STATEMENT OF SCOTT BURLESON
WESTFARM FOODS
at the
UNITED STATES DEPARTMENT OF AGRICULTURE PUBLIC HEARING ON CLASS III AND IV MILK PRICING FORMULAS

Re: Proposal No.1

Federal Milk Market Order Hearing
Docket No. AO-14-A74, DA-06-01

My name is Brian Scott Burleson. I am the Director of Manufacturing for the Ingredients Division of WestFarm Foods. My business address is 635 Elliott Avenue West, Seattle, Washington, 98119.

WestFarm Foods conducts all processing and marketing operations for Northwest Dairy Association, a dairy cooperative with about 640 members, including 520 in the Pacific Northwest Federal Milk Marketing Order. The Ingredients Division includes five plants, including four nonfat dry milk plants and one cheese / whey plant.

I have worked in the Ingredients Division of WestFarm Foods for the last 19 years. In my current role as Manufacturing Director for the Ingredients Division, I am responsible for plant operations in four nonfat dry milk (NFDM) drying facilities, and one cheese/whey drying operation. My duties include equipment design, plant/equipment operation, product quality, process modifications, purchasing of new equipment, and commissioning of equipment. Prior to my current position, I was manager of our cheese/whey plant in Sunnyside, Washington. Before that, I was involved in the construction and initial start-up of our NFDM processing facility in Jerome, Idaho, and was plant manager after its opening in 2002. During my career at WestFarm Foods, my responsibilities have included dryer/ evaporator operator, supervisor, whey plant manager, NFDM plant manager and cheese/whey plant manager. During my career with WestFarm Foods I have worked in four different processing facilities. I was involved in evaporation and drying activities in our Chehalis, Washington facility, which dries both nonfat dry milk and whey. I played a key role in the design and initial start-up of our Sunnyside, Washington facility that originally manufactured NFDM, but later was converted to a cheese/whey operation.

The purpose of my presentation today is to provide information on the processing differences between NFDM and whey powder. I hope to clarify the process differences associated with the manufacture of these two different products, and the related differences in costs.

In preparation for this hearing, I was asked to review the testimony presented by CK Venkatachalam ("Venkat") in *May 2000 FMMO Class III Hearing*, a copy of which is attached to my testimony. My purpose in reviewing the attached was to determine if the assumptions remain valid today. Based upon my review, I believe that the assumptions remain valid and accurate for the kind of system that was described in Venkat's testimony. This whey manufacturing process remains in use in many manufacturing operations today.

However, systems that incorporate a reverse osmosis ("R.O.") step to reduce the amount of water removed through the evaporator are becoming more prevalent. Therefore, I will present an update of Venkat's original analysis using the simple average of the energy costs from the Rural Cooperative Business Service plant cost survey. Additionally, I will describe the whey processing systems that incorporate reverse osmosis and compare costs for those systems compared to nonfat dry milk.

It is important to mention that while several plants are incorporating the use of reverse osmosis for water removal from the whey stream, the total amount of water needing to be removed remains the same. About 55% more water is removed per pound of whey powder when compared to one pound of NFDM powder.

In the traditional system outlined by Venkat, energy costs required to produce whey powder are higher than the energy costs required to produce NFDM by 1.12¢ per pound. The following assumptions are used to calculate the energy costs associated with producing whey powder and nonfat dry milk:

- Dilute whey and skim contain an average TS of 6% and 9% respectively
- Assuming no losses, product yields at 97% TS would be 6.19 pounds whey and 9.28 pounds NFDM per 100 pounds of dilute feed
- Steam cost of $7.99 per 1000 lbs
- Electricity cost of 5.8¢ per KWH
- 8 lbs of water removal per pound of steam
- Additional power consumption for whey:

-	4 x 50 HP	=	200 HP for separators and clarifiers
-	6 x 15 HP	=	90 HP for crystallizers
-	10 x 15 HP	=	150 HP for additional pumps
-	Total installed	=	440 HP. Operate at 75% capacity (330HP).
			Consumption at 75% capacity will be 247 KWH

Table 1 in Exhibit____ our attachment to this testimony, *Energy Cost Differences for Whey and NFDM Drying, Based on Venkat Testimony, May 2000 FMMO Class III Hearing*, demonstrates the updated differences in costs to dry whey and nonfat dry milk, based on the whey and nonfat drying process outlined by Venkat in his May 2000 testimony.

The calculations of the additional energy cost to produce finished whey relative to NFDM in the above table can be summarized as follows:

	Cents/Lb
Evaporator steam	0.538
Refrigeration for crystallizers	0.188
Dryer gas	0.100
Additional power	0.294
TOTAL	**1.120**

The additional equipment costs associated with producing equivalent volumes of dry whey were documented by Venkat and have increased over the last five years. However, I was unable to secure updated quotes in preparation for this hearing and am, therefore using the quotes as of Venkat's testimony. He concluded that the additional cost of capital in a whey powder operation is 1.1 cents per pound of whey powder and annual depreciation for the additional equipment is approximately 0.685 cents per pound of whey powder.

Therefore, the incremental whey energy & equipment costs associated with producing whey powder as compared to producing NFDM is 2.905 cents

Source	Cents per lb. of whey powder
Energy	1.120
Capital	1.100
Depreciation	0.685
Total	2.905

Whey Processing using Reverse Osmosis.

Previously, I had made reference to reverse osmosis becoming more prevalent in whey processing systems. That being said, I feel it is very important to better explain what a reverse osmosis system is comprised of, and a brief explanation of how reverse osmosis systems operate.

Development and History:

The concentration of whey by Reverse Osmosis has been in use in the Dairy Industry since the late 1970s. Its primary use has been to pre-concentrate the liquid whey prior to evaporation. This pre-concentration step allows more whey to be processed without expanding the capacity of the evaporator.

Process Description:

The basic principal of this process is to concentrate the solids in sweet whey for use as food grade whey. The process is described as follows:

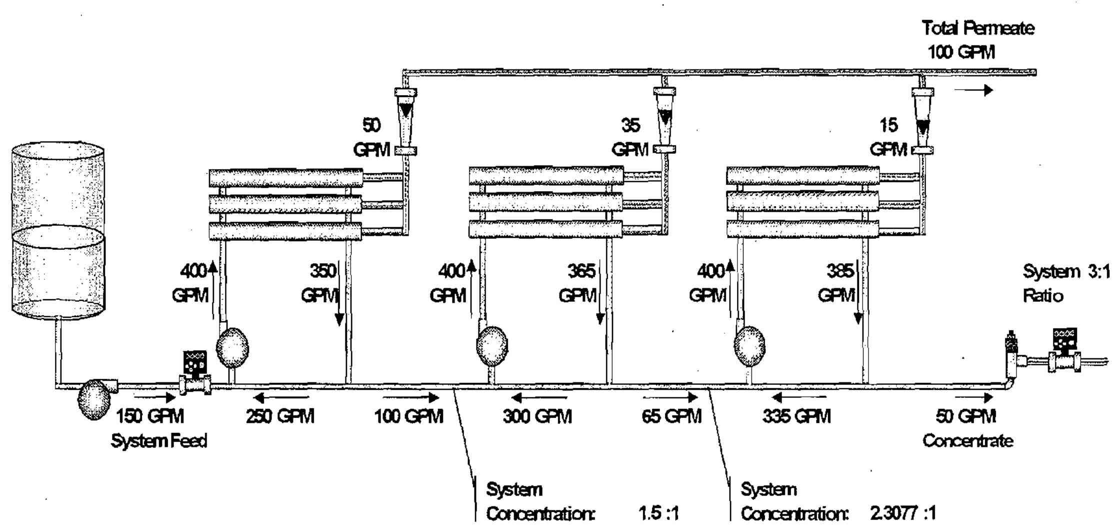
The process begins by making sure the sweet whey is fines saved and has a fat level of no higher than .07%. This will ensure the smooth operation of the membrane system. The whey at this point will have a solids content between 6-6.5% and a pH of 5.8 - 6.1.

The whey is then pasteurized and typically cooled to 70° F. and processed on a reverse osmosis membrane system. The membrane system is designed as a multi-stage continuous production plant capable of processing whey up to 20 hours per day. The whey is fed into the system at a predetermined feed rate. It is then fed into a system balance tank, and then passes through a series of pumps capable of generating up to 600 pounds of pressure. The whey then enters the membrane in each stage where a separation of water from the whey takes place. The water passes through the membrane and is called permeate. The minerals, lactose, protein, and fat are rejected by the membrane and are called the concentrate. In a process such as that used by WestFarm Foods, we concentrate the whey to 14% total solids.

The whey concentrate can now be fed to an evaporator or another membrane system for further processing.

Following production, the system is configured for CIP (clean-in-place) and a series of chemical steps are done to remove the soil from the membrane surface so that production can resume for another 20 hours of operation.

Below is an example of a reverse osmosis process flow diagram:



While reverse osmosis is an important element in the production of whey powder, it is by no means the only processing difference when compared to NFDM production. Chart 1 in Exhibit ___ our attachment to this testimony, *Comparison of Process Flow Steps to Dry Whey Powder versus NFDM Powder*, outlines the differences in process flow between nonfat dry milk and whey, when reverse osmosis technology is used. I will now walk you through the differences in the process, based on the testimony attached.

This process chart outlines the differences in the manufacturing process for whey and nonfat dry milk in our WestFarm Foods plants.

Our Operations analyst team worked with our engineers to calculate the comparative energy costs for whey and nonfat dry milk processing. Table 2 in Exhibit___, our attachment to this testimony, *Energy Cost Differences for Whey and NFDM Drying*, outlines the differences in drying costs for whey and nonfat dry milk.

I will use this Utility Cost Analysis to explain the utility consumption difference between the production of NFDM and whey powder.

Once again, I will remind you of the major distinction between the two products – the throughput. Both product streams run at 185K lbs per hour. However, the whey stream starts at 6% total solids, compared to 9% for skim milk. This means that the production volume we use to determine our per-unit costs is 11,433 lbs dry whey versus 17,165 pounds nonfat dry milk. In other words the nonfat finished product volume is 50% greater than the whey volume.

In whey processing, we introduce the R.O. system prior to the evaporator. This process will remove a significant amount of the water at a relatively low cost. In total, we use around 250 HP for the process, netting a cost of $11.15 per hour, or one-tenth cent per pound finished product. The R.O. system will yield us a whey product of about 14% total solids range. The assumption for electric cost is 5.8 cents per kwh.

After the R.O., we go to the evaporator. It costs about the same $78 per hour to run the evaporator for both whey and NFDM. The only significant difference is throughput. This adds an additional 2 tenths of a cent per pound onto the whey processing cost. We use a cost assumption of $0.799 per therm ($7.99 per MMBTU). One might ask why the evaporation costs are the same for both whey and NFDM. This is associated with the use of steam for both the flash cooler and the hot well, used when processing whey, but not used when processing NFDM. We also see a reduction in the efficiencies on evaporators when operating on whey, due to an increased rate of fouling associated with calcium precipitation.

Whey has to be crystallized before it is sent to the dryer. This adds an additional interface, but adds only one-hundredth cent cost per pound of whey.

Drying costs are a straightforward calculation, based on water removal. We utilize an additional two thousand BTUs to remove the extra 4,500 lbs of water from the skim milk. However, the volume of finished product is again the key factor leaving the drying of the whey a half-cent per pound higher than NFDM, even though the NFDM drying cost is higher on a per hour basis.

For the rest of the equipment in the plant, the cost per pound is relatively the same, or slightly higher for whey powder.

Since we use the R.O. to remove water, this will reduce the utility requirements as demonstrated above. The trade-off is higher annual maintenance and membrane replacements. The membrane costs run slightly more than a third of a cent per year. This brings the total cost difference per pound to 1.2 cents.

On a per-pound basis, in summary, we use around 3,100 kwh per hour when drying whey compared to 2,840 required drying skim. We actually use less total MMBTUs when drying whey (40.5 MMBTUs compared to 55.5 MMBTUs).

We have also completed an analysis of the equipment cost differences associated with processing of whey powder using reverse osmosis technology versus NFDM drying costs. Table 3 in our Exhibit___ outlines the additional equipment costs when drying whey.

Additional equipment costs, including RO filter replacement, add about 1.86 cents to the processing cost to dry whey.

I have prepared a summary of the information put together by Venkat in 2000, Venkat's information using 2004 utility rates, and the whey cost analysis completed by WestFarm Foods. Table 4 in our Exhibit___ to this testimony, *Comparison of Cost to Dry Whey vs. NFDM,* shows the differences in whey and nonfat dry milk drying costs between Venkat's original testimony, his testimony updated for 2004 energy costs, and the WestFarm Foods cost estimates using Reverse Osmosis technology, also based on 2004 energy costs.

Venkat's original whey processing estimates showed a whey drying cost difference of 2.559 cents over nonfat dry milk. When updated to 2004 energy costs, that difference grows by almost ½ cent to 2.905 cents. The whey drying system used by WFF substitutes somewhat lower capital costs, energy costs, and depreciation for the cost of membrane replacement. Based on this whey drying system, we calculate a 2.71 cent cost difference between whey and nonfat dry milk.

In summary, it appears that regardless of the process method used, the lower solids level of diluted whey compared to nonfat dry milk results in significantly higher costs for whey removal. These additional costs must be considered when determining a manufacturing allowance for whey.

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STATEMENT OF C. K. VENKATACHALAM
LEPRINO FOODS COMPANY
at the
UNITED STATES DEPARTMENT OF AGRICULTURE PUBLIC HEARING ON CLASS III AND IV MILK PRICING FORMULAS

Alexandria, Virginia
May 2000

Introduction & Background:
My name is C.K.Venkatachalam and, since it is too long, I have shortened it as Venkat. I am the Director of Whey Products Technical Services for Leprino Foods Company (Leprino), headquartered in Denver, Colorado. My business address is 1830 West 38th Avenue, Denver, Colorado 80211-2200. I hold a Bachelors degree in Chemical Engineering and have 38 years of industrial experience. Early in my career, I worked with multinational companies such as Exxon, Unilever and Cadburys. My past 21 years work has been with the dairy industry and I have been with Leprino Foods for the past 6 years. My background includes designing, installing and commissioning preheaters, evaporators, HTST equipment and flash coolers for milk, whey, whey protein concentrate and permeate products while working with GEA Wiegand, a design engineering firm specializing in dairy evaporation equipment. I worked with GEA for 15 years, and during that time, I was responsible for planning, project engineering, design, installations and startup of 50+ evaporator systems. I have also performed cost / benefit analysis for evaporation / reverse osmosis systems and helped several customers optimize their equipment purchases. In my current position with Leprino, I am responsible for analyzing whey operations with a view to improving efficiencies while maintaining or improving the finished product quality. I also specify major pieces of equipment such as separators/clarifiers, membrane systems, HTST units, evaporators, dryers, powder handling and powder packaging systems and commission them to process the intended products.

Purpose:
The purpose of my presentation today is to provide technical information regarding the differences in the manufacturing processes between whey powder and NFDM, focusing primarily on energy utilization and equipment requirements. Sue Taylor is testifying on behalf of Leprino on the policy issues under consideration at this hearing. One issue that I understand Sue will discuss in her testimony is the need for a higher whey make allowance in the Class III price formula. I am told that when establishing the current Class III price formula, USDA assumed that manufacturing costs for whey and nonfat dry milk (NFDM) are the same. For the reasons discussed below, this is an erroneous assumption.

There are a few similarities between whey powder and NFDM. Before elaborating on the differences, I wish to point out the similarities. Milk for both of these products is processed first through clarifiers for fines removal, separators for skimming fat to an acceptable level and is legally pasteurized in an HTST system. The similarities stop here.

There are significant differences between whey and NFDM. Let me start with the process itself. In addition to the processes required in the production of NFDM, whey powder production requires additional separation and pasteurization, a crystallization process, and a two stage dryer. In addition to the initial pass through a clarifier, separators, and pasteurizer that occurs prior to cheese production, the whey stream coming off the cheese vats must pass through a clarifier and be separated and pasteurized a second time. To produce sweet whey powder, the pasteurized whey is then evaporated to about 52 to 55% solids and is flash cooled to about 85° to 95°F to form nuclei of fine lactose crystals. This product is then cooled in jacketed / agitated crystallizers to about 45°F, under controlled cooling conditions. The resulting slurry is then spray dried in a two stage dryer to produce a free flowing non-caking powder. The powder is packed in poly lined Kraft paper bags which are heat sealed.

There are significant differences between Whey and NFDM with respect to initial solids content. Dilute whey has a total solids content of 6.3% (ranges from 6.1 to 6.5%). For 100 pounds of whey powder we need to remove about 1,440 lbs of water. Expressed another way, we need to remove 14.4 lbs of water per pound of whey powder. About 94% of this water is removed during evaporation while the balance of 6% is removed during drying. As you can see, evaporation is the single most energy intensive operation in the powder manufacturing process.

Skim used to produce NFDM has a total solids content of 9.25% (ranges from 9.0 to 9.5%). Pasteurized nonfat milk is evaporated to about 54% total solids and is spray dried in a hot condition. Unlike whey, there is no crystallization involved. This condensed product is spray dried in a single stage dryer to produce nonfat dry milk and is packed in heat sealed poly lined Kraft paper bags. For 100 pounds of NFDM, we need to remove 1,048 lbs of water. Expressed similar to whey powder, we need to remove 10.5 lbs of water per pound of NFDM.

Thus, the main differences between whey powder and NFDM production can be summarized as follows:

	Whey Powder	NFDM
a) Pounds of water removed per pound of powder	14.4	10.5
b) Energy to crystallize	needed	not needed
c) Capital for equipment	extra clarifier, separator, pasteurizer, larger evaporator, crystallizers and refrigeration equipment, double stage dryer	smaller evaporator, single stage dryer
d) Extra power to operate additional equipment	needed	not needed

As a result of these differences, it costs more to produce whey powder. Although it obviously requires more labor and management to operate and maintain the additional equipment and processes associated with whey production, I will focus on the energy and equipment costs which are within my area of expertise.

Energy costs to produce whey powder are higher than the energy costs to produce NFDM. associated with producing whey powder and nonfat dry milk:

- dilute whey and skim contain average TS of 6.3% and 9.25% respectively
- assuming no losses, product yields at ~~97%~~ 3% moisture would be 6.49 pounds whey and 9.54 pounds NFDM per 100 pounds of dilute feed
- steam cost of $4.25 per 1000 lbs
- electricity cost of 6¢ per KWH
- 8 lbs of water removal per pound of steam
- Additional power consumption for whey:
  - 4 x 50 HP = 200 HP for separators and clarifiers
  - 6 x 15 HP = 90 HP for crystallizers
  - 10 x 15 HP = 150 HP for additional pumps
  - Total installed = 440 HP. Operate at 75% capacity (330HP). Consumption at 75% capacity will be 247 KWH

My written testimony includes a table that details the calculations.

	Dilute Whey	per pound finished product (6.49# / cwt dilute whey)	Skim	per pound finished product (9.54 # / cwt skim)
Composition (pounds)				
solids	6.30		9.25	
water	93.70		90.75	
total volume	100.00		100.00	
Evaporation to 54% TS				
water removed	88.330		82.870	
÷ # water removed / # steam	8.000		8.000	
pounds steam required	11.000		10.400	
x $ per 1,000 pounds steam	$4.250		4.250	
Steam Cost	$0.047	0.723¢	0.044	0.462¢
Crystallization				
KWH for refrigeration	0.2		none	
price / KWH	$0.060			
Refrigeration cost	$0.012	0.185¢	$0.000	0.000¢

	Dilute Whey	per pound finished product (6.49# / cwt dilute whey)	Skim	per pound finished product (9.54 # / cwt skim)
Drying to 97% TS				
water removed	5.17		7.59	
BTUs required	11,000		15,340	
x $ per therm	$0.280		$0.280	
Dryer gas cost	$0.031	0.474¢	$0.043	0.450¢
Additional Power Required (2MM pound / day plant)				
Additional HP installed	440			
HP used (@ 75%)	330			
KWH / HP	0.748			
KWH	247			
price / KWH	$0.060			
Additional power cost / hour	$14.82			
4,875 pounds produced/hour		0.304¢		0.000¢
Total		1.686¢		0.912¢

The calculations of the additional energy cost to produce finished whey relative to NFDM in the above table can be summarized as follows:

	Cents per Pound
Evaporator steam	0.261
Refrigeration for crystallizers	0.185
Dryer gas	0.024
Additional power	0.304
TOTAL	0.774

There are also additional equipment costs associated with producing equivalent volumes of dry whey. The additional equipment required to produce whey powder requires additional capital. This additional capital impacts the business in two ways: additional interest costs and additional depreciation.

Additional equipment required for a whey plant relative to a butter-powder plant, assuming both plants receive 2 million pounds of raw milk per day, are:

Additional Equipment	Total Cost ($MM)
Two clarifiers	$ 0.70
Two separators	0.70
Evaporator/ bldg/services	1.80
6 crystallizers / with controls and cooling piping	1.20
Additional fluid bed / bldg / services	1.20
Total	$5.60

Operating 350 days each year, this plant could produce roughly 40.9 million pounds of whey powder annually. Spreading the $5.6 million of additional capital costs over this 40.9 million pounds of whey powder, using an 8% cost of capital, the additional cost of capital in a whey powder operation is 1.1 ¢/lb of whey powder. Amortized over 20 years, annual depreciation for the additional equipment is approximately 0.685¢/lb of whey powder.

In summary, incremental whey energy & equipment costs associated with producing whey powder as compared to producing NFDM is 2.559¢.

Source	¢/lb of whey powder
Energy	0.774
Capital	1.100
Depreciation	0.685
Total	2.559

As I stated earlier, the additional equipment in whey operations requires other costs such as extra labor to run the equipment, additional maintenance, as well as increased overhead costs. My testimony only covers the additional energy and equipment costs in whey processing, however these other operating costs should not be overlooked.