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From Dairy Product to Milk Check: A Primer on Current Federal Order Pricing

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For each of the NASS wholesale dairy products the conversion from the wholesale price to the component price will be illustrated in the following section. The make allowance values are those effective as of December 1, 2006. After determining the component values a representative milk check is calculated. NASS is the National Agricultural Statistical Service, USDA.

From NASS wholesale market prices to milk component prices:

Grade AA Butter Price => Butterfat Price:
This is the wholesale product defined as 80% butterfat, salted product, meeting USDA standards. *A plant which produces butter is allowed a gross return, which is termed the "'make-allowance'", defined as the difference between the wholesale price of 1 pound of butter and the value of the butterfat equal to $0.115 per pound.* Farm to plant milk loss is recognized by the factor +0.9825. The yield factor for the wholesale butter to butterfat conversion is +0.82. Dividing the loss factor by the yield (.9825 / .82 = 1.1981) provides the overall yield factor for the conversion of butter back to butterfat.

The formula used to convert Grade AA Butter price to a butterfat value per pound:

Butterfat Value = [NASS Butter Price – 0.115] *[(1-0.0175) / 0.82]

This butterfat value is the minimum price which can be paid by a buyer to a milk producer per pound of butterfat provided the buyer is subject to Federal Order pricing

rules. As a minimum price, the milk shipper may negotiate a high price with the buyer. If the buyer is not regulated then the butterfat price is strictly a matter of economics.

Nonfat Dry Milk Price => Nonfat Solids Price:
This is the wholesale product defined as Nonfat Dry Milk. The wholesale product is USDA Extra Grade and USPH Grade A, non-fortified nonfat dry milk. *A plant which produces nonfat dry milk is allowed a gross return, which is termed the "'make-allowance'", defined as the difference between the wholesale price of 1 pound of nonfat dry milk and the value of the nonfat solids. This "'make-allowance'" is fixed at $0.14 per pound.* The yield factor for the wholesale nonfat dry milk to nonfat solids conversion is +1.00.

The formula used to convert USDA Extra Grade and USPH Grade A, non-fortified nonfat dry milk to a Nonfat Solids value per pound:

Nonfat Solids Value = [NASS Nonfat Dry Milk Price – 0.14] * [(1-0.01)]

This Nonfat Solids value is the minimum price which can be paid by a buyer to a milk producer per pound of nonfat solids provided the buyer is subject to Federal Order pricing rules. As a minimum price, the milk shipper may negotiate a high price with the buyer. If the buyer is not regulated then the nonfat solids price is strictly a matter of economics.

Dry Whey Price => Other Solids Price:
This is the wholesale product defined as Dry Whey. This wholesale product is defined as USDA Extra Grade edible non-hygroscopic dry whey. *The "'make-allowance'" for Dry Whey is the same as that for cheese and is set at $0.159.* The yield factor is +1.03 for the conversion from Dry Whey to Other Solids.

The formula used to convert USDA Extra Grade edible non-hygroscopic dry whey to an Other Solids value per pound:

Other Solids Value = [NASS Extra Grade edible non-hygroscopic Dry Whey Price - 0.159] * [1 / (1 – 0.032)]

This Other Solids value is the minimum price which can be paid by a buyer to a milk producer per pound of other solids provided the buyer is subject to Federal Order pricing rules. As a minimum price, the milk shipper may negotiate a high price with the buyer. If the buyer is not regulated then the other solids price is strictly a matter of economics.

Cheese Price => Protein Price:
The calculation required to convert the wholesale cheddar cheese price to an equivalent protein price is somewhat more complicated than the previous conversions. This calculation requires the computation of a sales weighted average cheese price using the wholesale price of 40 pound cheddar cheese blocks, Wisconsin State Brand, USDA Grade A (or better) and 500 pound barrels of cheddar cheese, Wisconsin State Brand,

USDA Extra Grade (or better) adjusted to 38% moisture. *A plant which produces either or both types of cheddar cheese is allowed a gross return, which is termed the "'make-allowance'", defined as the difference between the wholesale price of 1 pound of cheddar cheese and the value of the protein equal to $0.165 per pound*. The yield factor for the wholesale cheese to protein conversion is also slightly more complicated because cheese yield responds to changes in both protein content of milk and butterfat content of milk. The yield factor for the protein component is 1.383 and for the butterfat component is +1.572.

Using NASS cheddar cheese price for October 2004 we can review the computations. First we know that the sales weighted average cheese price is $1.5256. Second we know that after the processor has been paid $0.165 to make one pound of cheese the remaining wholesale value is $1.3606 per pound of cheese. Now we must convert to a raw milk equivalent price. The Van Slyke formula is used and from this we know that each one pound of raw milk of standard composition will make 1.405 pounds of wholesale cheese. However, we must also recognize that 1 pound of milk shipped from the farm is not realized at the plant, i.e., there are farm-to-plant losses which must be accounted for in the yield formula. After making this adjustment the Van Slyke adjusted yield factor is 1.383. Therefore we multiply the $1.3606 by 1.383 and we determine that our protein has a derived farm gross value of $1.8817 per pound. This pays us for the protein that we produce and ship to the cheese maker – almost.

We also know that one pound of cheese contains butterfat and this butterfat has a value for which we should be paid. Again the Van Slyke formula tells us that if the net cheese price is $1.3606 and the butterfat yield from raw milk to cheese is 1.572 after farm-to-plant loss adjustment, then the butterfat value in cheese is $1.3606 x 1.572 which gives us a value of $2.1389 per pound of butterfat that we produce and ship to the cheese plant.

Now we cannot be paid for our milk as if it where simultaneously pure protein and pure butterfat which is what would occur if we simply added these two values together. We need to make an adjustment for the butterfat that we are already being paid for by subtracting this value from our gross protein value $2.1389. We know that butterfat from the wholesale butter market has a producer value of $1.9020 per pound. Not all of this value is realized by the producer so under the Federal Order pricing rules we use only 90 percent of this value. By subtracting this adjusted amount from the cheese butterfat value [$2.1389 - $1.7118] we calculate the residual value of butterfat in our milk that is sold to the cheese plant. This is $0.4217 per pound.

Now we almost have the complete calculation. In the manufacturing process for cheddar cheese butterfat is used in a fixed ratio to protein of 1.17 to one. Therefore, so that we are compensated fully for the butterfat in the cheese we multiply the $0.4217 by 1.17 to arrive at the total butterfat value of $0.4997 per pound. Now we can add together the $2.1389 protein value and the $0.4997 butterfat value and we have a total value of raw milk used in the manufacture of cheddar cheese on a protein basis of $2.3814 per pound.

The formula used to convert Cheddar Cheese Price to a butterfat adjusted Protein value per pound:

Protein Value = [(NASS Cheese Price – 0.165) * 1.383)] + [((NASS Cheese Price – 0.165) * 1.572) – butterfat value * 0.90) * (3.5 / 2.99))]

This Protein value is the minimum price which can be paid by a buyer to a milk producer per pound of protein provided the buyer is subject to Federal Order pricing rules. As a minimum price, the milk shipper may negotiate a high price with the buyer. If the buyer is not regulated then the protein price is strictly a matter of economics.

Class 3 Price: Revenue from dairy products less the Federal Order Margin

The Federal Milk Marketing Order pricing calculation, using the milk component values and a standardized 100 pounds of milk, to arrive at the Class 3 price is:

C3 Price = 3.5 * Butter Value + 2.99 * Protein Value + 5.69 * Whey Value.

By substituting each of the valuation rules examined above into this class 3 rule, and then combining all of the yield factors which are constants together, the Class 3 rule can be expressed as:

C3 Price = {0.4193 * NASS Butter Price} + {9.637 * NASS Cheese Price} + {5.878 * NASS Whey Price} – 2.575.

From this last expression we can see that the Class 3 price, by rule, is a weighted sum of the revenue generated by the conversion of butter at .4193 pounds, cheese at 9.637 pounds, and whey at 5.878 pounds per 100 pounds of milk of standard composition (3.5% butterfat, 2.99% protein, and 5.69% other solids). The combined make allowance is $2.575 per cwt of milk processed.

We have now completed the calculations necessary to convert reported NASS wholesale prices for the basic dairy commodities of Butter, Cheese, Skim Powder, and Dry Whey to the pay prices for Butterfat, Protein, Nonfat Solids, and Other Solids. Clearly, and this is a very important point, the prices received as dairy producers are directly derived from the prices that wholesalers of dairy products can get from the wholesale market. These wholesale prices are in turn determined by what the retail market can charge and consumers are willing to pay for these products. The current Federal Order pricing system is designed to provide for retail to wholesale to farm market price signaling. Higher cheese prices should signal higher protein prices and therefore increased emphasis on higher protein milk. Or, higher butter prices should signal higher butterfat prices and therefore increased emphasis on higher butterfat milk at the farm level.

From market pricing to a milk producer's milk check $$'s

The final step to understanding the Federal Order Mideast Area pricing rules will be to relate these calculations directly to your milk check revenue. The prices we have calculated are reproduced here to remind us of the component prices that influence the milk check. The NASS dairy product prices and milk component values are given Table 1. A representative dairy producer's milk check is shown in Table 2.

Table 1: NASS Dairy Product Prices and Milk Component Values.

Weighted Average NASS Price (monthly)	Commodity Price per pound, October 2004	Component	Milk Component Price per pound, October 2004
Cheddar Cheese	$1.5256	Protein	$2.3814
Nonfat Dry Milk	$0.8565	Nonfat Solids	$0.7093
Whey Protein	$0.2247	Other Solids	$0.0677
Calculated Butterfat Prices (3)			
Class IV (Same as Class III)	$1.700	Butterfat (b)	$1.9020
Class III Grade AA Butter	$1.700	Butterfat (b)	$1.9020
Class II Butterfat			$1.9090
Class I Butterfat			$1.8915

Table 2: Sample Milk Producer Check October 2004 Values.

Made to the order of Bella Acres Dairy				Check #53500
	LBS.	DESC.	RATE	TOTAL
(A) Grade A pounds	180,066.00	Lbs.		
(B) Grade A Butterfat	6,302.31	Lbs.	1.9020	$11,986.99
(C) Grade A Protein	5,386.67	Lbs.	2.3814	$12,827.82
(D) Grade A Other Solids	10,252.06	Lbs.	0.0677	$694.06
(E) Producer Price Differential (market)	1800.66	Cwt.	0.73	$1,314.48
(F) Location Adjustment to PPD (producer's)	1800.66	Cwt.	0.1000	$180.07
(G) Volume Premium	1800.66	Cwt.	0.0200	$36.01
(H) Quality Premium (SSC)	1800.66	Cwt.	0.0600	$108.04
(I) Over-Order Premium				
(J) Gross Amount				$27,147.47
(K) Total Deductions	1800.66	Cwt.	$0.60	($1,080.40)
(L) Net Check				$26,066.64
(M) Your Mailbox Price	$26,066.64 *divided by* 1800.66			**$14.48**

Let's review each of these items:

(A) Grade A pounds: The total quantity of milk shipped for the month.
(B) Grade A Butterfat: The total quantity of butterfat shipped for the month.
(C) Grade A Protein: The total quantity of protein shipped for the month.
(D) Grade A Other Solids: The total quantity of other solids shipped for the month.

Bella Acres Dairy shipped 180,066 pounds of Grade A milk during the month of October 2004. Before we move ahead with an examination of each of the calculations necessary to arrive at the producers' mailbox price, it is necessary to review the relationship between the pounds of components shipped by the producer and the price that is used to value those components. Table 3 shows the relevant information for these calculations. In this example, the "test" or percent of each component in one hundredweight of milk is assumed to be equal to the same test values used to compute the Class III milk price. Keep in mind that practice, you and most dairy producers will ship milk with percentages that are either higher or lower than these values and therefore your component value will not equal exactly the Class III price. Of course you should always strive to ship milk with component test values that exceed the standard values.

Table 3. Base milk price calculation, October 2004.

Product	Percent	Quantity	Unit	Price ($)	Gross Value $'s
(A) Grade A pounds	%	180,066.00	Lbs.		
(B) Grade A Butterfat	3.5	6,302.31	Lbs.	1.9020	$11,986.99
(C) Grade A Protein	2.9915	5,386.67	Lbs.	2.3814	$12,827.82
(D) Grade A Other Solids	5.6935	10,252.06	Lbs.	0.0677	$694.06
Base Price Paid for Components		($11987 + $12828 + $694)**) / 1,800.66 = $14.17**			

For Bella Acres Dairy, the October composition of milk tested at 3.5% butterfat, 2.9915% protein, and 5.6935% other solids. To arrive at the total pounds of butterfat shipped and valued, we multiply the total milk shipped by 3.5% and multiply by the price of butterfat per pound:

- Total Pounds of Butterfat to be Valued = 180,066 x +0.035 = 6,302.310 lbs.
- Total Value of Butterfat = 6,302.310 x $1.9020 = $11,986.99

To arrive at the total pounds of protein shipped and valued, we multiply the total milk shipped by 2.9915% and multiply by the price of protein per pound:

- Total Pounds of Protein to be Valued = 180,066 x +0.029915 = 5,386.67 lbs.
- Total Value of Protein = 5,386.67 x $2.3814= $12,827.82

To arrive at the total pounds of Grade A Other Solids shipped and valued, we multiply the total milk shipped by 5.6935% and multiply by the price of Other Solids per pound (Table 4):

- Total Pounds of Grade A Other Solids to be Valued = 180,066 x +0.056935 = 10,252.057 lbs.
- Total Value of Grade A Other Solids = 10,252.057 x $0.0677 = $694.06

Bella Acres Dairy will be paid $14.17 per hundredweight before any other additions or subtractions. *This base price for components and the Class III price are identical provided the test percentages equal the standard composition percentages for class III milk!* Note that this is the same price that we calculated for the Class III price in Table 3. This is only the base price and represents the calculated market value of the butterfat, protein and solids shipped by the owner's of Bella Acres Dairy. This would be the end of the value calculations IF the shipped milk is not eligible for a return from the Mideast Area Market-wide pool. To add the additional value to the milk check we must understand the basics of the Producer Price Differential (PPD) and its calculation. This is the next topic in this guidebook.

Mideast Area Market => Producer Price Differential

For those producers whose milk is delivered to a plant which pools on the Federal Order this base price is augmented by the addition of the Producer Price Differential (adjusted for location of the plant to which the producer's milk is first received). Note, the PPD is available only to milk producers shipping to a Federal Order Pool plant. The PPD is calculated by the Market Administrator's Office for the Mideast Area Market. The calculation is not something that can be completed directly by the producer but only by the Administrator because it uses confidential information. A general definition of the PPD that will suffice for our purposes is the following:

The Producer Price Differential is the difference in value between a hundredweight of milk, of standard composition, that is priced at the Class III component values and the same value of that milk if it were used to produce Class I though IV products in the same proportion as the Mideast Market Area. Let's consider an example. We know from our Class III calculations completed in Table 3 that this price is $14.17 per hundredweight. This is the value of the milk if it where used exclusively to manufacture products defined as Class III dairy products. What we do not know is the value of this same 100 pounds of milk if it were used to produce products distributed within the Mideast Area Market. For October 2004 we have calculated the Class prices and we know from the data supplied by the Administrator's Office the utilization of milk within the Mideast Area. Using these numbers we can *approximate* the value of the October PPD:

Table 4. Computation of the Producer Price Differential, October 2004.

Mideast Area Market FO #33.			
Milk Use Class	Market Utilization*	Class Price	Weighted Class Price
Class I	36	$16.78	$6.04
Class II	15	$13.57	$2.04
Class III	44	$14.16	$6.23
Class IV	5	$12.81	$0.64
Statistical Uniform or Weighted Average Price			$14.95
Class III Price per cwt.			$14.16
Producer Price Differential as Uniform less Class III			$0.79
*: estimated for October 2004. Utilization varies by month.			

The PPD as reported by the Market Administrator's Office for October 2004 will very likely not equal what we have calculated at $0.79. Why the difference? First, we can only get an approximation because the actual calculations take into account the exact location for each of the reporting milk plants within the Mideast Area and we do not have access to this proprietary information. Therefore we cannot directly adjust for location differences. To handle zone adjustments we can use an average value supplied by the Market Administrators Office. As an approximation to the zone adjustment for the Mideast Marketing Area we can use $0.035 per cwt. Taking this into account we would reduce any discrepancy by this amount per cwt.

Second, there is approximately $0.045 to $0.05 cents that is subtracted from the PPD as a reserve fund to be held by the Market Administrator Office. If we further reduce any difference by this amount we can arrive at a *very good approximation* to the reported PPD.

What does the PPD represent to a milk producer?

It is the added value or return that we realize by shipping our milk to a buyer that is *eligible to participate* in the Mideast Area Market market-wide pool. If your milk buyer participates in the Mideast market-wide pool, your milk takes on added value from the Class II and Class I differentials and this additional return from the classified pricing system is returned directly to you the milk producer. It is a major principle of the Federal Order program that each milk producer shares equally, based on milk contributed to the market-wide pool, in this added financial return. The expected added value per hundredweight for October 2004 is $0.73 (note our estimated from Table 4 is $0.79).

Now we are in position to complete our milk check calculations. Returning to a portion of Table 2 (shown below) we can determine that the PPD adds $1,314.48 to the value of our milk over and above its value had we not been able to participate in the Mideast Area Market classified pricing system. Because the plant which receives our shipped milk is located away from the Cuyahoga County zone of the Mideast Area Market, we receive an +$0.10 addition as our location adjustment, as determined by the regulations governing

the Mideast Area Federal Order. These location zones and the price adjustment is shown in the appendix, Figure 2. After accounting for additional premiums for volume, and quality (based on the somatic cell adjustment), we determine that the total value of our milk shipped is $27,147.04. Subtracting an additional $1080.40 for check-off and hauling fees we are left with $26,066.64. Dividing this dollar amount by the total hundredweight shipped the owners of Bella Acres Dairy have a mailbox price of $14.48 / cwt.

(E) Producer Price Differential (market)	1800.66	Cwt.	0.73	$1,314.48
(F) Location Adjustment to PPD (producer's)	1800.66	Cwt.	0.1000	$180.07
(G) Volume Premium	1800.66	Cwt.	0.0200	$36.01
(H) Quality Premium (SSC)	1800.66	Cwt.	0.0600	$108.04
(I) Over-Order Premium				
(J) Gross Amount				$27,147.04
(K) Total Deductions	1800.66	Cwt.	$0.60	($1,080.40)
(L) Net Check				$26,066.64
(M) Your Mailbox Price	$26,066.64 *divided by* 1800.66			**$14.48**

How is the Somatic Cell Adjustment calculated in the Mideast Marketing Area?

In the Mideast Marketing Area, each producer will receive an adjustment for quality as measured by their average somatic cell count. This adjustment is calculated as the weighted average cheese price multiplied by +0.0005 and rounded to the 5th decimal place. The standard somatic cell count is specified as 350,000 or 350. For each producer their respective average somatic cell count is subtracted from 350 and multiplied by the adjustment factor. The resulting amount is rounded to the nearest cent and represents a subtraction or addition to the pay price per hundredweight. Table 18 illustrates this calculation for three representative average somatic cell counts using October 2004 data.

Table 5. Mideast Somatic Cell Adjustment, October 2004.

Weighted Average Cheese Price	$1.5256		
Multiply by SSC adjustment factor	0.0005		
SSC Adjustment Rate	$0.00076		
	1	2	3
Standard	350	350	350
SSC Average	250	600	340
Quality Deviation	100	-250	10
X ($0.00076)	$0.076/cwt	($0.19)/cwt	$0.0076/cwt