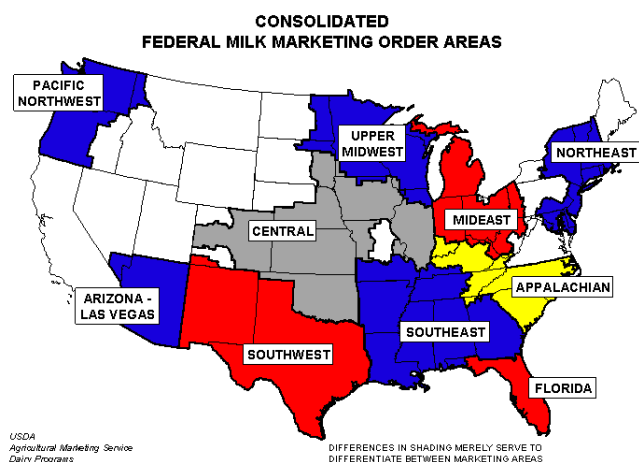


## Determining U.S. Milk Quality Using Bulk-tank Somatic Cell Counts, 2009

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 Milk Quality Monitoring Committee, monitor U.S. milk quality using bulk-tank somatic cell count (BTSCC) data provided by 4 of the Nation's 10 Federal Milk Marketing Orders (FMOs)<sup>5</sup> [figure 1].

Figure 1.



BTSCC refers to the number of white blood cells (primarily macrophages and leukocytes), secretory cells, and squamous cells per milliliter of raw milk.<sup>1</sup> 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.<sup>2,3,4</sup> Numerous studies have also shown that operations with increased BTSCCs are more likely to have milk that violates antibiotic residue standards.<sup>5,6,7</sup> The most frequently cited reason for

antibiotic residues in milk is placing cows treated with antibiotics in the milking string before the recommended withdrawal period.<sup>6</sup>

To ensure high-quality dairy products, BTSCCs are monitored in milk shipments using standards outlined in the U.S. Pasteurized Milk Ordinance (PMO).<sup>8</sup> In the United States, the legal maximum BTSCC for "Grade A" milk shipments is 750,000 cells/mL. If a producer has two out of four shipments that test above the maximum (usually tested 30 to 45 days apart) a written notice is issued and an additional sample is tested within 21 days. If three of the last five test counts exceed the maximum, regulatory action is required, which includes:

1) suspension of the producer's permit; 2) milk in violation not being sold as Grade A product; and/or 3) monetary penalties.

Maximum BTSCC levels for other countries include 400,000 cells/mL in the European Union (EU),<sup>9</sup> Australia, and New Zealand;<sup>10</sup> 500,000 cells/mL in Canada;<sup>11</sup> and 1,000,000 cells/mL in Brazil.<sup>12</sup>

Although there has been some support in the last few years for lowering the maximum BTSCC for the United States to 400,000 cells/mL, no changes have been made to the PMO. However, new regulations for dairy products exported to the EU may stimulate more support for the reduction.<sup>13</sup>

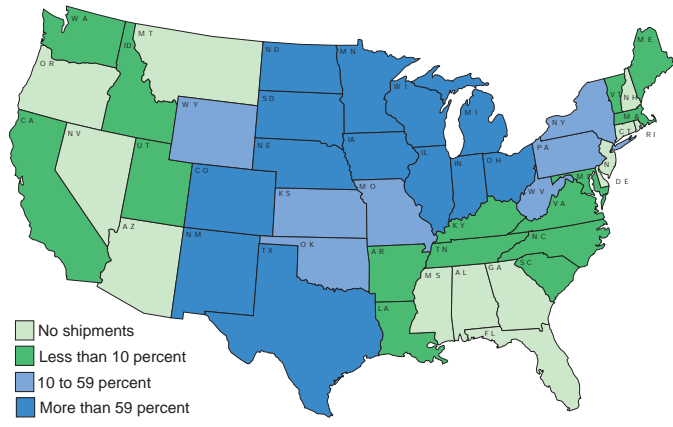
The EU's regulations are centered on on-farm testing to encourage adherence to a 3-month geometric mean BTSCC of 400,000 cells/mL, although EU member states have considerable latitude in formulating the specifics of their individual programs. It is not yet known how the United States may alter its BTSCC testing program for dairy shipments to the EU in light of this new information regarding the EU's regulations.

### Monitored FMOs

In 2009, four FMOs were monitored: Central, Mideast, Southwest, and Upper Midwest. These FMOs monitored milk from 32,854 producers located in 34 States and accounted for 86.1 billion pounds, or 45.5 percent, of the 189.3 billion pounds of pooled and nonpooled milk produced in the United States in 2009. Each of the 34 States marketed at least 1 shipment through the monitored FMOs during 2009 (figure 2).

\* FMOs 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 in 2009, by State**



In 2009, 353,578 milk shipments were monitored (table 1). The upper Midwest FMO accounted for 47.0 percent of the milk monitored and 21.4 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 opposite was true for the Southwest FMO, where 2.5 percent of the shipments accounted for 17.2 percent of the monitored milk, which reflects the larger herd sizes in the Southwest FMO.

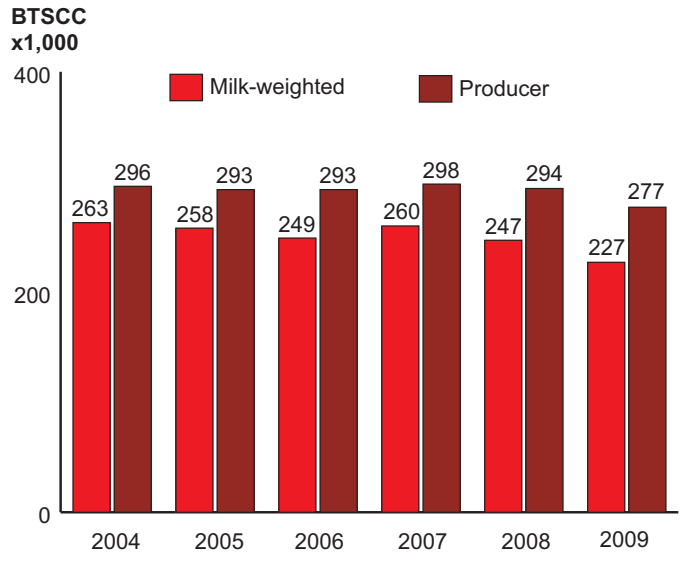
**Table 1. Percentage of Milk and Shipments Marketed Through Monitored FMOs during 2009**

FMO	Milk		Shipments		
	Billion Pounds	Pct.	Pct. U.S.	Number (x1,000)	Pct.
Upper Midwest	40.5	47.0	21.4	215.9	61.1
Central	13.7	15.9	7.2	42.2	11.9
Mideast	17.1	19.9	9.0	86.6	24.5
Southwest	14.8	17.2	7.9	8.9	2.5
Total	86.1	100.0	45.5	353.6	100.0

**2009 BTSCC trends**

The milk-weighted geometric BTSCC mean in 2009 was 227,000 cells/mL compared with 247,000 cells/mL in 2008 (figure 3). 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 294,000 cells/mL in 2008 to 277,000 cells/mL in 2009.

**Figure 3. Milk-weighted and Producer BTSCC, 2004-2009**



**Evaluating BTSCC levels**

Table 2 shows the cumulative percentage of milk, shipments, and producers by five BTSCC levels during 2009. More than 99 percent of milk and 98 percent of shipments monitored met the current PMO limit of 750,000 cells/mL. Of the 32,854 producers, 90.5 percent (all but 3,121) shipped milk with BTSCCs below 750,000 cells/mL during all months monitored.

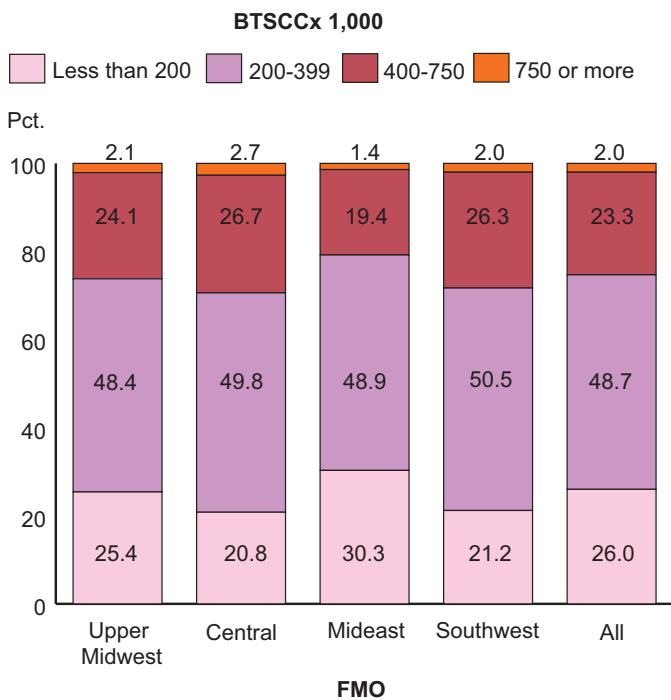
In 2009, during all monitored months, 89.0 percent of milk would have met the goal of 400,000 cells/mL, but only 50.1 percent of producers would have done so.

**Table 2. Percentage of Milk, Shipments, and Producers by BTSCC Level During 2009**

BTSCC (x1,000 cells/mL)	Percent		
	Milk (86.1 billion pounds)	Shipments (353,578)	Producers (32,854)
Less than 100	2.4	3.0	0.5
Less than 200	40.1	26.0	9.6
Less than 400	89.0	74.7	50.1
Less than 650	98.8	95.5	83.7
Less than 750	99.5	98.0	90.5

Figure 4 shows the percentages of shipments at various BTSCC levels for each FMO. Almost 50 percent of shipments in all FMOs were between 200,000 and 399,000 cells/mL. Of all shipments, 2.0 percent had BTSCCs above 750,000 cells/mL.

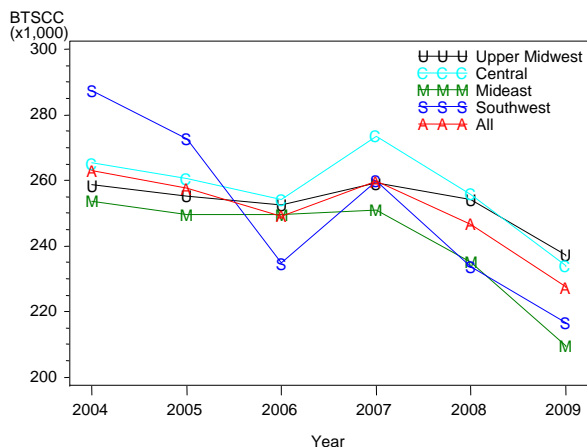
**Figure 4. Percentage of Shipments by FMO and by BTSCC Level, 2009**



**FMO and State BTSCC trends**

Figure 5 shows milk-weighted BTSCCs for monitored FMOs during the last 6 years. The milk-weighted BTSCC has decreased for all FMOs since 2007. The Upper Midwest FMO had the highest BTSCC during 2009 at 237,000 cells/mL, while the Mideast FMO had the lowest at 210,000 cells/mL.

**Figure 5. Milk-weighted BTSCCs, by FMO and by Year**



Thirteen States marketed 60 percent or more of the milk produced in their States through the monitored FMOs and accounted for 92.7 percent of the total monitored milk (table 3). Michigan, Minnesota, New Mexico, Texas, and Wisconsin accounted for 68.4 percent of all FMO-monitored milk. Overall, milk shipments in 2009 from monitored FMOs showed a downward trend in milk-weighted BTSCC levels. Twelve of the 13 States that shipped 60 percent or more of total milk production had decreased BTSCCs in 2009 compared with 2008 while BTSCCs for North Dakota was unchanged during the same period.

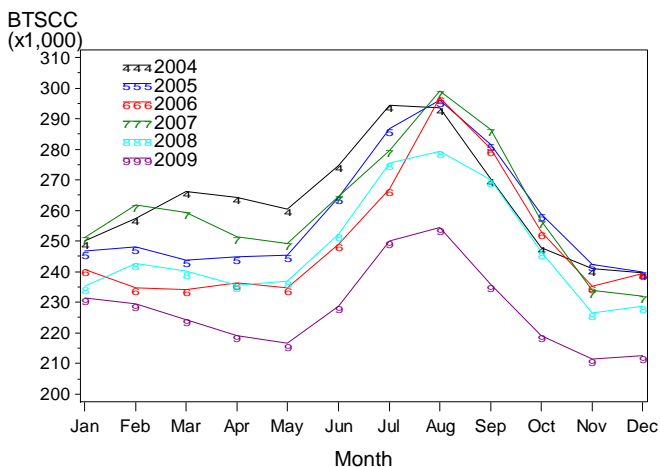
**Table 3. Milk-weighted BTSCC for States Shipping 60 Percent or More of Total Milk Production through Monitored FMOs**

State	Percent Total Monitored Milk—2009	BTSCC (x1,000)					
		2004	2005	2006	2007	2008	2009
CO	3.1	225	215	207	237	208	200
IL	2.0	276	260	282	272	262	260
IN	2.8	254	247	248	272	261	237
IA	6.8	284	272	269	282	281	252
MI	9.4	247	239	233	237	211	183
MN	10.6	287	276	261	270	266	249
NE	1.7	286	285	264	274	266	194
NM	9.8	264	250	217	236	216	196
ND	0.3	276	277	245	276	269	269
OH	5.0	267	269	270	267	253	225
SD	2.6	306	282	267	292	275	262
TX	9.4	318	305	258	285	254	239
WI	29.2	249	246	246	249	247	233
13 States	92.7	265	257	247	258	245	226

## Seasonal BTSCC trends

Monthly monitoring of BTSCCs continues to show that BTSCCs peak during the summer months (July through September) when higher temperatures and humidity increase stress on cows and provide conditions more favorable for bacterial growth [figure 6]. In 2009, monthly milk-weighted BTSCCs were highest during August (254,000 cells/mL) and lowest in November (212,000 cells/mL).

**Figure 6. Milk-weighted BTSCCs by Year and by Month**



## Summary

BTSCCs from monitored FMOs are indicative of the quality of the Nation's milk supply. Data from 2009 show a decrease of 20,000 cells/mL in the milk-weighted geometric mean BTSCC compared with 2008. The largest decrease was observed in BTSCCs in the Mideast FMO, which decreased from 235,000 cells/mL in 2008 to 210,000 cells/mL in 2009. All 13 States shipping 60 percent or more of their milk through the 4 FMOs had the same or lower BTSCCs in 2009 compared with 2008. The recognition of the EU testing requirements will likely put increased pressure on the United States to adopt a 400,000 BTSCC limit in the near future.

## References

1. Current Concepts in Bovine Mastitis. 1996. NMC Publication, Verona, WI.
2. 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.
3. 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.
4. 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.

5. 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.

6. Ruegg, PL. 2005. Relationship between bulk tank milk somatic cell count and antibiotic residues. *Proceedings 44<sup>th</sup> NMC Annual Meeting* pp 28–35, Madison, WI.

7. 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.

8. Grade A Pasteurized Milk Ordinance, 2007. [http://www.michigan.gov/documents/mda/MDA\\_DP\\_07PMOFinal\\_251324\\_7.pdf](http://www.michigan.gov/documents/mda/MDA_DP_07PMOFinal_251324_7.pdf) – Accessed 11/10/2009

9. Hillerton JE, Berry EA. 2004. Quality of the milk supply: European regulations versus practice. *Proceedings 43<sup>rd</sup> NMC Annual Meeting* pp 207–214.

10. Smith, KL, Hogan, JS. 1998. Milk Quality - A Worldwide Perspective. *Proceedings 37<sup>th</sup> National Mastitis Council Annual Meeting* pp 3–9.

11. Canadian Food Inspection System Website. Canadian Food Inspection System Implementation Group National Dairy Regulation and Code Production and Processing Regulations - Milk Quality Standards. [http://www.cfis.agr.ca/english/regcode/ndrc/amdmt\\_jul\\_and\\_oct2005/2005\\_ppr\\_e.pdf](http://www.cfis.agr.ca/english/regcode/ndrc/amdmt_jul_and_oct2005/2005_ppr_e.pdf) – Accessed 10/30/2009.

12. Rodrigues CO, Cassoli LD, Machado PF. 2005. Milk quality and new regulations in Brazil. *J Dairy Sci* 88:272.

13. Agricultural Marketing Service – Certification of dairy products intended for export to the European Union <http://www.ams.usda.gov/AMSv1.0/getfile?dDocName=STELPRD3636640> – Accessed 6/02/2010.

For more information, contact:

USDA:APHIS:VS:CEAH  
NRRRC Building B, M.S. 2E7  
2150 Centre Avenue  
Fort Collins, CO 80526-8117  
970.494.7000  
Email: [NAHMS@aphis.usda.gov](mailto:NAHMS@aphis.usda.gov)  
<http://nahms.aphis.usda.gov>

#589.0710

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotope, etc.) should contact USDA's TARGET Center at (202) 720–2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250–9410, or call (800) 795–3272 (voice) or (202) 720–6382 (TDD). USDA is an equal opportunity provider and employer.

Mention of companies or commercial products does not imply recommendation or endorsement by the U.S. Department of Agriculture over others not mentioned. USDA neither guarantees nor warrants the standard of any product mentioned. Product names are mentioned solely to report factually on available data and to provide specific information.