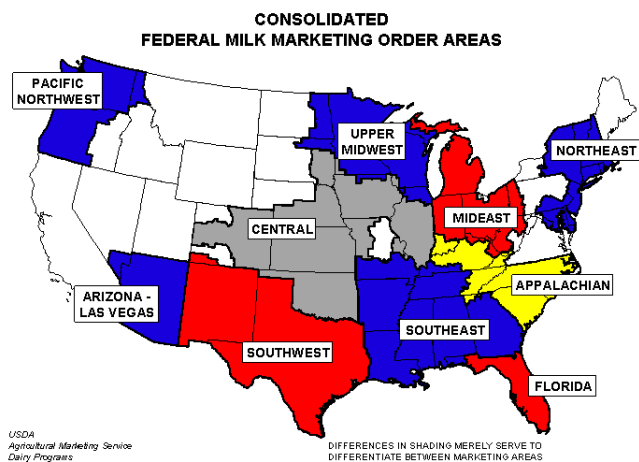


## Determining U.S. Milk Quality Using Bulk Tank Somatic Cell Counts, 2007

U.S. milk quality is monitored by the USDA's Animal and Plant Health Inspection Service's Centers for Epidemiology and Animal Health (CEAH), in conjunction with USDA's Agricultural Marketing Service (AMS) and the NMC's (formerly the National Mastitis Council) Milk Quality Monitoring Committee. AMS provides CEAH with data on bulk tank somatic cell counts (BTSCCs) from 4 of the Nation's 10 Federal Milk Marketing Orders (FMOs<sup>1</sup>) [figure 1]. CEAH analyzes the data and reports the results annually, and NMC provides guidance and oversight for the analysis and reporting.

Figure 1.



BTSCC refers to the number of white blood cells (leukocytes) and secretory cells per milliliter of raw milk. BTSCCs are used as a measure of milk quality and as indicators of overall udder health. High BTSCCs can negatively impact cheese yield and reduce the quality and shelf life of pasteurized fluid milk. Numerous studies have also shown that operations with

increased BTSCCs are more likely to have antibiotic residue violations.

To ensure high-quality dairy products, BTSCCs are monitored in milk shipments from producers, using standards outlined in the U.S. Pasteurized Milk Ordinance. The legal maximum BTSCC for milk shipments from Grade A producers is 750,000 cells/ml. Producers with 2 out of 4 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.

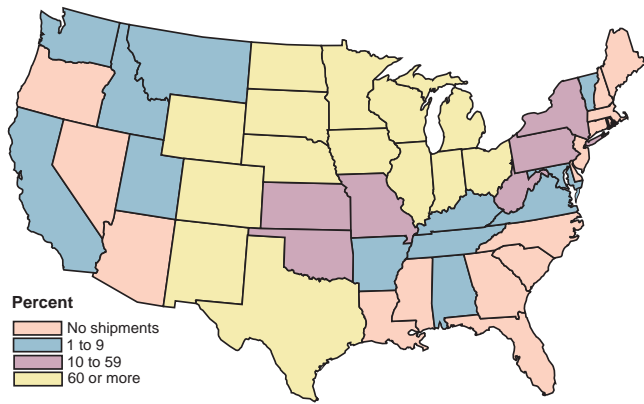
Maximum BTSCC levels for other countries include 400,000 cells/ml in the European Union (EU), 500,000 cells/ml in Canada, and 750,000 cells/ml in Brazil.

### Monitored FMOs

In 2007, four FMOs were monitored: Central, Mideast, Southwest, and Upper Midwest. These FMOs monitored milk from 36,528 producers located in 32 States and accounted for 81.4 billion pounds or 43.9 percent of the 185.6 billion pounds of pooled and nonpooled milk produced in the United States in 2007. Each of the 32 States marketed at least one shipment through the monitored FMOs during 2007 (figure 2). Fourteen States (Colorado, Illinois, Indiana, Iowa, Michigan, Minnesota, Nebraska, New Mexico, North Dakota, Ohio, South Dakota, Texas, Wisconsin, and Wyoming) marketed more than 60 percent of the milk produced in their States through the monitored FMOs.

<sup>1</sup> 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.

**Figure 2. Percentage of Total Milk Production Shipped Through Monitored FMOs by State, 2007**



There were 385,427 milk shipments monitored in 2007 (table 1). The upper Midwest FMO accounted for 45.7 percent of the milk monitored and 20.1 percent of all milk shipped 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 17.3 percent of the monitored milk, which reflects the larger herd sizes in the Southwest FMO.

**Table 1. Pounds of Milk and Shipments Monitored During 2007**

FMO	Milk			Shipments	
	Pounds (Billions)	Pct.	Pct. U.S.	Number (x1,000)	Pct.
Upper Midwest	37.2	45.7	20.1	227.6	59.0
Central	12.5	15.4	6.7	49.8	12.9
Mideast	17.6	21.6	9.5	98.1	25.5
Southwest	14.1	17.3	7.6	10.0	2.6
Total	81.4	100.0	43.9	385.5	100.0

### Evaluating BTSCC levels

Table 2 shows the cumulative percentage of milk, shipments, and producers by four BTSCC levels during 2007. 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 the 36,528 producers, 88.6 percent (all but 4,164 producers) shipped milk with BTSCCs below 750,000 cells/ml during all months monitored. In addition, in 2007 83.2 percent of the monitored milk had BTSCCs less than 400,000 cell/ml, which is the current EU regulatory limit. Only 43.8 percent of U.S. producers shipped milk with BTSCCs below 400,000 cell/ml.

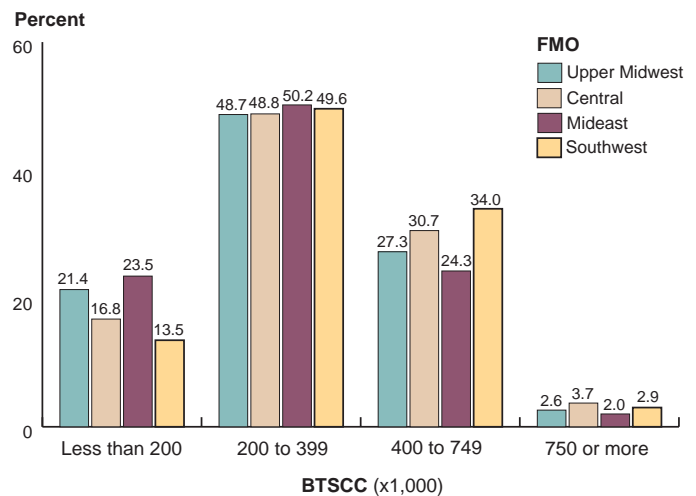
**Table 2. Percentage of Milk, Shipments, and Producers Meeting BTSCC Levels During 2007**

BTSCC (x1,000)	Milk (81.4 Billion Pounds)	Shipments (385,427)	Producers* (36,528)
Less than 100	1.6	2.3	0.4
Less than 200	27.7	21.2	6.7
Less than 400	83.2	70.3	43.8
Less than 750	99.2	97.4	88.6

\*Percentage of producers that shipped milk with BTSCCs below set level for 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 3.8 percent of shipments from each FMO were above 750,000 BTSCC.

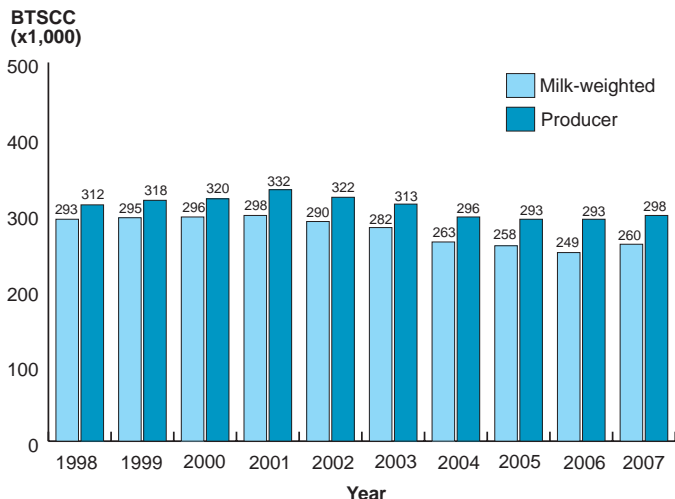
**Figure 3. Percentage of Shipments by BTSCC Levels, 2007**



### Milk-weighted and producer BTSCC trends

The milk-weighted geometric BTSCC mean in 2007 was 260,000 compared to 249,000 in 2006 (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—increased from 293,000 in 2006 to 298,000 in 2007.

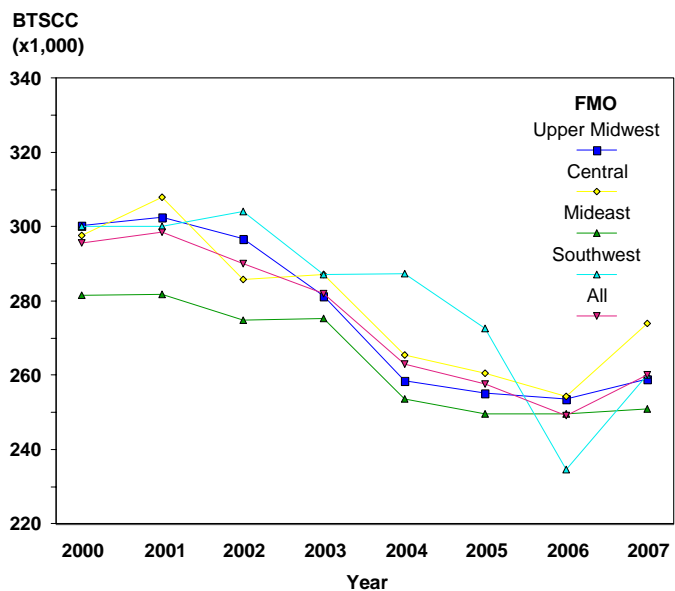
**Figure 4. Milk-weighted and Producer BTSCCs, 1998-2007**



**FMO and State milk-weighted BTSCC trends**

Figure 5 shows milk-weighted BTSCCs for monitored FMOs during the last 8 years. Only the last 8 years are displayed because FMOs were reorganized in 2000. The Southwest FMO, which had shown the largest decrease in BTSCC during both 2005 and 2006, had the largest increase from 2006 to 2007 (235,000 to 260,000 cells/ml, respectively). The majority of milk marketed through the Southwest FMO comes from Texas and New Mexico. Minnesota and Wisconsin accounted for 40.8 percent of all FMO-monitored milk.

**Figure 5. Milk-Weighted BTSCC by FMO and by Year**



The 14 States that shipped 60 percent or more of their total milk production through the 4 monitored FMOs accounted for 93.2 percent of the total monitored milk (table 3). Overall, milk shipments in 2007 from monitored FMOs showed an upward trend in milk-weighted BTSCC levels. Only 2 of the 14 States that shipped more than 60 percent of total milk production (Illinois and Ohio) had decreased BTSCCs in 2007 compared with 2006.

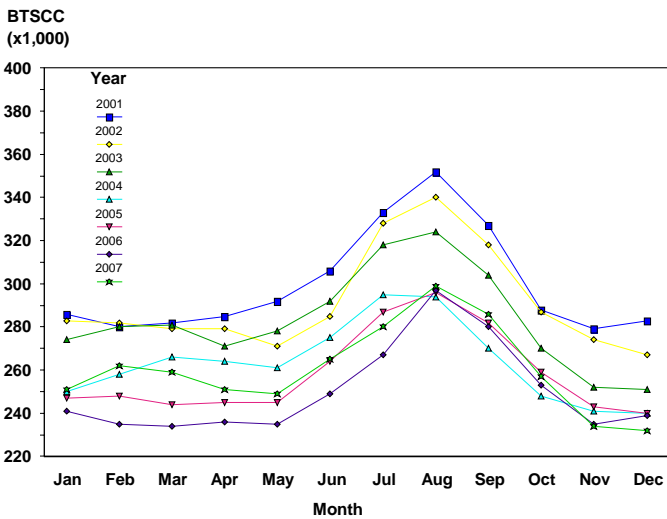
**Table 3. Milk-weighted BTSCCs for States Shipping 60 Percent or More of Total Milk Production Through FMOs**

State	Pct. Total Monitored Milk	BTSCC (x1,000)					
		2002	2003	2004	2005	2006	2007
CO	3.0	248	250	225	215	207	237
IL	2.4	295	298	276	260	282	272
IN	3.1	274	268	254	247	248	272
IA	6.8	309	306	284	272	269	282
MI	9.5	262	258	247	239	233	237
MN	10.5	347	317	287	276	261	270
NE	1.4	303	317	286	285	264	274
NM	8.7	273	260	264	250	217	236
ND	0.3	262	293	276	277	245	276
OH	5.3	288	296	267	269	270	267
SD	2.5	343	351	306	282	267	292
TX	9.3	347	326	318	305	258	285
WI	30.3	276	269	249	246	246	249
WY	0.1	280	301	369	296	234	335
14 States	93.2	291	283	265	257	247	258

**Seasonal BTSCC trends**

Monthly monitoring of BTSCCs continues to show that BTSCCs peak during July through September (figure 6). In 2007, monthly milk-weighted BTSCCs were highest during August (299,000 cells/ml) and lowest in December (232,000 cells/ml).

**Figure 6. Milk-Weighted BTSCC by Year and by Month**



## Summary

BTSCCs from monitored FMOs are a measure of the quality of the Nation's milk supply. Data from 2007 show an increase of 11,000 cells/ml in the milk-weighted geometric mean BTSCC. The largest increase was observed in BTSCCs in the Southwest FMO, which increased from 235,000 in 2006 to 260,000 in 2007. Increases in BTSCCs were widespread, as 12 of 14 States shipping 60 percent or more of their milk through the four FMOs had higher BTSCCs in 2007 compared with 2006.

## References

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.

Canadian Food Inspection System Website. Canadian Food Inspection System Implementation Group National Dairy Regulation and Code Production and Processing Regulations - Milk Quality Standards. Available at: [http://www.cfis.agr.ca/english/regcode/ndrc/amdmt\\_jul\\_and\\_oct2005/2005prod\\_2e.shtml#P1\\_47](http://www.cfis.agr.ca/english/regcode/ndrc/amdmt_jul_and_oct2005/2005prod_2e.shtml#P1_47) - accessed June 11, 2008

Current Concepts in Bovine Mastitis  
NMC, 1996  
Verona, WI

Grade A Pasteurized Milk Ordinance, 2003.  
USPHS, FDA. Available at:  
<http://www.cfsan.fda.gov/~ear/pmo03toc.html>

Hillerton JE, Berry EA. 2004. Quality of the milk supply: European regulations versus practice. *NMC 43rd Annual Meeting Proceedings* pages 207-214

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.

National Mastitis Council: Guidelines for accurate sampling and reporting of bulk tank milk cell counts, 2002. Available at: [www.nmconline.org/docs/BTSCCGuide.pdf](http://www.nmconline.org/docs/BTSCCGuide.pdf)

Ruegg PL, Tabone TJ. 2000. The relationship between antibiotic residues violations and somatic cell counts in Wisconsin dairy herds. *J Dairy Sci* 83:2805-2809

van Schaik G, Lotem M, Schukken YH. 2002. Trends in somatic cell counts, bacterial counts and antibiotic residue violations in New York State during 1999-2000. *J. Dairy Sci* 85:782-789.

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