SECTION V: MILK QUALITY

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1. WHAT IS MILK QUALITY?

The quality of the milk produced by your ewes is measured by several aspects:

- The level of bacteria in the milk;
- The number of somatic cells (which are a measure of inflammation or mastitis);
- The freezing point as affected by water contamination;
- Presence of residues of veterinary drugs and other chemicals or toxins, and
- By its colour, flavour and odour

All of these aspects influence the milk's shelf life; its taste and palatability; its safety for the public; the quality and quantity of the cheese and other dairy products that can be made from the milk; and the healthiness of the product.

The factors that determine milk quality are numerous and are within the power of the producer to influence positively. Some of these aspects are regulatory, i.e. measured and enforced by the provincial government (not in Ontario) and all are enforced by the processor or cheese plant, which purchases the milk for processing. For these reasons – and because we all want to produce the best milk possible – the production of high quality milk has to be the number one goal of all dairy sheep producers, their veterinarians and businesses and extension personnel that work with the producers.

1.1 REGULATORY LEVELS IN DIFFERENT JURISDICTIONS

Unlike the dairy cattle and goat industries where bulk tank regulatory levels are strictly regulated and dairy producers must be licensed to ship milk, there are no government regulations for dairy sheep in Ontario but are in other regions in Canada (e.g. Quebec). However, milk processors have the right to reject milk if they do not meet their "in-house" standards.

1.1.1 ACCEPTABLE LEVELS OF SOMATIC CELLS IN SHEEP MILK

Milk quality parameters are not regulated federally in Canada; however Quebec has implemented mandatory standards in their dairy sheep industry. For SCC levels, the acceptable threshold is 750,000 cells/mL. In the US, the acceptable SCC regulatory levels of raw milk set for dairy sheep is the same as in Quebec and is the same as for dairy cattle in that country, i.e. 750,000 cells/mL.

In Ontario, regulatory levels for cattle are lower, i.e. 400,000 cells/mL. It is not known if this level could be achieved by dairy sheep producers and no information exists in this province on average SCC levels in dairy sheep flocks. Dairy cattle produce milk through a merocrine system, so there is less damage to secretory cells in the udder, while both sheep and goats produce through an apocrine system, so that there are inflammatory factors in the milk. With sheep, this is estimated to be 15,000 cells/mL and with goats, 150,000 cell/mL. See Section I.1.2.2 for an explanation of merocrine and apocrine secretion.

1.1.2 ACCEPTABLE LEVELS OF BACTERIA IN SHEEP MILK

Standard plate count (SPC) is a measure of bacteria in raw milk (colony forming units or CFU/mL of milk) and is explained in more detail below (Section V.3). In the U.S., raw milk should have <100,000 CFU/mL, while pasteurized milk should have <20,000 CFU/mL. In Quebec, the allowable level for SPC is 50,000 CFU/mL. In Ontario, goat milk allowable level is 50,000 CFU/mL.

2 SOMATIC CELL COUNT (SCC)

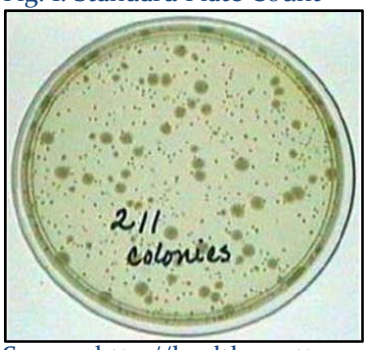
Somatic cell counts and interpretation are covered in Section II.5.3. As they are a measure of the level of mastitis (subclinical to clinical), they are important in milk quality. Mastitic milk has a reduced shelf life, decreased cheese-making ability and a disagreeable taste. The bacteria responsible for mastitis may also pose a risk to the consumer's health.

3 BACTERIAL CONTAMINATION OF MILK AS MEASURED BY STANDARD PLATE COUNT

3.1 WHAT DOES THE STANDARD PLATE COUNT MEASURE?

Standard Plate Count (SPC) is a standardized measurement of bacterial contamination of milk, and is taken on-farm at each bulk milk pickup or a pooled sample taken from milk thawed after previously being frozen in buckets. By measuring a raw pooled milk sample using SPC, the total number of bacteria in that milk sample is calculated. This type of quality standard is the same whether cattle, sheep or goats. It does not determine what types of bacteria are affecting the milk, or where the bacteria are coming from, but it does give a good indication that there is an issue with milk quality on-farm.

Fig. 1. Standard Plate Count



Source: http://healthyeasttx.org/

3.2 HOW IS SPC MEASURED?

SPC is a measure of the number of live, aerobic bacteria present in a milk sample. After the pooled milk is aseptically sampled (with no preservative), it is chilled and sent to a designated laboratory for testing. A measured milk sample is diluted with sterile water and then a specific amount of this mixture is streaked onto plates containing a nutrient media (agar), which allows any live bacteria present in the milk to grow. The plate is incubated aerobically for 48 hours in a warm environment. Each bacterium forms a colony on the plate, which can be seen and counted with the naked eye (Fig. 1). SPC is measured as a colony-forming unit (CFU) per mL of milk (also covered in Section II.5.4.2). The number of colonies on the plate = the number of live bacteria which can grow in air (aerobic) in that volume of milk. This is then arithmetically calculated so that the number of bacteria per mL/milk is obtained.

While regulatory limits in different jurisdictions vary, it is possible and preferable to keep bacterial counts less than 10,000 CFU/mL. High bacterial counts cause the milk to spoil more quickly, interfere with cheese making and can pose a public health risk.

3.3 HOW DOES SPC COMPARE TO OTHER MEASURES OF BACTERIAL CONTAMINATION?

SPC is not usually a measure of mastitis but rather associated with both poor milking and equipment hygiene. However, there are times both SPC and SCC increase at the same time, such as when the flock has a higher prevalence of subclinical mastitis, caused by environmental pathogens (see Section II.3.2).

3.3.1 BACTERIA NOT MEASURED BY SPC

SPC does not measure all bacteria in milk, i.e. it does not measure the number of dead bacteria; bacteria which grow only anaerobically (without air); nor other organisms such as algae (prototheca) and yeasts.

3.3.2 BACTOSCAN

In dairy cattle and dairy goats, bacterial numbers in milk are measured using a system called Bactoscan. This is an automated counter similar to an SCC counter, and counts individual bacteria thus giving a more accurate and less labour intensive measure of bacterial contamination of milk.

Fig. 2. Bactoscan

Source: http://www.agentek.co.il/catalog.php?id=3934

3.3.3 PLATE LOOP COUNT

In some cases SPC is not performed by a laboratory but rather the less accurate plate loop count (PLC) or the spiral plate count (SPL). Although these alternative tests are effective in monitoring bacterial counts in pooled milk, the PLC is not as precise. Whenever possible, SPC should be performed rather than PLC or SPL.

3.3.4 LABORATORY PASTEURIZED COUNT

The laboratory pasteurized count (LPC) is essentially the same test as the SPC, but the milk is first pasteurized (72 °C (161 °F) for 15 sec). Generally, this test is done on samples if the SPC levels are high, e.g. > 50,000 CFU/mL. In some cases, the LPC levels are normal, as all bacteria have been killed at the time of pasteurization, however often the LPC is elevated leading to milk quality issues. If the SPC is high, LPC also tends to be high. Pasteurization is not a complete fix for poor milk quality.

3.3.5 PRELIMINARY INCUBATION COUNT

Preliminary Incubation Count (PIC) is a milk quality measurement on raw milk that attempts to mimic what happens to milk if it is not refrigerated properly. This test is similar to SPC; however, the milk is only incubated for 18 hours, and at a lower temperature. It is rarely used to assess milk quality.

Fig. 3. Udder and teat preparation

3.4 WHAT ARE THE USUAL SOURCES OF HIGH BACTERIAL COUNTS IN MILK?

High bacterial counts in pooled milk are correlated with poor milking hygiene, inadequate maintenance of milking equipment, and to a lesser extent, udders with intramammary infections. If there are residues or films of milk or milk stone on any milking equipment, bacteria can grow and affect the SPC levels in a bulk

tank. Specifically, the following are more common sources of high bacterial counts:

- Poor udder preparation prior to milking, including dirty udders and wet teats
- Unsanitary milking equipment, including milking claws, pipelines and hoses
- Inflations that are overused, and cracked, causing bacteria to become trapped
- Bulk tanks or buckets that are unsanitary, and not maintained at the proper temperature for cooling milk can drastically increase the bacterial count in tanks
- Buckets of pooled milk that are not frozen quickly and / or not kept frozen
- Water heaters in the sanitation system that do not reach optimal temperature or that have insufficient capacity for the entire cleaning process
- Udder infections primarily caused by environmental pathogens such as *Streptococcus uberis* and *Streptococcus dysgalactia* – both uncommon udder pathogens in sheep.
- Increased external temperature and humidity

3.5 TROUBLE-SHOOTING HIGH BACTERIAL COUNTS IN MILK

There are many sources of high bacterial counts, many of them associated with milking equipment, sanitation processes and milk storage. It is important to monitor these sources closely to maintain an appropriate SPC in dairy sheep milk.

Fig. 4. Bacteria in cracks in liner

Fig. 5 Worn liner

3.5.1 TEAT CUP INFLATIONS (LINERS)

Inflation quality can have a significant effect on bacterial counts in milk. If there is significant wear over time, the inflation can harbour pathogens that can be transferred to the teat end (Fig. 4). Common places of increased bacterial counts in inflations are cracks in the liner, specifically the short milking tube, or general surface roughness along the liner. All inflations should be changed on a regular basis to ensure that they are always in optimal condition (Fig. 5; Fig. 6). See Section IV.3.2.1 for details.

3.5.2 EQUIPMENT CLEANLINESS

It is important to keep milking units as clean as possible during milking to ensure that manure or debris do not enter the claws, and into the milk line. Proper udder cleanliness before milking will decrease the chance of bacteria entering the milking units. In addition, water hoses should be installed in the milking parlour to rinse milking units if they become excessively dirty.

Fig. 6. Milk inside shells

BIOFILMS, MILKSTONE AND OTHER DEPOSITS

Biofilms and deposits are build-ups that occur in the milking system due to improper cleaning that are relatively difficult to remove without proper sanitation, and can increase bacterial counts in the bulk tank (Fig. 7). Biofilms, although visually difficult to detect in the milking lines, can be successfully removed with oxidizing cleaning solutions. Mineral deposits are

inorganic salts of minerals, and can increase significantly if the water in the wash system is particularly hard, or if the cleaning solutions are not being used as directed. If these mineral deposits are not removed, and interact with the milk components, milkstones may begin to form (Fig. 8). The acid-rinse portion of the cleaning process helps to properly remove these deposits from the milking system. This is covered in detail in Section IV.2.

Fig. 7. Film inside bulk tank

PROPER DRAINAGE FROM LINES

When sanitizing the milking system, it is important that all areas of the milking equipment are washed correctly. Along with the washing correctly, it is important that all washing liquids drain correctly from the system. Bucket milking systems need to check and clean the vacuum line regularly. Over-filling a bucket mlker may cause milk residue to enter the vacuum line. Bucket milk pulsator check valves may still allow milk residue to enter the vacuum line. In pipeline systems a split liner may results in vacuum line residues (Fig. 9).

Fig. 8. Milkstone in line

Any pooled liquids can result in increased bacterial counts in the milking equipment, and can be transferred into the bulk tank. There any various places in the milking equipment that could harbour pooled fluid, and it is important to check them regularly to ensure that they are functioning properly.

Fig. 9. Milk in vacuum line

PAILS FOR HAND MILKING

Ensuring that pails are sanitized properly before milking is critical to keep bacterial counts low. This is especially true with hand milking pails, as these are open systems that are constantly exposed to the environment. Between milkings, it is important to store pails upsidedown so debris and flies do not fall into the bucket.

First perform a warm rinse. Then use hot chlorinated alkaline dairy detergent with vigorous brush cleaning, followed by a rinse with dairy acid. Let dry thoroughly before stacking / nesting together. Milking pails that are made of stainless steel are preferred over other types of buckets, such a plastic. The stainless steel will not scratch or become indented easily, which will decrease the chance of bacteria harbouring in these areas. If the pails become damaged, or if they are in rough condition from excess use over time, they should be replaced with new pails.

Fig. 10. Filling a milk pail

PAILS FOR STORING FROZEN MILK

It is probably quite variable how clean the pails are when returned to the farm from the processor. If pails do not appear clean the cleaning procedure would be to first perform a warm rinse. Then use hot chlorinated alkaline dairy detergent with

vigorous brush cleaning, followed by a rinse with dairy acid. Let dry thoroughly before stacking / nesting together. If pails get nested together before they are dry, mold will start quickly. Lids and pails should be stored on the farm where they don't get dirty or dusty (e.g. in the milk house).

If pails are clean when returned from the processor then sanitize the pail and lid with chlorine prior to filling the pails.

Fig. 11. Wash water hot enough?

3.5.3 WATER TEMPERATURE FOR CLEAN-UP

Water temperature during the cleaning and sanitation process must be hot enough to ensure cleaning chemicals work effectively (Fig. 11). As a rule, wash water should not drop below **49 °C (120 °F).** Tank capacity should be sufficient that water is still hot at the end of the wash cycle (Fig. 12). See Section IV.2 for details.

Fig. 12. Tank big enough?

It is important that cleaning systems that are automatic are programmed properly by a manufacturer representative to ensure that the system is at the correct temperature and that each cleaning cycle is being run for an appropriate period of time.

3.5.4 WATER QUALITY

Fig. 13. Water quality is important

It is important to ensure that the water that is being used for cleaning and sanitizing has low bacterial and coliform counts. Abnormally high counts can be common with well water on farms, and this can lead to high bacterial counts in the bulk tank. It is important that water used in both cleaning and sanitizing washes is from a potable water supply. Although this water supply should have appropriate bacterial counts, a proper sanitizer should be mixed with the water to ensure that the equipment is being sanitized properly.

Fig. 14. Teat cups should be secure

Additionally, hard water will cause build-up of scale inside the milk-lines making cleaning more difficult. It will also require a higher concentration of cleaning solutions to be used to be effective. It will also build-up inside the water heater, decreasing its efficiency and ability to rapidly heat water. Consider installing a water softener if the water is too hard (more than 30 grains per gallon).

3.5.5 TEAT CUPS FALLING OFF DURING MILKING

In milking parlours, there is a chance that teat cups will fall off during milking, primarily with agitated ewes kicking them off. It is important to ensure that ewes, especially those in their first lactation, are milked in a calm environment to minimize

nervousness and stress. This will decrease the chance of teat cups falling to the floor of the parlour stall. If the units do fall off during milking, it is important to spray them completely and try and remove any debris before reattaching them.

3.5.6 AIR INJECTOR SETTINGS

Air injectors are used to force the wash solution slug out to reach the entire milking system, and reach the milking receiver jar. Any variations in this air injector will alter the ability of the solution to be distributed throughout the entire milking system, and bacteria may grow in the unsanitized areas. The cleaning solution slug should have a velocity of approximately 25 – 30 ft/sec, and if it is not at this level, the air injector should be altered.

Fig. 15. Keep air injectors clean

3.5.7 COOLING OF THE MILK IN THE TANK

Ensuring that the bulk tank is cooling milk properly is essential to maintain the milk quality before it is shipped. Appropriate cooling temperature also decreases the chance of increasing bacterial counts in the milk. It is important to have a consistent temperature during milking, and during storage time so bacterial levels do not fluctuate (Fig. 16).

Fig.16. Temperature of milk tank

SPEED OF ACHIEVING THE PROPER TEMPERATURE

Cooling of milk should occur rather quickly after milking, to ensure that bacterial counts are low. The cooling mechanism of a bulk tank should be programmed so milk is cooled within one hour of the beginning of milking, and this temperature should remain consistent until the milk is picked up for shipment.

MAINTAINING THE PROPER TEMPERATURE

Temperature in a bulk tank should remain between 1 - 4 °C (34-40 °F) at all times, with temperatures in the lower range for extended storage times. Ideally, temperature should not be consistently over this temperature, or bacterial counts will begin to rise (Fig. 17).

Fig. 17. Time temperature recording

FLUCTUATIONS IN OR UNEVEN TEMPERATURE

Although the bulk tank should be maintained below 4 °C (40 °F), there will be some fluctuations when new milkings are added to the bulk tank. During milking times, it is common for this blended milk to be held at approximately 7 °C (45 °F). Once it has been agitated properly, milk temperature should drop to the 4 °C (40 °F) benchmark.

EFFECTS OF STORAGE OVER LONG PERIODS

Although milk is generally picked up every second or third day on-farm, there could be times where milk is stored for an extended period of time. Even though this milk will be kept below 4 °C (40 °F),

there is still a chance that bacterial counts will rise. For example, Pseudomonades have the capability of growing at relatively low temperatures, so if milk is stored for an extended period of time in a cooled environment, there is a chance for bacterial growth. Farms, whose milk is picked up every 4 to 7 days, are particularly at risk of this problem. Storing milk as close to 1 °C without freezing will help keep SPC low.

Fig. 18. Milk containers in freezer

3.5.8 FREEZING OF THE MILK IN CONTAINERS[1]

CONTAINERS USED TO FREEZE MILK

The container (e.g. buckets or pails) should be food grade and in good condition. Each container must be uniquely identified along with having the farm identification clearly indicated on the container and lid. Do not use containers that previously held another food as the odour in the plastic may taint the milk.

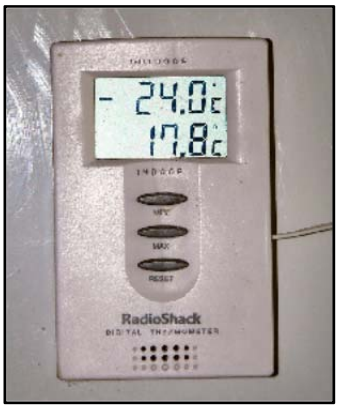
Plastic liners (e.g. bags) may be used but should be of a sturdy grade to prevent tearing and disintegration after freezing. They should be single use. The outside, as well of inside of the containers must be clean and free of organic material. The inside should also be free of any chemical residue or residual water from the cleaning protocol. To learn about cleaning the containers, see Section IV.2.5.2.

Fig. 19. Milk should be cooled prior to freezing

ACHIEVING THE PROPER TEMPERATURE

To facilitate rapid freezing of a significant volume of milk (e.g. several litres), first chill the milk to at least 4 °C before putting into containers for freezing. The milk should be chilled to 10 °C or less within 1 hr of the commencement of milking and to 4 °C or less within 2 hrs after milking is completed. Warm milk put immediately into the freezer may not freeze properly in the middle, leading to spoiling of the milk. Chilled milk that is to be frozen must be frozen within 72 hrs of milking. It must remain in a frozen state until it is received by the processor.

Fig. 20. Freezer "in-door / out-door" thermometer



MAINTAINING AND MONITORING THE PROPER TEMPERATURE

Once frozen, milk should remain at a consistent temperature until it is sent for processing. Ideally, milk should be kept at temperatures at or below -27 °C (-10 °F), allowing for storage for 6 to 12 months. If stored in a home freezer (i.e. -12 °C (10 °F), storage time is limited to 3

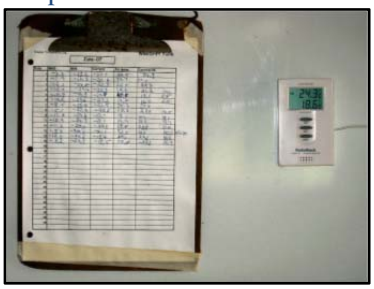
[1] National Dairy Code 5th edition: http://www.dairyinfo.gc.ca/index_e.php?s1=dr-rl&page=canada

months. If temperatures increase significantly, the milk may separate and will not able to be processed correctly.

If milk is to be added to a container containing frozen milk, it must first be chilled to 4 °C or less, prior to adding. This is to prevent thawing of the frozen milk which may cause spoiling.

Daily records must be kept of the freezer temperature. As part of the **Canadian Sheep and Lamb Food Safe Farm Practices** program, forms are available for recording freezer temperatures[2]. Many other useful forms are also available. It is strongly recommended that all dairy sheep producers enrol in this program.

Fig.21. Record freezer temperatures



REQUIREMENTS OF THE ON-FARM FREEZER

The freezer unit must be equipped with an accurate temperature-measuring device, ideally with an alarm system if the freezer should fail or the temperature goes too high (Fig. 21). Freezers and storage racks need to be free of corrosion or other signs of deterioration, and must be kept sanitary.

3.5.9 UDDER CLEANLINESS

Udder cleanliness has been covered in Section III.1.1.

3.5.10 HAND-MILKING CLEANLINESS

Hand milking has been covered in Section II.4.9.2 and Section III.5.

3.5.11 MASTITIS AS A CAUSE OF HIGH BACTERIAL COUNTS IN THE MILK

Fig. 22. Mastitic milk

It is less common for high bacterial counts to be directly attributable to bacteria shed with the milk. Although these bacteria contribute to the SPC, usually the number is low and is rarely responsible for levels in violation. Exceptions to this are infections with some environmental bacteria, specifically *Strep. uberis* and *Strep. dysgalactia*. These bacteria were previously covered in Section II.3.2.1.

Wet and dirty barns or pastures, failure to properly clean and disinfect udders and teats prior to milking, and failure to effectively teat dip post-milking contribute to the risk of sheep contracting this type of mastitis. Failure to properly identify infected udders and treat or cull the responsible ewes will increase this problem in the flock as well. Screening for mastitis of all causes should be part of your udder health program and will also identify these animals.

[2] http://www.cansheep.ca/cms/en/Programs/FoodSafeFarmPractices/FoodSafetyFarmPractices.aspx

3.5.12 FLY CONTROL

Flies are attracted to organic material, e.g. milk and manure – and can transfer bacteria between these two materials. They will bite teats and transmit mastitis pathogens. Care should be taken to keep flies out of buckets and bulk tanks. Reduce fly populations by trapping, using premise sprays for use in livestock facilities and keeping the barn clean. Dead stock composting facilities should be kept away from the parlour and livestock rearing areas.

Fig. 23. Hand-milking bucket with flies

Fig. 24. Fly control is important to udder health

3.6 OTHER BACTERIAL MEASURES OF MILK QUALITY

3.6.1 COLIFORM COUNTS

Coliform counts are a measure of the number of coliform bacteria that grow on either MacConkey's agar, or violet red bile agar after being incubated for 48 hours. These bacteria originate from environmental sources, particularly manure and may be *Escherichia coli* – i.e. *E. coli, Salmonella*, *Klebsiella* (found in dirty sawdust and shavings), *Enterobacter* and *Pseudomonas*. While these bacteria do cause mastitis, the number of bacteria shed in the milk from this source tends to be low as most are killed by the inflammatory process in the udder. Rather, these counts are usually indicative of unsanitary issues during milking, such as udders or milking units contaminated with manure.

There are no regulatory standards for coliform counts in raw milk. Some processors and buyers will use the standard of under 100 CFU/mL.

4 FREEZING POINT

Adulteration of milk refers to the addition of a substance to the milk, which negatively affects its quality. One main concern with pooled milk is the addition of water to the milk, which is generally done unbeknownst to the producer. However, addition of water may be unusual – rather the larger risks are listed below:

- Malfunction of the bulk tank and pipeline cleaning system
- Freezing of milk in the bulk tank
- Washing of buckets but not properly drying before filling with milk.

Excess water in the milk is monitored by using freezing point, or cryoscope measurement. The freezing point is measured in degrees Hortvet or Celsius. Research by the International Dairy Federation found the average freezing point for sheep milk was -0.545° C (-0.49 to -0.584).

5. DETECTION OF INHIBITORS AND OTHER CHEMICALS

Milk samples may be tested by the processor for presence of chemicals in the milk, which inhibit the growth of bacteria. These "inhibitors" are usually antibiotics but may also be disinfectants. Other chemicals include veterinary treatments, e.g. dewormers (anthelmintics), treatments for external parasites, NSAIDS. Use of veterinary drugs, the rules, regulations and risks are covered in more detail in Section VI.3.

Presence of inhibitors is very damaging to milk quality. It may prevent cheese making, and presence of some drugs may cause an allergic response in people consuming affected milk products. Usually the tank is discarded but if transported by milk truck, the entire contents of the truck may need to be discarded. Often fines are assessed by the processor to recoup losses from presence of inhibitors.

Below is a table modified from the OMAF Factsheet "Troubleshooting Antibiotic Residues in Goat Milk"[3] . More information on avoiding residues is covered in Section VI.

Table V.1. Troubleshooting antibiotic residues in milk

CAUSES	SOLUTIONS
A) Milk from treated ewes enters the bulk tank before the end of the milk withdrawal period	
No permanent written records of treatments	Keep a permanent record of treatments. Use the Food Safe Farm Practices program[4] and recording system. Keep the records in or close to the milking parlour so that information can be easily checked.
Forgetting the ewe was treated **Poor identification of the treated ewe**	Mark all treated ewes in an easily recognized manner (Fig. 25). The identification should be easily seen while milking the ewe (e.g. leg band), be semi-permanent and removable once the withdrawal period has ended. Livestock crayon is likely not a good idea for these reasons.
Poor communication between the person who administers treatments and the person who milks	Information on all treated animals should be written on a blackboard or posted on a bulletin board near the milking parlour so all people can easily find the information (Fig. 25).
Milking one half when the other half was treated with an intramammary product	Because the antibiotics are absorbed into the body, they may also be present in the other untreated half. Keep both halves out of the tank.
The milk line is used as a vacuum source to milk the treated ewe, when using a trap bucket to withhold the milk	Check with the equipment supplier to see whether the pulsator on the bucket can be adapted to provide vacuum to the trap bucket.
Separate milker unit not used for treated ewes	Milk the treated ewes last, or with separate equipment to ensure no contaminated milk can enter the milk supply (Fig. 26).

[3] http://www.omafra.gov.on.ca/english/livestock/goat/facts/info_trshtaresgtm.htm
[4] http://www.cansheep.ca/cms/en/Programs/FoodSafeFarmPractices/FoodSafetyFarmPractices.aspx

CAUSES	SOLUTIONS
Milker unit not cleaned properly between treated and untreated ewes	Thoroughly clean the milking unit between treated and untreated ewes.
Treated dry ewes not managed separately from milking ewes (Fig. 27)	Keep dry ewes separate from milking ewes so don't accidently enter the parlour. Identify dry ewes (e.g. leg band) as soon as dry treated so not accidently milked.
B) Prolonged drug withdrawal time because antibiotics used improperly or without appropriate guidance	
Antibiotics are used at an increased dose, frequency or duration of treatment, different route of administration than indicated on the drug label	Use antibiotics in lactating dairy ewes only with a veterinary prescription from your flock veterinarian and with a valid veterinary client patient relationship (VCPR).
Using antibiotic drugs not approved for lactating dairy ewes[5]	Only use antibiotics within a valid VCPR. If not sure if withdrawal time is sufficient, request milk testing for inhibitors using an approved test.
Purchase ewes that were previously treated	Purchase only from farms on the Canadian Sheep and Lamb Food Safe Farm Practices program. Ask vendor for treatment records. Test the milk of ewes with an unknown treatment history.
Dry ewes which have been "dry treated", lamb earlier than withdrawal time for product	Keep and consult records of all withdrawal dates for dry-treated ewes and dates of "safe to go in the tank". Consult flock veterinarian if this occurs.
Feeding medicated feeds	Medicated feeds should be clearly labelled and stored away from milking flock feeds. Feed handling equipment should be cleaned between types of feeds.
Inadequate udder preparation when topical antibiotic products are used	Follow proper protocols for udder preparation. Only use topical antibiotics on the advice of the flock veterinarian.

Fig. 25. Treatment record from the Canadian Sheep and Lamb Food Safe Farm Practices program (left). Identify treated animals (centre). Communicate with milkers (right)

[5] No antibiotics are licensed for use in lactating dairy ewes in Canada. Extrapolation of withdrawal times for products licensed for dairy cows must be done on the advice of the flock veterinarian with a valid VCPR.

6. MILK ODOUR AND FLAVOUR

While mastitis does cause off-flavours, other natural compounds found in sheep milk are also responsible for a "barny" taste to the milk. Sheep milk tends to have higher levels of certain "smelly" compounds – in particular cresols, than cattle. Feeds may influence the level of cresols in the milk. Other factors that can influence flavour in a negative manner are high grain diets, which result in SARA (see Section I), corn silage, weeds, poor air quality. Low vitamin E will result in an oxidized "cardboard" flavour to the milk.

Fig. 26. Milk treated animals separately by hand or by bucket

Fig. 27. Separate dry ewes from milking. Use strict milking order. Keep dry period products separate from milking.