hundreds of raw milk farmers across the USA and Canada
- RAWMI currently has 19 LISTED farms, who are committed to producing low-risk raw milk and submit test data to RAWMI monthly
Universal Access to Safe Raw Milk
Raw Milk Opposition Has a United Voice
50 states with 50 different shades of raw milk chaos...

....Chaos encouraged by the FDA & processing industry

In Canada...simply illegal to sell raw milk, but you can own your own cow or goat!
But consumers love it!
Raw Milk Benefits

- Raw milk is nutritionally superior

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*“ACTIVE” MEANS: Easily digestible, and not destroyed or changed from processing. Our bodies thrive MOST on active, unprocessed nutrients because it is natural and truly organic.*
Raw Milk Benefits (cont.)

- Studies show that raw milk is correlated with:
  - Easier digestion
  - Stronger immune systems
  - Fewer ear infections
  - Less asthma
  - Fewer allergies
  - Reduced eczema
  - Fewer colds
  - Improved gut health
Consumption of raw milk correlates to lower rates of asthma and allergies.

However, study concludes “At this stage, consumption of raw farm milk cannot be recommended as a preventive measure.”

This is why RAWMI training is necessary!
Raw Milk Risks

- Raw milk can harbor pathogens that lead to infection, serious illness, and death
  - E coli 0157:H7
  - Salmonella
  - Campylobacter
  - Listeria monocytogenes
- For human illness to occur four things must align:
  - Pathogen must be present
  - Pathogen must be virulent
  - Pathogen load must be high enough
  - Host must be susceptible
Raw Milk Risks (cont.)

• Shiga-toxin producing e Coli 0157:H7 (STEC) has lowest cell count threshold for illness
• As few as five cells can cause hemolytic uremia syndrome (HUS)
  • HUS = kidney damage
Safe, low risk raw milk is achievable!
RAWMI Method for Low-Risk Raw Milk

- Develop Risk Assessment and Management Plan (RAMP)
  - Grass-to-Glass risk management
  - Helps you identify and understand the risks on your own farm
  - Lets you identify Critical Control Points (CCP) and develop Standard Sanitary Operating Procedures (SSOP) to ensure risks are well-managed
- RAWMI can help you one-on-one in developing your RAMP and optimizing your system
- Test milk monthly for coliforms and standard plate count to make sure RAMP, CCP, and SSOP are working
The RAWMI Effect

- RAWMI training has been shown to reduce outbreak rates by 78% meanwhile there has been an increase in raw milk permits issued over the same time period.


[NOTE: outbreak in 2017 was from an unlicensed farm.]
Two Types of Raw Milk

Used milk filters from Organic Pastures Dairy, a dedicated raw milk farm

Used milk filters from a conventional dairy farm

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Two Types of Raw Milk (cont.)

<table>
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<th>Study</th>
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$^1$Total positive pathogen tests include Campylobacter, Pathogenic E. coli, Listeria monocytogenes, and Salmonella.

$^2$Studies conducted in the United States.

$^3$N/A: Not available or not applicable.

$^5$Studies conducted in Canada.
Outbreaks Decreasing While Raw Milk Consumption is Rising

Raw Milk in California

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Size Doesn’t Matter

- Raw milk producers of ALL sizes need to follow strict sanitary practices to prevent illness
  - Micro dairies as well as large dairies
Grass-to-Glass Risk Management
The Basis of Raw Milk Safety: Conditions, Conditions, Conditions

- All conditions matter: pasture, cows, udders, internal milk system, external milk lines
<table>
<thead>
<tr>
<th>Grass-to-Glass Continuum</th>
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</thead>
<tbody>
<tr>
<td>Grass</td>
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<tr>
<td>Cows</td>
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<td>Milking</td>
</tr>
<tr>
<td>Management</td>
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<td>Glass</td>
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</table>

- **Water**: Pasture conditions
- **Wild Animals**: Animal health/feed
- **Udders**: Temperatures
- **Cleaning**: Testing
- **Chilling**: Training

**Keep:**
- Clean clean
- Cold cold
- Hot hot
- Green green

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Quick Checklist

- **When best practices are being used:**
  - Cows are in good health with good body conformation, udders, coat, etc.
  - Cows get sunshine and have access to outdoors and grass
  - Udders are cleaned very well, stripped, pre-dipped, and dried before milking begins
  - Everything involved in milking process looks very clean, including milking parlor, all milking equipment, milk jars/bottles, etc.
  - Milk is chilled to below 38 F in less than an hour
  - Milk is tested regularly for SPC and coliforms
  - Shelf life of milk is at least 2 weeks without souring
  - No rising bubbles in milk (which would indicate high presence of coliform bacteria)
An Example of a Simple, Small-Scale Raw Milk System
#1 Mindset
- Dedication to excellence
- Diligence
- Plan for success

#2 Conditions
- Healthy cows
- Maintained areas
#3 Organized and Clean Milking

- Clean dry udders
- Milk is checked
- Monitor the process
- Stress-free conditions
#4 Sanitary Management of Milk

- Bacteria counts double every 20 minutes
#5 Rapid Chilling in Ice Bath
- Below 38 degrees F in <1 hour

#6 Keep Cold
- Below 38 degrees F
An Example of a Large-Scale Raw Milk System
#1 Mindset
- Dedication to excellence
- Diligence
- Plan for success

#2 Conditions
- Healthy cows
- Maintained areas

©Raw Milk Institute 2019
#3 Organized and Clean Milking

- Clean dry udders
- Milk is checked
- Monitor the process
- Stress-free conditions
#4 Sanitary Management of Milk

- Milk lines are clean inside and out
- All surrounding areas are kept clean
#5 Rapid Chilling
- Below 38 degrees F in <1 hour)

#6 Keep Cold
- Below 38 degrees F
Risk Optimization - Grass
Pasture

- Adequate space
- Cows rotated through pasture
- Perimeter fencing is secure and allows for minimum 3-yards gap between neighboring livestock
- **Beware** - chickens and pigs pose risks
Water

- Pasture regularly watered via rain or irrigation
- Water is a transfer mechanism for bacteria and pathogens
  - Water tested at least annually
Risk Optimization - Cows
Cow Health

- Cows fed appropriately to maintain good body condition
- Tested negative for tuberculosis, Johne’s disease, brucellosis, etc.
Cows with Health Risks

- Freshening cows are at greatest risk for carrying pathogens, mastitis, etc.
  - Risks of using milk from freshening cows for direct human consumption
  - Can be used for cheese and butter
- Recommended to separate cows with health risks (such as mastitis) from herd
Biosecurity

- Biosecurity is essential to protect the herd from infectious diseases
- Infectious animal disease can be transmitted by:
  - Direct or indirect contact with infected animals, their secretions and discharges
  - Mother to offspring, including via milk and in uterus
  - Contaminated equipment, food, pasture or water
  - Contaminated dosing and injecting equipment
  - Insects and wildlife
  - Humans and their vehicles (including transport vehicles)
Biosecurity (cont.)

- Biosecurity measures include:
  - If possible, maintain a closed herd
  - Only purchase non-lactating animals for replacement, preferably heifers
  - **Not** purchasing a lactating cow and putting her directly with your lactating cows
  - **Not** sharing bulls between herds
  - Ensuring prospective animals have tested negative for diseases
Biosecurity (cont.)

• Biosecurity measures (cont.)
  • Isolation area/paddock for sick or new cows
    • Separate airspace, water supply, or drainage with other animals
    • Equipment for use only in isolated area
  • Minimum of 3 yards away from other livestock areas
  • New or returning livestock isolated for 21 days
  • Clean hands and boots, and change clothes, before going to other areas
Risk Optimization - Milking
Cleanliness

- Build a culture of cleanliness
- No chickens or birds in milking areas
- Easy access hand washing facilities
- Boots wash station and/or boots are regularly cleaned (such as 1x/day)
Cleanliness (cont.)

- All confinement areas need to be maintained and clean
- No chickens or birds in milking areas
Milking Equipment

- All milking equipment is kept clean
- Inflation liners are replaced per manufacturer’s recommendations
- Vacuum pressure management
  - High vacuum pressures are associated with increased mastitis
This vacuum hole goes directly into the milk flow:

Is this wet?
Is this clean all the time?
What’s wrong here?
Udders

- **Before milking**
  - Wash very well
  - Dry udder and teats with clean udder cloth, starting with the teats first and then moving to outer areas last, not retouching the clean dry teats
  - Predip teats with teat dip solution and wait for 30 seconds
  - With clean hands or gloves, strip teats to eliminate foremilk and observe milk quality
Udders (cont.)

- **Shower Power!**
  - No belly fly habitat...organically
  - Mostly clean udders
  - Refreshed happy cows
  - They leave their manure in spray pen
Udders (cont.)

- Water moves bacteria – Dry is good!
Udders (cont.)

- Is your teat dip a contaminant?
- Keep it clean... Use a spray bottle!
Udders (cont.)

- After milking
  - Post dip with iodine-based teat dip
- Beware of contamination
- Protect your udder rags
Details make all the difference between low-risk raw milk and risky raw milk!

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Management

- Keep - Clean Clean
- Keep - Green Green
- Keep - Hot Hot
- Keep - Cold Cold

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Bacteria Counts

Environmentals
Feed
Health
Udders

All up from here

Milk system
Management
Chilling

LOW POINT

Udder Meets Machine

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KISS

KEEP IT “SHORT” AND SIMPLE

Short distance between cow and milk container

Cow-Bucket-Container!
Space Management

- Separations between livestock and milk processing areas
- Clean, washable walls and work surfaces in milk room
- Proper storage of clean equipment

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Proper Space Management

- Smooth, cleanable, dry
- Inventories protected from contamination
- Well lighted
- Covered
Lighting

- Ensure adequate lighting
Buckets

- Easy to clean and operate

Not OK

OK

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Buckets (cont.)

- Grade A stainless steel buckets
- Proper storage and drying
Equipment Management

- Know what is clean and keep it clean
- Know what is not clean
- Keep them separated
- If they ever cross-contaminate, discard and start over
Equipment Management (cont.)

- Separate equipment for food vs. other uses

Food contact

Floors and non-food contact
Floors

- Floors flow to a drain
- No puddles
Floors (cont.)

- Wet floors cause condenser to freeze up – Loss of Chilling!
Air Management

- Trap the cold air - Cold air is expensive yet essential for raw milk freshness
Air Management (cont.)

- Positive air pressure in the filling room
- Keeps out flies, dust, etc.
Keep Your Equipment Spotless

Whatever you have...
...take good care of it

Inside and out!
Biofilms

- In milk production, biofilms are symbiotic colonies of bacteria that adhere to the inside of the milk lines, valves, crevices, etc.
Biofilms (cont.)

- Quorum Sensing
  - Bacteria within biofilms are protected from sanitizers due to multispecies cooperation
  - Biofilms are hard to kill!
- Biofilms provide a safe haven for pathogens
  - E coli 0157:H7
  - Salmonella
  - Campylobacter
  - Listeria monocytogenes
- Pieces of biofilm can detach and contaminate the milk

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Pipelines and Tanks

- Big challenges
  - Valves
  - Gaskets
  - Low points
  - Bends
- All create opportunities for biofilm growth
Pipelines and Tanks (cont.)

- Valves, gaskets, etc. need to be completely disassembled and cleaned very often
- Valve on milk tank needs to be completely disassembled and cleaned every time the milk tank is emptied
Pipelines and Tanks (cont.)

- Clean-in-place (CIP) protocols need to include both alkalines and acids
- Biofilms can become resistant to specific cleaners
  - ~Once per month: use different cleaners to target cleaner-resistant biofilms
Pipelines and Tanks (cont.)

- Clean-in-place (CIP) protocols work best with cool water first, followed by very hot water with alkaline sanitizers
  - Starting with cool water reduces the chance milk coagulation in the lines
- Measure temperature of hot water at exit from system to ensure it is hot enough
- After alkaline sanitizer, clean with acid sanitizer
- Avoid quaternary ammonias
Milk Stacking

- Milk stacking occurs when milk from multiple milkings is placed in the same tank.
- Milk stacking increases the chance of having a bacterial problem.
  - One bad batch can contaminate the rest!
- Recommended to avoid milk stacking as much as possible.
Pasteurized Milk Risks

• Producing both pasteurized and raw milk is risky!
• Pasteurized milk provides an ideal growth environment for Listeria monocytogenes
  • No beneficial bacteria to outcompete the Listeria
• Care needs to be taken to keep pasteurized milk completely separated from raw milk
Crate Management

- Crates washed and kept clean
- Sunlight can help with sanitation
Bird Nests

- Birds can spread Campylobacter and Salmonella
- Inspectors do not like bird nests near creameries
Risk Optimization - Glass
Bottle Washing

- Improperly cleaned bottles can cause bacterial issues!
- Storage of clean jars and containers needs to be managed
Bottle Lids

- Metal lids can shed rust
- Rust feeds iron-loving pathogens
- Consider using plastic lids instead
Raw Milk Testing
Even Raw Milk From Clean Conditions Can Have Pathogens

Most common sources of raw milk pathogens in clean conditions:

- Torn inflation liners
- Biofilms
- Mastitic cows with an internal pathogen infection

Campylobacter, Ecoli 0157:H7, Salmonella and Listeria have all been detected from inside udders.

Try testing the milk filters to really discover pathogens!

Don’t be fooled!
About RAWMI Common Standards

- Developed by RAWMI in conjunction with international group of:
  - Medical doctors, epidemiologists, and nutritional consultants
  - Veterinarians
  - Food safety experts and scientists
  - Raw milk producers and consumers
- No standards can guarantee perfectly safe food
- However, when followed diligently, these guidelines dramatically reduce the risk of illness from consumption of raw milk
RAWMI Common Standards

- Develop a Risk Assessment and Management Plan (RAMP) for your individual farm
  - Grass-to-Glass risk management:
    - Animal welfare, health, and management
    - Milking hygiene
    - Product handling
  - Critical Control Points (CCP) and Standard Sanitary Operating Procedures (SSOP) to ensure risks are well-managed
- Sell raw milk for direct human consumption only from your own farm
  - No commingling of raw milk from other dairies
RAWMI Common Standards (cont.)

- Test for coliform bacteria at least monthly
  - Target: a rolling three-month average of < 10 coliforms per ml raw milk
- Test for Standard Plate Count (SPC)* at least monthly
  - Target: a rolling three-month average of < 5,000 per ml raw milk
- Test regularly for pathogens, including:
  - *Salmonella* spp.
  - *E. coli* 0157:H7
  - *Campylobacter* spp.
  - *Listeria monocytogenes*

*SPC data is preferred; however, Bactoscan data is acceptable.
Why Test Monthly?

- The RAMP, SSOP, and CCP ensure that there is a plan in place for producing low-risk raw milk
- Follow the RAMP, SSOP, and CCP, but also test milk regularly
- Monthly testing can help identify trouble spots such as:
  - Biofilms growing in milk lines due to improper cleaning
  - Cracked inflation liners, leading to biofilm growth
  - Teats not being cleaned properly
  - Milk not being cooled quickly enough
Standard Plate Count (SPC)

- SPC is a measure of the total number of aerobic bacteria in the milk
- High SPC can indicate dirty milking equipment, poor cooling, and/or poor udder prep
Coliforms

- Coliform bacteria is a way to measure the overall hygiene and cleanliness of the milk
  - High coliform counts can indicate environmental or fecal contamination on the udders or milking equipment
  - High coliform counts are likely to correspond to the presence of pathogens in the milk
  - Coliforms assess “Haystack” conditions not the “needles in the Haystack”
# Interpreting Test Data

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Interpreting Test Data (cont.)

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<tr>
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</table>
Pathogen Tests

- Regular testing for pathogens gives you further insight into the quality and cleanliness of your milk
- On-farm pathogen testing is dangerous and not recommended
- Have a plan in place for how you will respond in case of a positive pathogen detection
Test Protocols

- Test both the bulk tank and the finished product regularly
- Use proper shipping or transport protocols
  - Ensure that samples are cold when they arrive at lab
Low-risk raw milk IS achievable!
RAWMI Standards and Data vs. FDA Standards

Standard Plate Count (SPC)

- RAWMI Average of 664 Data Points: 1,225 cfu/ml
- RAWMI Common Standards: 5,000 cfu/ml
- FDA PMO Standards for Milk Produced for Pasteurization: 100,000 cfu/ml

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RAWMI Standards and Data vs. FDA Standards (cont.)

Coliforms

- RAWMI Average of 822 Data Points: 2.5 cfu/ml
- RAWMI Common Standards: 10 cfu/ml
- FDA PMO Standards for Milk Produced for Pasteurization: 750 cfu/ml

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Testing Doesn’t Have to Be Expensive

- Edwin Shank, from The Family Cow, has pioneered on-farm testing for SPC and coliforms
- On-farm testing
  - Initial set-up costs are just a few hundred $$
  - Inexpensive in the long-run
  - Allows you to test as often as you’d like
  - Allows you to troubleshoot problems much more efficiently

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Raw Milk Lessons Learned
Inspections

- Inspectors inspect everything!
Raw Milk Outbreaks and Pathogen Detections

- California dairy
  - Campylobacter
  - E coli 0157:H7
- Fresh cow
Raw Milk Outbreaks and Pathogen Detections (cont.)

- New York dairy
  - Listeria
- Torn inflation liners

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Raw Milk Outbreaks and Pathogen Detections (cont.)

- Pennsylvania dairy
  - Campylobacter
- Chickens
Raw Milk Outbreaks and Pathogen Detections (cont.)

- California dairy
  - Ecoli 0157:H7
- Neighbor’s beef cows
UK Raw Milk Challenges

- 25% failure rate for 170 UK permitted dairies - RAWMI visit 2018
- When visiting, found the problem in 15 minutes
- Raw milk being commingled with milk intended for pasteurization
E coli 0157:H7 Case Study

- Investigators found:
  - No animal health testing documentation for brucellosis and tuberculosis or health permits
  - Beef cattle contact with wild elk
  - No water or wastewater system available at milk barn for milking operations or cleaning
  - No hand washing sinks available for cleaning and sanitizing
  - No bacteriological test results available for the farm's well-water system
  - Mud/manure with standing water at entrance to the milk barn parlor
  - Milking bucket in direct contact with unclean surfaces during milk production
  - Multiple instances providing for the opportunity for cross-contamination
  - No separate milk processing area from domestic kitchen
  - No raw milk warning label provided on containers

Southern Washington 2005
Successful FDA Inspection

- Organic Pastures Dairy - 2019
- Purpose of inspection to:
  - Assure compliance with 10-year-old court order which mandated no shipping of raw dairy products over state lines
  - Assure that dairy was in compliance with new FDA Food Safety Modernization Act (FSMA) regulations
- Inspectors spent four days examining paperwork and swabbing surfaces in on-farm creamery plant
- Total of ~200 samples – swabbed everything, everywhere, searching for pathogens:
  - Under door mats
  - Inside drains
  - Behind doors
  - Behind sinks
- Inspection results: FDA found NO pathogens in any of their tests!
How and Why to Become RAWMI LISTED
The Gold Standard for Raw Milk Producers

- RAWMI LISTED Farms are dedicated to producing clean, safe raw milk
- RAWMI LISTED Farms:
  - Develop a plan for managing the health and hygiene of their farm
  - Test their milk regularly to ensure compliance with the RAWMI Common Standards

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Benefits of RAWMI Listing

- Farmer support
- Continuing education for best practices
- RAWMI LISTED farmers form a like-minded community, providing resources and mutual support
Benefits of RAWMI Listing (cont.)

- Farmer support (cont.)
  - Assistance with trouble-shooting, potential recalls, and media communications
- Access to RAWMI brochures and posters
Benefits of RAWMI Listing (cont.)

- Consumer confidence
  - Informed consumers seek out milk from RAWMI LISTED farms
  - Milk is regularly tested, delicious, and has longer shelf life

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Benefits of RAWMI Listing (cont.)

- Insurance and inspection
  - Lower liability insurance rates
  - Improved relationships with regulators and inspectors
How to Become RAWMI LISTED

- Fill out and submit application
- Application provides general details about the location, climate, size of herd, etc.

### Farmer Application for RAWMI LISTING

<table>
<thead>
<tr>
<th>Farm Contact Information</th>
<th>Please type all information/answers in this column (Column B)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date:</td>
<td></td>
</tr>
<tr>
<td>Farm name:</td>
<td></td>
</tr>
<tr>
<td>Owner:</td>
<td></td>
</tr>
<tr>
<td>Farm manager:</td>
<td></td>
</tr>
<tr>
<td>Street address:</td>
<td></td>
</tr>
<tr>
<td>City:</td>
<td></td>
</tr>
<tr>
<td>State:</td>
<td></td>
</tr>
<tr>
<td>Zip Code:</td>
<td></td>
</tr>
<tr>
<td>Telephone number (farm office):</td>
<td></td>
</tr>
<tr>
<td>Telephone number (cellular):</td>
<td></td>
</tr>
<tr>
<td>Email:</td>
<td></td>
</tr>
<tr>
<td>Website:</td>
<td></td>
</tr>
<tr>
<td>Other internet communication forum (URLs for Facebook, Twitter, etc.):</td>
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<table>
<thead>
<tr>
<th>Herd Information</th>
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<tbody>
<tr>
<td>Are you currently producing raw milk?</td>
<td></td>
</tr>
<tr>
<td>When did you begin producing raw milk for human consumption?</td>
<td></td>
</tr>
<tr>
<td>Have you been in continuous production since that time?</td>
<td></td>
</tr>
<tr>
<td>Total herd size:</td>
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<tr>
<td>Lactating cow herd size:</td>
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<table>
<thead>
<tr>
<th>Owner Experience and History</th>
<th>Please type all information/answers in this column (Column B)</th>
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<tbody>
<tr>
<td>What type of farm or dairy experience did you have prior to producing human milk?</td>
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<tr>
<td>What off-farm expertise do you have (any prior careers and/or special)</td>
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<tr>
<td>Why do you produce raw milk?</td>
<td></td>
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<tr>
<td>What is your personal motivation to produce raw milk?</td>
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<table>
<thead>
<tr>
<th>Environmental Location and Conditions</th>
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<tbody>
<tr>
<td>Describe the climate:</td>
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<td>Temperature range in summer:</td>
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<tr>
<td>Temperature range in winter:</td>
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</tr>
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</table>
How to Become RAWMI LISTED (cont.)

- Create your Risk Assessment and Management Plan (RAMP)
  - Gain knowledge of potential risks in your production system
    - Biosecurity (protecting herd from transmission of disease)
    - Animal welfare, health, and management
    - Milking hygiene
    - Product handling

How to Write a RAWMI RAMP
Producing very low risk raw milk for Human Consumption

Presented by: Mark McAfee
Chairman of the Board, RAWMI

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How to Become RAWMI LISTED (cont.)

- One-on-one mentoring with RAWMI
  - Identifying potential trouble spots
  - Refining your RAMP, Standard Sanitary Operating Procedures (SSOP), and Critical Control Points (CCP)
  - Optimizing your overall operation for low-risk raw milk
How to Become RAWMI LISTED (cont.)

- Test your milk for compliance with RAWMI Common Standards
- Join the community of RAWMI LISTED Farmers!
Strive for Excellence

- Safe raw milk production requires dedication and integrity
- Safe raw milk is a long-term mission
  - Never fully completed or fully perfected
- There will always be something to learn and much to teach