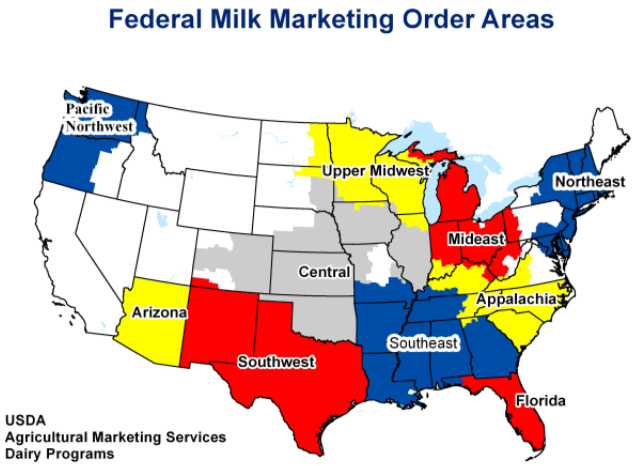
Determining U.S. Milk Quality Using Bulk-tank Somatic Cell Counts, 2012

The USDA's Animal and Plant Health Inspection Service's Centers for Epidemiology and Animal Health, in conjunction with USDA's Agricultural Marketing Service (AMS) and the National Mastitis Council'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*) [fig. 1]. The remaining six FMOs do not collect BTSCC information.

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.[1] BTSCCs are used as a measure of milk quality and as indicators of overall udder health. There is an inverse relationship between BTSCCs and cheese yield and the quality/shelf-life of pasteurized fluid milk.[2 3 4] Numerous studies have also shown that operations with increased BTSCCs are more likely to have milk that violates antibiotic residue standards.[5 6 7] 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.[6]

To ensure high-quality dairy products, BTSCCs are monitored in milk shipments using standards outlined in the U.S. Pasteurized Milk Ordinance (PMO).[8] 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 counts exceed the maximum, regulatory action is required, which includes:

1) suspend the producer's permit, or

2) forego permit suspension, provided the milk in violation is not sold as Grade A, or

3) impose monetary penalty in lieu of permit suspension, provided the milk in violation is not sold or offered for sale as Grade A product.

Maximum BTSCC levels for other countries is 400,000 cells/mL in the European Union (EU),[9] Australia, New Zealand,[10] and Canada.[11] The maximum BTSCC level in Brazil is 1,000,000 cells/mL.[12]

Although there has been increasing support in the last few years for lowering the maximum BTSCC for Grade A milk in the United States to 400,000 cells/mL, no changes have been made to the PMO. In May 2013, the National Conference on Interstate Milk Shipments did not lower the U.S. limit, despite the fact that on January 1, 2012, the U.S. dairy industry began transitioning to a producer-level milk sampling program to verify BTSCCs and standard plate count compliance with EU regulations for products exported to the EU.[13 14]

EU regulations are also centered on testing milk from individual farms but require adherence to a 3-month geometric mean BTSCC of less than 400,000 cells/mL. EU member states have some latitude in formulating the specific details of their individual programs.

U.S. producers that have four consecutive rolling 3-month SCC means greater than the 400,000 cells/mL limit cannot export milk to the EU unless derogation** is requested and approved. If derogation is not approved, the milk supplier must suspend, segregate, or discontinue certification.[13]

A few States have reduced the SCC limit for producers in their States. These States include California, Idaho, and Washington (J Jonker, National Milk Producers Federation, pers. comm.).

* 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.

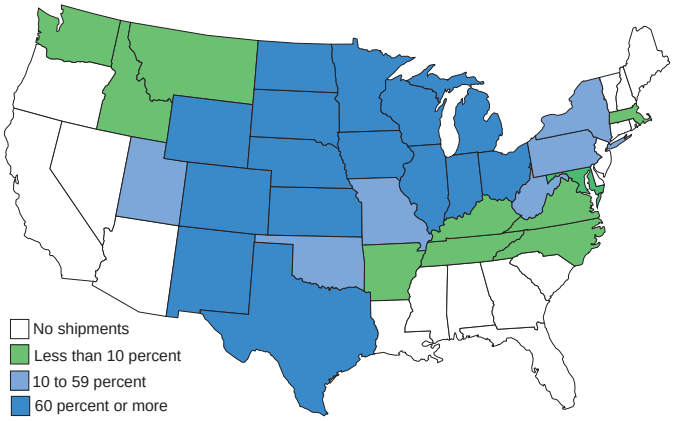
**A derogation is a provision in an EU legislative measure that allows for all or part of the legal measure to be applied differently, or not at all, to individuals, groups, or organizations.

In addition, the EU also has regulations on bacterial standard plate counts. For these regulations, a 2-month geometric mean is used based on a minimum of two standard plate counts performed monthly. The bacterial limit for the EU is 100,000 cells/mL, which is also the limit for Grade A milk in the United States; however, the United States and the EU calculate compliance differently.[13]

Monitored FMOs

In 2012, four FMOs were monitored: Central, Mideast, Southwest, and Upper Midwest. These FMOs monitored milk from 28,274 producers located in 31 States and accounted for 94.8 billion pounds (47.4 percent) of the 200.3 billion pounds of milk produced in the United States in 2012.[15] Each of the 31 States marketed at least 1 shipment through the monitored FMOs during 2012 (fig. 2).

Figure 2. Percentage of total milk production shipped through monitored FMOs in 2012, by State



In 2012, 309,343 milk shipments were monitored (table 1). The Upper Midwest FMO accounted for 45.8 percent of the milk monitored in the four FMOs and 21.7 percent of all milk produced in the United States. The Upper Midwest and Mideast FMOs had a higher percentage of shipments relative to the amount of monitored milk. The opposite was true for the Central and Southwest FMOs, in which 12.0 and 2.5 percent of shipments accounted for 16.6 and 18.3 percent of the monitored milk, respectively, reflecting the larger herd sizes in these two FMOs.

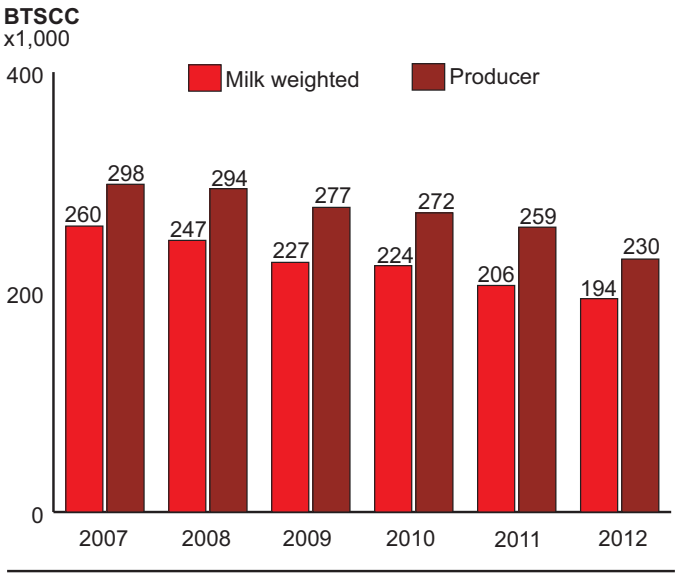
Table 1. Percentage of milk and shipments marketed through monitored FMOs during 2012*

	Milk			Shipments	
FMO	Billion pounds	Pct. monitored	Pct. of U.S. production	Number (x1,000)	Pct.
Upper Midwest	43.5	45.8	21.7	188.1	60.8
Central	15.7	16.6	7.9	37.1	12.0
Mideast	18.3	19.3	9.1	76.5	24.7
Southwest	17.3	18.3	8.7	7.6	2.5
Total	94.8	100.0	47.4	309.3	100.0

2012 BTSCC trends

The milk-weighted geometric BTSCC mean in 2012 was 194,000 cells/mL compared with 206,000 cells/mL in 2011, a decrease of 12,000 cells/mL (fig. 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 259,000 cells/mL in 2011 to 230,000 cells/mL in 2012.

Figure 3. Milk-weighted and producer BTSCCs, 2007–12



Since 1997, the milk-weighted BTSCCs in the United States have decreased 101,000 cells/mL (34.2 percent).[16] Similarly, producer shipment BTSCCs have decreased 83,000 cells/mL (26.5 percent) during the same period.

Data collected from herds enrolled in the Dairy Herd Information Association (DHIA) present similar trends. Since 1997, BTSCCs in DHIA herds have decreased 36.3 percent from 314,000 to 200,000 cells/mL in 2012.[17]

Evaluating BTSCC levels

More than 99 percent of milk and shipments monitored met the current PMO limit of 750,000 cells/mL (table 2). Of the 28,274 producers, 96.5 percent (all but 990) shipped milk with BTSCCs below 750,000 cells/mL during all months monitored.

In 2012, during all monitored months, BTSCC in 95.6 percent of milk was less than 400,000 cells/mL; 64.5 percent of producers shipped milk below this limit for the entire year.

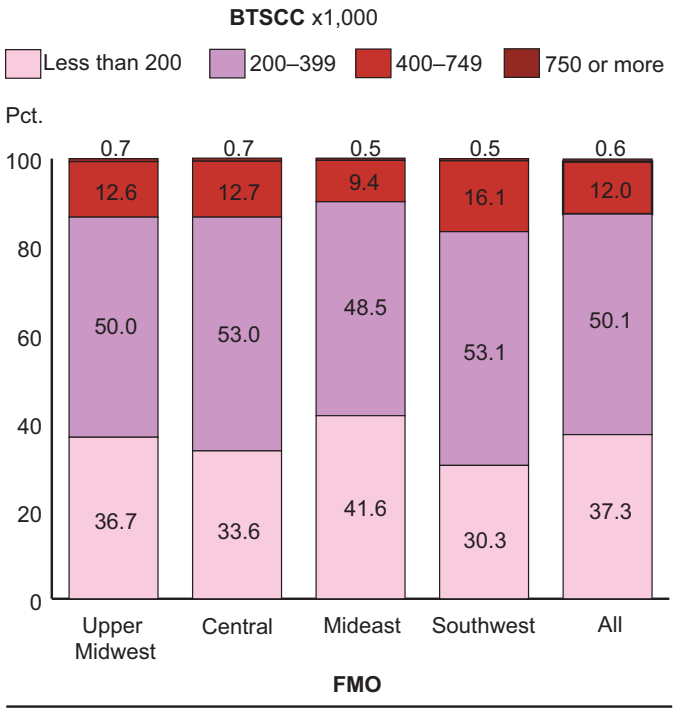
Table 2. Percentage of milk, shipments, and producers by BTSCC level during 2012

BTSCC (x1,000 cells/mL)	Percent		
	Milk (94.8 billion lb)	Shipments (309,343)	Producers* (28,274)
Less than 100	5.5	5.2	0.9
Less than 200	53.4	37.3	15.0
Less than 400	95.6	87.4	64.5
Less than 650	99.7	98.6	93.4
Less than 750	99.9	99.4	96.5

*All shipments for the entire year met criteria.

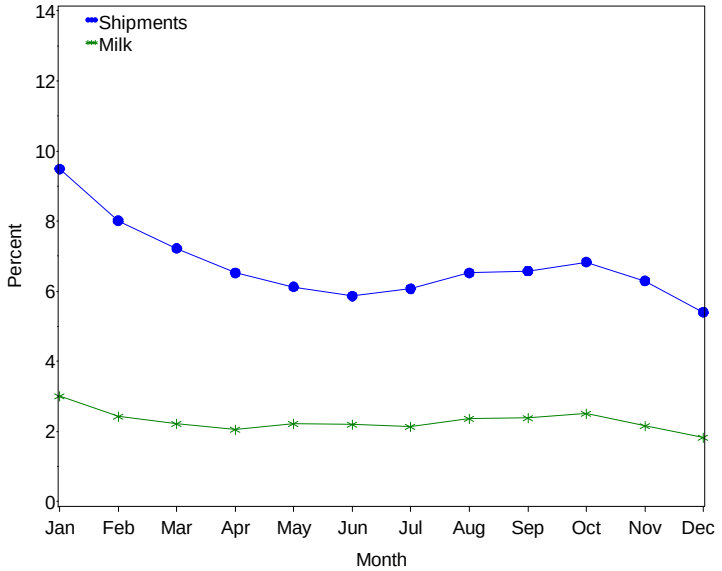
In 2012, about 50 percent of shipments in all FMOs had BTSCCs between 200,000 and 399,000 cells/mL. The four FMOs had a similar percentage of shipments in each of the four BTSCC levels, although a slightly higher percentage of shipments in the Mideast region were below 400,000 cells/mL (fig. 4).

Figure 4. Percentage of shipments, by FMO and by BTSCC level, 2012



Based on the criteria for the EU Health Certification Program from USDA–AMS—which call for a 3-month geometric mean BTSCC of less than 400,000 cells/mL—6 to 10 percent of U.S. shipments would have been noncompliant during 2012 (fig. 5). These shipments represented less than 3 percent of milk shipped during the monitored months.

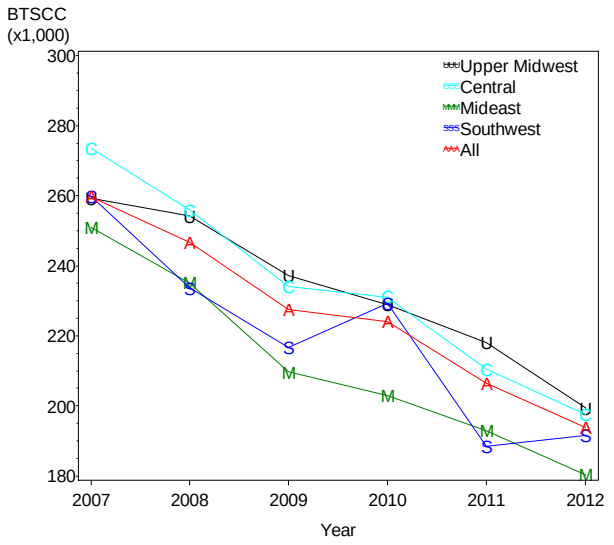
Figure 5. Percentage of shipments and milk in 2012 that would have been noncompliant with the EU Health Certification Program's BTSCC criteria, by month



FMO and State BTSCC trends

BTSCCs for all monitored FMOs combined have decreased every year since 2007 (fig. 6). With the exception of the Southwest FMO in 2010 and 2012, milk-weighted BTSCCs have decreased for each FMO since 2007. The Upper Midwest and Central FMOs had the highest BTSCCs during 2012 at 199,000 and 198,000 cells/mL, respectively, while the Mideast FMO had the lowest at 180,000 cells/mL. BTSCCs in the Southwest FMO have shown the most variation from 2009 to 2012.

Figure 6. Milk-weighted BTSCCs by FMO and by year



Fifteen States marketed 60 percent or more of the milk produced in their States through the monitored FMOs and accounted for 95.3 percent of the monitored milk in the four FMOs (table 3). Michigan, Minnesota, New Mexico, Texas, and Wisconsin accounted for 68.8 percent of all FMO-monitored milk. Thirteen of the 15 States had decreased BTSCCs in 2012 compared with 2011.

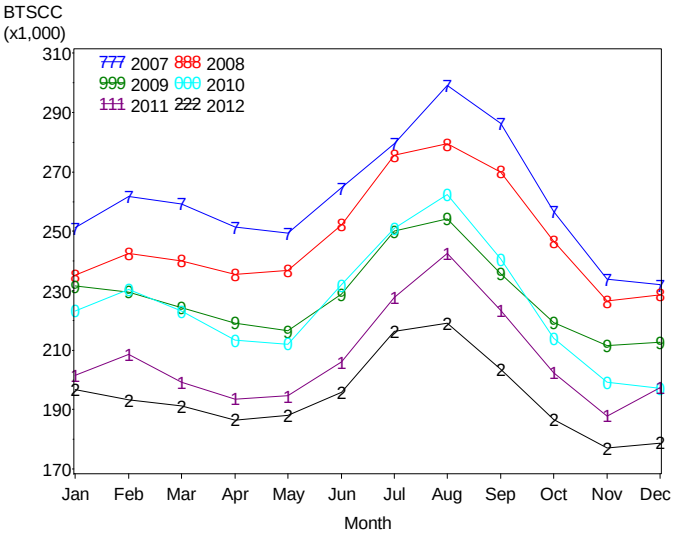
Table 3. Milk-weighted BTSCCs for States shipping 60 percent or more of their total milk production through monitored FMOs

State	Percent total monitored milk—2012	BTSCC (x1,000) by Year					
		2007	2008	2009	2010	2011	2012
CO	3.3	237	208	200	196	186	168
IL	1.8	272	262	260	258	241	214
IN	2.9	272	261	237	225	204	197
IA	7.4	282	281	252	241	228	206
KS	1.8	304	279	256	256	205	204
MI	9.9	237	211	183	174	167	156
MN	9.8	270	266	249	236	227	205
NE	1.5	274	266	194	184	182	182
NM	9.5	236	216	196	207	167	175
ND	0.3	276	269	269	271	276	243
OH	4.9	267	253	225	226	220	202
SD	2.5	292	275	262	248	247	220
TX	10.9	285	254	239	253	208	207
WI	28.7	249	247	233	230	218	199
WY	0.1	335	356	196	139	127	124
15 States	95.3	259	246	227	223	206	193

Seasonal BTSCC trends

Monthly monitoring 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 (fig. 7). In 2012, monthly milk-weighted BTSCCs were highest during August (219,000 cells/mL) and lowest in November (177,000 cells/mL). BTSCCs were lower in all months of 2012 compared with 2011.

Figure 7. Milk-weighted BTSCCs by year and by month, 2007–12



Summary

BTSCCs from monitored FMOs are indicative of the quality of the Nation's milk supply. The overall BTSCCs from the four FMOs have decreased every year since 2007. Data from 2012 show a decrease of 12,000 cells/mL in the milk-weighted geometric mean BTSCCs compared with 2011. The BTSCCs for three of the four FMOs decreased between 2011 and 2012. Thirteen of the 15 States shipping 60 percent or more of their milk through the 4 FMOs had lower BTSCCs in 2012 than in 2011. In addition to improvements in management practices, the current EU import regulations may be partially responsible for the decrease in BTSCCs and the corresponding improvement in milk quality in 2012.

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