Section 2

Wastewater Characteristics

Both the amount and concentration of milking center wastewater are variable from farm to farm and even from season to season on the same farm. Variations in the amount of water depend on the amount of water used to wash the cows' udders, the milking equipment, and the milking parlor; to precool the milk (when cooling water is disposed of); and to provide water softening back flush in some systems. Other additions to the volume can come from the disposal of waste milk and manure left by the cows in the parlor or holding area. To help minimize the amount of water used and to reduce the size of the treatment system, the volume of wastewater can be reduced by reusing washwater to clean the floors, keeping cows' udders clean to minimize extra washing, using the correct amount of water for washing-equipment cycles, scraping manure out before using a hose to clean the parlor floor, and avoiding adding precooler water to the waste stream. Table 1 shows the ranges of water use common to milking centers. Milking more often than twice a day will add additional wastewater.

Estimating the Amount of Wastewater Produced

The work sheet (pages 4–5) allows one to estimate by several methods the amount of wastewater produced. In some instances the amount of water used can be determined by catching it in a container of known size. This is one way of calculating the volumes directly. Another way of calculating the volume is to determine the flow rate by directing the flow to a container and timing it and then multiplying that rate by the total time that flow is used. Sometimes the volumes of water used can be obtained from the manufacturer's rating on equipment. An accurate way to determine actual water use is to borrow a water meter and install it for several weeks in the water line to the milking center.

Table 1
Wastewater generation from washing operations

Washing Operation	Approximate Wastewater Generated (units vary)
Bulk tank	5% of bulk tank volume
Automatic	50–60 gallons/wash
Manual	30–40 gallons/wash
Milk pipeline[a]	75–125 gallons/wash
Milking system Clean-in-Place (CIP) (parlor)	12–20 gal/unit, four-cycle cleaning
Bucket milkers	30–40 gallons/wash
Miscellaneous equipment	30 gallons/day
Back flush	1 gallon/cow milked/milking
Cow prep	
Automatic	1–4.5 gal/cow-milking
Manual	0.25–0.5 gal/cow-milking
Wash pen	3–5 gal/cow-milking
Milk house floor	10–20 gal/day
Parlor floor (hose down)	50–100 gal/wash
Parlor floor and cow platform	
High-pressure or high-volume hose	500–1,000 gal/wash
Parlor and holding area floor with flushing	
Parlor only	20–30 gallons/cow-day
Parlor and holding area	25–40 gallons/cow-day
Holding area only	10–20 gallons/cow-day
or Automatic flushing	1,000–2,000 gal/wash

[a] Volume increases for long lines in large stanchion barns.
Sources: adapted from MidWest Plan Service, 1985; Reinemann and Springman, 1992.

Milking Center Wastewater Work Sheet

1. Bulk tank

manufacturer's rating

= _____ gallons/wash

or measured amount

= _____ gallons/wash

or 5% of bulk tank volume

= _____ gallons/wash

or guess = _____ (30–60) gallons/wash

= volume used _____ gallons/wash

x _____ washes per day

= _____ gallons per day

2. Milking system CIP

Include prerinse (if included in wastewater flow), wash, acid rinse, and sanitize cycles. See DPC Guideline 2, *Guidelines for Effective Installation, Cleaning, and Sanitizing of Milking Systems.*

manufacturer's rating

= _____ gallons/wash

or measured amount

= _____ gallons/wash

or guess = _____ (75–300) gallons/wash

= volume used _____ gallons/wash

x _____ washes per day

= _____ gallons per day

3. Milk house

3a. Bucket milkers

measured amount

= _____ gallons/wash

or guess = _____ (30–40) gallons/wash

= volume used _____ gallons/wash

x _____ washes per day

= _____ gallons per day

3b. Milk house floor

measured amount

= _____ gallons/wash

x _____ washes per day

= _____ gallons per day

or guess = _____ (10–20) gallons/day

volume used = _____ gallons per day

4. Parlor

4a. Cow prep (automatic)

manufacturer's rating

= _____ gallons/cow-milking

or measured amount

= _____ gallons/cow-milking

or guess = _____(1–4.5) gallons/cow-milking

= volume used _____ gallons/cow-milking

x _____ cow-milkings per day

= _____ gallons per day

or cow prep (manual)

measured amount

= _____ gallons/cow-milking

or guess = _____ (0.25–0.5) gal/cow-milking

= volume used _____ gallons/cow-milking

x _____ cow-milkings per day

= _____ gallons per day

or cow prep (wash pen)

measured amount

= _____ gallons/cow-milking

or guess = _____ (3–5) gal/cow-milking

= volume used _____ gallons/cow-milking

x _____ cow-milkings per day

= _____ gallons per day

4b. Back flush

manufacturer's rating

= _____ gallons/cow-milking

or measured amount

= _____ gallons/cow-milking

or guess = _____ (1 gallon)/cow milked/milking

= volume used _____ gallons/cow-milking

x _____ cow-milkings per day

= _____ gallons per day

4c. Parlor floor (hose wash-down)

measured amount

= _____ gallons/wash

or guess = _____ (50–100) gallons/wash

= volume used _____ gallons/wash

x _____ washes per day

= _____ gallons per day

or parlor floor and cow platform with a high-pressure hose

measured amount

= _____ gallons/wash

or guess = _____ (500–1,000) gallons/wash

= volume used _____ gallons/wash

x _____ washes per day

= _____ gallons per day

or parlor cow platform and holding area floor with flushing

measured amount

= _____ gallons/flush

or guess = _____ (1,000–2,000) gallons/flush

= volume used _____ gallons/flush

x _____ flushes per day

= _____ gallons per day

4d. Manure produced in parlor and holding area

manure produced

= _____ gallons per cow per day

x percent of time in parlor and/or holding area

_____ percent of the day divided by 100

= _____

= _____ gallons of manure per day

– _____ gallons of manure removed by scraping or channeling

= _____ gallons per day

5. Milk wasted

measured amount

= _____ gallons/milking

or guess = _____ gallons/milking

= volume used _____ gallons/milking

x _____ milkings per day

= _____ gallons per day

6. Feed spilled

measured amount

= _____ gallons/milking

or guess = _____ gallons/milking

volume used _____ gallons/milking

x _____ milkings per day

= _____ gallons per day

7. Cooling sprays

measured amount

= _____ gallons/minute

or guess = _____ gallons/minute

= volume used _____ gallons/minute

x _____ minutes per day

= _____ gallons per day

8. Other water sources

measured amount

= _____ gallons/milking

or guess = _____ gallons/milking

= volume used = _____ gallons/milking

x _____ milkings per day

= _____ gallons per day

9. Total wastewater, manure, milk, and feed entering the waste treatment handling system (total # 1–8)

= _____ **gallons per day**

The concentration of wastewater depends on the amount of dilution and the amount of contaminants added. If a liberal amount of water is used to wash down the milking parlor, or if all the precooler water is sent down the milk house drain, this can dilute an otherwise strong concentration by adding a large volume of clean water. Reducing the amounts of milk, manure, and feed that go down the drain can significantly reduce the concentration of the wastewater. Controlling the addition of milk to wastewater is especially critical. Milk has a five-day Biochemical Oxygen Demand (BOD_5) of 100,000 mg/l. This high BOD_5 makes treatment of wastewater with a large amount of milk very difficult. A high BOD_5 means that it takes a lot of oxygen to degrade the waste. With all the oxygen used up, the waste turns into an anaerobic environment accompanied by bad odors and slower treatment. It is important for the health of any wastewater treatment system to reduce the amount of milk going into it.

Manure has a BOD_5 of around 20,000 mg/l. While lower than the BOD_5 of milk, this is still high compared to household waste that has a BOD_5 of 300 mg/l. The fibers in the manure are more stable and don't demand as much oxygen as milk, but these solids do fill settling tanks and plug soil pores. It is important to keep the amount of manure in the wastewater as low as possible. Scraping the manure off the floor of the parlor to add it to the rest of the manure before hosing down the parlor floor will help prevent problems in the wastewater treatment system.

Table 2 shows average values for the waste characteristics of milking center wastes. These values will be different depending on the amount of water used and the amount of waste materials introduced. Both of these factors are within the control of the management on the farm. Ranges in the amount of wastewater produced per cow, as shown in table 2, and in the BOD_5 of the wastewater (400 mg/l to 10,000 mg/l) demonstrate that these values can be controlled and reduced to a certain extent. Table 2 shows the increases in concentrations that occur when water from the milking parlor and especially the holding area cleanup is included in the wastewater system. Such differences in the concentration of the wastewater should be taken into account in selecting and designing the treatment system.

Table 2
Dairy waste characterization—milking center

Component	Units	Milk House Only	Milk House and Parlor	Milk House, Parlor, and Holding Area [a]	Milk House, Parlor, and Holding Area [b]
Volume	ft ^{3}/day/1,000#	0.22	0.60	1.40	1.60
Water volume	gal/day/1,400 lb cow	2.3 [c]	6.3 [c]	14.7 [c]	16.8 [c]
Moisture	%	99.72	99.40	99.70	98.50
Total solids	% wet basis (w.b.)	0.28	0.60	0.30	1.50
Volatile solids	lb/1,000 gal	12.90	35.00	18.30	99.96
COD (chemical oxygen demand)	lb/1,000 gal	25.30	41.70	–	–
BOD_5	lb/1,000 gal	–	8.37	–	–
N	lb/1,000 gal	0.72	1.67	1.00	7.50
P	lb/1,000 gal	0.58	0.83	0.23	0.83
K	lb/1,000 gal	1.50	2.50	0.57	3.33

[a] Holding area scraped and flushed—manure excluded.
[b] Holding area scraped and flushed—manure included.
[c] These values may vary by up to 500%.
Source: Soil Conservation Service, 1992.