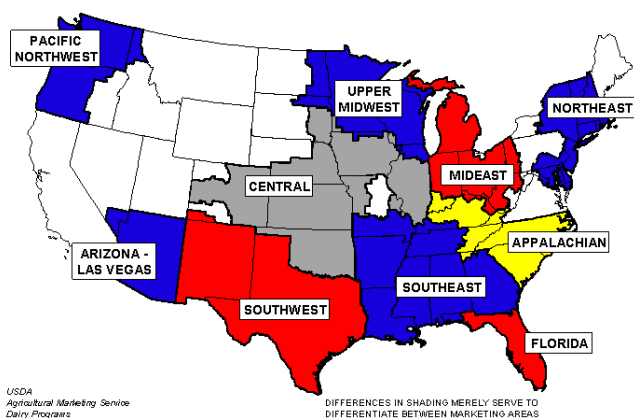


Determining U.S. Milk Quality Using Bulk Tank Somatic Cell Counts, 2005

The USDA's Animal and Plant Health Inspection Service's Centers for Epidemiology and Animal Health—in conjunction with USDA's Agricultural Marketing Service and the NMC's (formerly the National Mastitis Council) Milk Quality Monitoring Committee—monitor U.S. milk quality utilizing bulk tank somatic cell count (BTSCC) data provided by 4 of the Nation's 10 Federal Milk Marketing Orders (FMOs¹) (figure 1).

Figure 1. Consolidated Federal Milk Marketing Order Areas



BTSCC refers to the number of white blood cells (leukocytes) and secretory cells per milliliter of raw milk and is used as a measure of milk quality and as an indicator of overall udder health. High BTSCCs can negatively impact cheese yield and reduce the quality and shelf life of pasteurized fluid milk. To ensure high-quality dairy products, BTSCCs are monitored in milk shipments from producers, using minimum standards outlined in the U.S. Pasteurized Milk Ordinance. The legal maximum BTSCC for milk shipments from Grade A

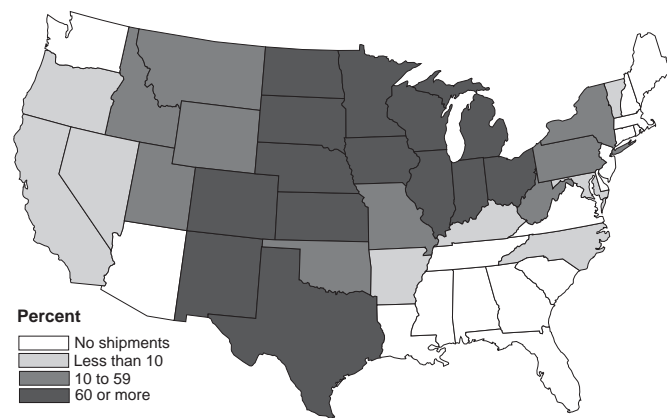
¹ Federal milk marketing orders are administrative units made up of groups of States and were established under the authority of the Agricultural Marketing Agreement Act of 1937, as amended. Their purpose is to stabilize markets by placing requirements on the handling of milk; data are collected to provide accurate information on milk supplies, utilization, and sales. Monitored orders were Central, Mideast, Southwest, and Upper Midwest.

producers is 750,000 cells/ml. Producers with two out of four shipments that test above the 750,000 limit (usually tested 30 to 45 days apart) receive a written notice and must have an additional sample tested within 21 days. If three of the last five counts exceed the maximum, then regulatory action is required. Regulatory actions include one of the following: 1) producer permit is suspended; 2) milk in violation is not sold as Grade "A"; or 3) a monetary penalty is assessed.

Monitored FMOs

In 2005, four FMOs were monitored: Central, Mideast, Southwest, and Upper Midwest. These FMOs monitored milk from 39,335 producers located in 31 States and accounted for 83.0 billion pounds, or 46.9 percent, of the 177.0 billion pounds of milk produced in the United States in 2005. Each of the 31 States marketed at least one shipment through the monitored FMOs during 2005 (figure 2). Fourteen States (Colorado, Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Nebraska, New Mexico, North Dakota, Ohio, South Dakota, Texas, and Wisconsin) marketed more than 60 percent of the milk produced in their States through the monitored FMOs.

Figure 2. Percentage of Total Milk Production Shipped Through Monitored FMOs by State, 2005



There were 425,349 milk shipments monitored in 2005 (table 1). The Upper Midwest FMO accounted for 43.0 percent of the milk monitored and 20.2 percent of milk produced in the United States. The Upper Midwest and Mideast FMOs had a higher percentage of shipments relative to the amount of milk. The reverse was true for the Southwest FMO, where 2.6 percent of the shipments accounted for 15.7 percent of the monitored milk, which reflects the larger herd sizes in the Southwest FMO.

Table 1. Pounds of Milk and Shipments Monitored During 2005

FMO	Milk		Pct. U.S.	Shipments	
	Pounds (billions)	Pct.		Number (1,000)	Pct.
Upper Midwest	35.7	43.0	20.2	230.3	54.2
Central	15.3	18.5	8.7	68.0	16.0
Mideast	19.0	22.8	10.7	115.9	27.2
Southwest	13.0	15.7	7.3	11.1	2.6
Total	83.0	100.0	46.9	425.3	100.0

Calculation of geometric mean

All BTSCC data in this report are presented as the geometric mean. The geometric mean, rather than the arithmetic mean, has been recommended when evaluating BTSCCs to decrease the variation or impact that high or low BTSCCs would have on the mean.

Calculation of the geometric mean can be done in two ways. Each value can be multiplied by the others and then the sum exponentiated to 1/total values. Alternatively, as in the example below, the average of the natural log values can be exponentiated to obtain the geometric mean. The geometric mean will always be lower than or equal to the arithmetic mean.

Example:

	<u>BTSCC</u>	<u>Natural Log of BTSCC</u>
	222,000	12.31
	115,000	11.65
	498,000	13.12
	250,000	12.43
Average	271,250 (arithmetic)	12.38
Exponentiate		237,400 (geometric)

Distribution of BTSCC levels

Table 2 shows the cumulative percentage of milk, shipments, and producers by five BTSCC levels during 2005. More than 99 percent of milk and 97 percent of shipments monitored met the current Pasteurized Milk Ordinance limit of 750,000 cells/ml. Of 39,335 producers, 88.9 percent (all but 4,366 producers) shipped milk with BTSCCs below 750,000 cells/ml during all months monitored.

Table 2. Percentage of Milk, Shipments, and Producers Meeting BTSCC Levels During 2005

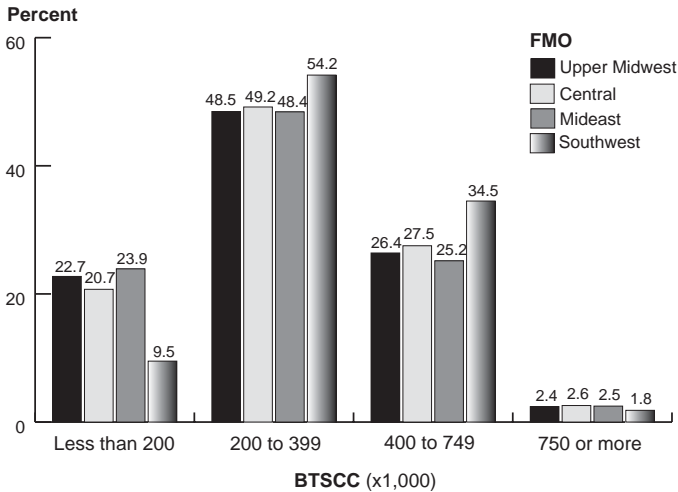
BTSCC (x1,000)	Milk (83.0 billion Pounds)		
	Shipments (425,349)	Producers* (39,335)	
Fewer than 100	2.1	2.8	0.4
Fewer than 200	28.0	22.4	6.9
Fewer than 400	83.8	71.1	43.9
Fewer than 650	98.1	94.7	81.0
Fewer than 750	99.3	97.6	88.9

*Producers shipped all monitored months below set level.

For the past several years, proposals to lower the BTSCC regulatory limit have been submitted to the National Conference on Interstate Milk Shipments. However, to date no rule changes have been made. The most recent NMC proposal (2005) called for a gradual, step-by-step lowering of the BTSCC limit from 750,000 to 400,000 cells/ml over an 8-year period. Ninety-eight percent of the milk and almost 95 percent of shipments monitored in 2005 would have met the first-year reduction to 650,000 cells/ml; 81 percent of producers would have met the first-year reduction requirements during all months monitored. In 2005, 83.8 percent of the milk would have met the final reduction goal of 400,000 cells/ml, but only 43.9 percent of producers would have done so during all monitored months.

Figure 3 shows the relationship between percentage of shipments at various BTSCC levels and FMO. Almost 50 percent of shipments in all FMOs were between 200,000 and 399,000 BTSCC. Less than 2.7 percent of shipments from each FMO were above 750,000 BTSCC.

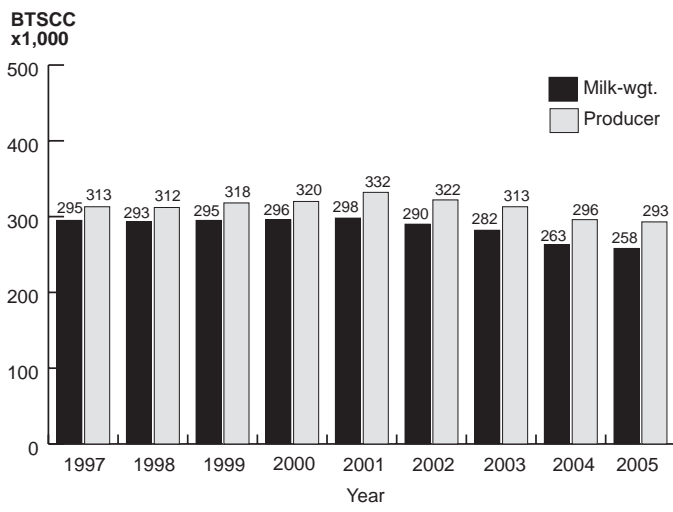
Figure 3. Percentage of Shipments by BTSCC Levels, 2005



BTSCC trends 1997-2005

The milk-weighted geometric BTSCC mean in 2005 was 258,000 cells/ml compared to 263,000 cells/ml in 2004 (figure 4). The milk-weighted BTSCC takes into account the amount of milk shipped by a producer, resulting in an overall BTSCC mean of monitored milk. The producer shipment BTSCC—which is a geometric, nonmilk-weighted mean of all shipments—decreased from 296,000 in 2004 to 293,000 in 2005.

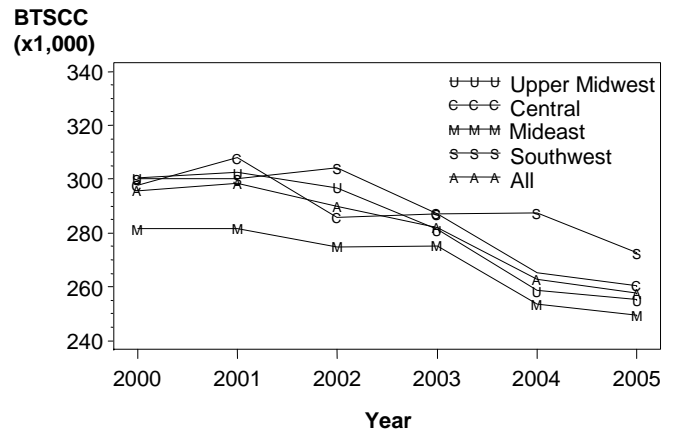
Figure 4. Milk-weighted and Producer BTSCCs, 1997-2005



FMO BTSCC trends 2000-2005

Figure 5 shows milk-weighted BTSCCs for monitored FMOs during the last 6 years. Only the last 6 years are displayed because U.S. FMOs were reorganized in 2000.

Figure 5. Milk-Weighted BTSCCs by FMO and by Year



State BTSCC trends 2000-2005

Fourteen States shipped 60 percent or more of their total milk production through the four monitored FMOs. These States accounted for 89.0 percent of the total monitored milk (table 3). Overall, milk shipments in 2005 from monitored FMOs showed a downward trend in BTSCC levels. The Southwest FMO showed the largest decrease in BTSCC during 2005. The majority of milk marketed through the Southwest FMO comes from Texas and New Mexico, and milk shipments from these States had shown little change in BTSCC levels during the previous 3 years. Minnesota and Wisconsin accounted for 42.8 percent of all FMO-monitored milk and showed a downward trend in BTSCCs in 2005.

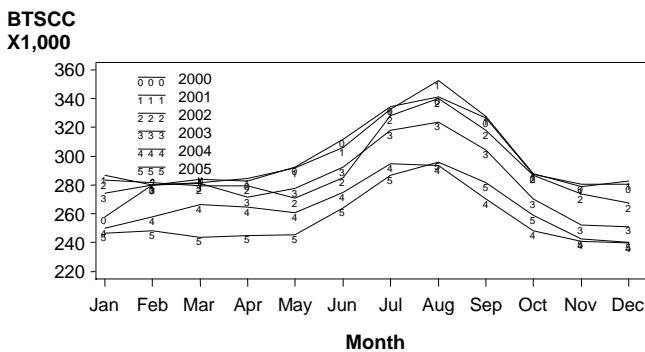
Table 3. BTSCCs for States Shipping 60 Percent or More of Total Milk Production Through FMOs, 2000-2005

State	Percent Total Monitored Milk	BTSCC (x1,000)					
		2000	2001	2002	2003	2004	2005
CO	2.6	280	279	263	259	244	231
IL	2.3	313	323	312	314	299	289
IN	2.5	299	319	303	296	276	278
IA	5.5	322	353	335	326	312	305
KS	2.0	347	361	328	332	325	342
MI	7.7	301	309	299	294	278	271
MN	10.2	368	389	382	345	321	316
NE	1.3	338	403	344	350	331	336
NM	9.4	273	279	291	274	282	264
ND	0.4	305	327	301	312	285	287
OH	4.9	312	322	311	320	294	294
SD	2.3	336	393	351	354	332	313
TX	7.7	387	386	396	386	371	361
WI	32.6	304	310	304	295	281	279
14 States	89.0	319	331	322	311	294	291

Monthly BTSCC trends 2000-2005

Monthly monitoring of BTSCCs continues to show that BTSCCs peak during July through September (figure 6). In 2005, monthly milk-weighted BTSCCs were highest during August (296,000 cells/ml) and lowest in December (240,000 cells/ml).

Figure 6. Milk-Weighted BTSCCs by Year and by Month



Summary

BTSCCs from monitored FMOs are a measure of the quality of the Nation’s milk supply. The overall average BTSCCs from the four FMOs declined during each of the past 4 years, and all FMOs showed a decline in BTSCCs between 2004 and 2005. Of the four monitored FMOs, the Mideast FMO had the lowest milk-weighted BTSCCs for 2000–2005, while the Southwest FMO had the highest BTSCCs in 2005. BTSCCs tend to peak during July and August and are lowest during the winter and spring months. The downward trend of BTSCCs during the last 4 years suggests that producers are actively working to improve milk quality.

References

Adkinson, RW, Gough, RH, Graham, R, et al. 2001. Implications of proposed changes in bulk tank somatic cell count regulations. *J Dairy Sci* 84:370-374.

Barbano DM, Rasmussen RR, Lynch JM. 1991. Influence of milk somatic cell count and milk age on cheese yield. *J Dairy Sci* 74:369-388.

Current Concepts in Bovine Mastitis NMC, 1996 Verona, WI

Grade A Pasteurized Milk Ordinance, 2003. USPHS, FDA, accessed from Internet at: <http://www.cfsan.fda.gov/acrobat/pmo03.pdf>

Klei L, Yun J, Sapru A, et al. 1998. Effects of milk somatic cell count on cottage cheese yield and quality. *J Dairy Sci* 81:1205-1213.

Ma Y, Ryan C, Barbano DM, et al. 1999. Effects of somatic cell count on quality and shelf-life of pasteurized fluid milk. *J Dairy Sci* 83:264-274.

Wells, SJ, Ott, SL. 1995. Individual and bulk tank somatic cell count results: What’s the quality of the U.S. milk supply? *Proceedings Natl Mastitis Council Ann Meet.* 34:11-22.

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