TESTIMONY OF DEAN SOMMERS
FEDERAL MILK ORDER HEARINGS
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My name is Dean Sommer. I have a Master of Science Degree in Food Science (University of Wisconsin, 1981) and a Bachelor of Science Degree in Biology/Chemistry (University of Wisconsin-Stevens Point 1977). For approximately the last 4 years I have been employed at the University of Wisconsin Center for Dairy Research as a Cheese and Food Technologist. In that capacity I work to further the interests of dairy farmers and the entire domestic dairy industry. I do this through working with cheese plants of all sizes across the entire country as well as the cheese customers they serve in order to strengthen and expand the use of and markets for cheese.

Prior to this position I worked for Alto Dairy Cooperative in Waupun, Wisconsin for 18 years. My positions with Alto Dairy included Manager of Technical Services (1985-1990), Vice-President of Technical Services (1991-1999), and Vice-President of Operations (2000-2003). In these roles I was responsible for all technical aspects of the business (milk quality, cheese quality, research and development, regulatory affairs, cheese technology) and in the last 4 years I was responsible for all aspects of cheese and whey operations including cheese yield. Alto Dairy at the time of my employment was an approximately $400 million dollar business producing approximately 200 million pounds of cheese per year in 3 large, modern up-to-date cheese manufacturing facilities. Cheese plant #1 in Waupun, Wisconsin was completed in 1983 and was, at the time and for most of the 1980's, the largest and most modern cheese plant in the country. Cheese plant #2 in Waupun was completed in 1997 with the most technologically up to date cheese vats and tables in existence. The Black Creek cheese plant, although an older facility, was also updated with some of the most modern, up-to-date equipment during the 1980's and 1990's.

MILKFAT RECOVERY IN CHEESE

The recovery of milkfat in cheese is one of the key elements in maximizing cheese yields. The Van Slyke equation, widely used in the industry to predict cheese yield, typically uses a figure of 93% as the maximum possible recovery of milkfat in cheese. All cheese plants try to maximize their recovery of milkfat in cheese in order to maximize cheese yields and overall profitability. Their ability to efficiently recover milkfat is a function both of the cheesemaking equipment they have as well as the skill of their cheesemakers in operating that equipment.

The greatest loss of milkfat during cheesemaking occurs during the cutting of the coagulum. Subsequently this is where most cheese plants concentrate their efforts in maximizing milkfat recovery. In my experience there are basically 3 types of cheese vats in commercial use: the traditional open vats, the vertical enclosed vat of the Damrow 'OO' style, and the horizontal enclosed vats. The open vats were used by virtually the entire industry until the 1970's when the first vertical enclosed vats came on the market. However, many cheese plants, in particular medium to smaller cheese plants, still use

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open vats. The vertical enclosed vats became the standard of the industry by the 1980's and remained so until the 1990's when the horizontal enclosed vats came on the market. However, there are hundreds of vertical enclosed vats still in use today, including 10 at the Alto, Waupun large cheese plant #1 and 4 at the Alto Black Creek facility. Today, most large, new cheese plants install horizontal enclosed vats.

One of the driving forces behind this progression of technology in cheese vats was fat recovery. It is widely recognized that among vat styles, open cheese vats have the least efficient recovery of milkfat at cutting, followed by vertical enclosed vats, and with horizontal enclosed vats having the most efficient milkfat recovery at cutting. Open cheese vats typically have fat levels in whey at draw in the area of 0.4% or higher. Using some simple mathematics one can calculate using a yearly average milkfat content in milk of 3.75% fat that this fat loss in whey represents 9.6% of the total milkfat that you started with. This means that with open vats at draw of the whey, and not including all of their other fat losses that occur in cheddar cheese manufacture which I will detail later in this document, you are already down to a maximum of 90.4% fat recovery compared with the Van Slyke theoretical figure of 93%. This is also documented in the scientific literature by Dr. David Barbano of Cornell University (Barbano and Sherbon, Journal of Dairy Science, 1984).

Vertical enclosed vats typically have better fat recovery at draw than do open vats. This is a result of the physics involved with cutting the coagulum in this style vessel. In my 18 years of experience at Alto Dairy, I would say the average milkfat concentration in whey at draw using this style vat is .29%. This number is also documented in the Barbano study cited above. Again, using some simple mathematics, this represents 7% of the original milkfat in the starting milk, which means that you are down to a maximum theoretical fat recovery in cheese of 93% **without taking into account unavoidable and significant fat losses at further steps in the cheesemaking process.**

Lastly, with horizontal enclosed vats, like we had at Alto in Waupun cheeseplant #2, the efficiency of fat recovery is better than with the other style vats previously mentioned. In my experience at Alto, I would say that our typical milk fat content of whey at draw with this style vat for cheddar cheese was .24%. This represents 6% of the original milkfat in the starting milk. This means that the maximum theoretical fat recovery in cheese was 94%, again **without taking into account unavoidable and significant fat losses at further steps in the cheesemaking process.**

TOTAL FAT LOSSES IN THE CHEESEMAKING PROCESS

At Alto Dairy we recognized the critical importance of milkfat recovery in the cheesemaking process to the overall profitability of the business. Because of this, I assigned an able person at Alto, Mr. John Boortz, to spend a majority of his time devoted to this issue over a period of a number of years. Our attempt was to get a firm handle on the mass balance of both milkfat and milk protein during the cheese making process, that is to say, knowing how much milkfat and milk protein we started with in our raw milk, measure how much of it ended up in our finished cheese, and by difference as well as by some measurements, determine how much milkfat and milk protein were lost in the whey as well as in other byproducts and streams. This was a daunting task in a large cheese plant. However, after years of study and using the statistically advantageous technique of gathering large data sets over long periods of time and using averages, we concluded that in general, depending on seasonality and other factors, our recovery of milkfat in our finished cheddar cheese ranged from 89-91%. If I would be asked to use a figure for realistic **average** milkfat recovery during the manufacture of cheddar cheese in a typical cheddar operation I believe that number would be very close to 90%. Traditional open vat plants would have figures lower than this. Plants with enclosed vertical vats would have values very close to this. The newest plants in the country with the very latest horizontal vats with the latest innovations in curd cutting, cooking, stirring and handling equipment would have figures higher than this.

OTHER LOSS POINTS FOR MILKFAT DURING CHEDDAR CHEESE MANUFACTURE

As previously mentioned, while the largest single loss of milkfat during cheesemaking occurs during the cutting of the coagulum, and due to this most cheeseplants concentrate their milkfat recovery efficiency efforts at this point, there are numerous other significant points in the cheesemaking process where milkfat is lost. The following is a general listing and discussion of those milkfat loss points.

Milk silos: For the purposes of these discussions I will pick up the cheesemaking process at the milk storage silo area, knowing full well there are other milkfat losses prior in the process to this during pick-up of the milk at the farm, and delivery of the milk to the intake at the cheese plant. Some milkfat loss occurs at the milk silo stage due to the fact that normally there is always a small amount of milk left in a silo when it is emptied. It is very difficult to get every last drop of milk out of the silo during the pumping process.

Milk clarifier/milk filters: Virtually all cheeseplants use some sort of mechanical milk clarifier or milk filter system to remove any extraneous foreign materials in the milk prior to cheesemaking. If the equipment is a clarifier, significant milksolids including milkfat is lost from the system during the frequent desludging cycles that the clarifier must undergo to remain effective. This lost milkfat and milksolids goes directly down the drain. In the case of milk filters, they too must be cycled or they will plug up, often with milkfat, and all of this fat and milk solids is lost to the drain.

Start-ups, changeovers, shut-downs: At the start-up to the day the milklines are filled with water. This water is chased with milk at the start of pasteurization, and there is a significant period of time when there is a dilute milk/water mix that is typically sent to drain because it is inefficient and may result in cheese defects to put this dilute mix into the vat. The same process occurs during mid-day wash-ups, some change-overs, and always during the shut down process (but in this case in reverse where you chase milk with water). In any regard, during these times significant amounts of milkfat are unavoidably lost.

Cheese fines: Cheese fines represent one of the potentially largest sources of loss of milkfat. All cheddar cheesemaking processes result in the generation of fines. There are many varied techniques used to recover these fines, ranging from recovering most of them to put back into cheese (a microbiologically dangerous and ill advised process) all the way to using none of them back in the cheese. It all depends on the equipment the cheese plant has at its disposal, the type of cheddar cheese they are making (aged cheddar vs mild cheddar vs cheddar for processing (i.e. process cheese)). In any regard all cheddar plants lose fines, it's just a matter of how much. These fines are, as in the case of cheddar cheese, rich in fat, and will start out at roughly the same fat content of cheddar cheese itself which would be 33%. Cheddar cheese plants can lose up to hundreds and even thousands of pounds of cheddar fines per day. For example, in the case of our Black Creek plant making cheddar cheese for aging, losses of fines that were not put back into the finished cheddar cheese averaged over 600 pounds per day. This represents approximately 0.4% of the total milkfat in their starting milk per day, meaning if they had a 93% milkfat recovery at whey draw, just the further loss in fines would lower their overall milkfat recovery to 92.6%.

Salt whey: After draw of the whey in the vat the curds are typically pumped to a finishing table or a matting conveyor. This process inevitably disrupts and shatters some curd, resulting not only in fines generation but in larger fat losses in the whey generated at this point than is seen at cutting. Furthermore, after all the sweet whey is removed the curd is dry salted and stirred. This process results in the generation of salt whey, which is much higher in milkfat than is sweet whey. While the overall volume of salt whey is much smaller than the volume of sweet whey, the relatively large fat content seen in salt whey represents a significant loss of milkfat during cheddar cheese manufacture.

Curd loss: After salting, the curd must be put into some sort of form or shape (hooping). Inevitably this process results in loss of product onto the plant floor. I have yet to see a cheese plant, whether Alto or any of the many other ones I have been in, that doesn't have some cheese curds on the floor. This is, with current technology, an unavoidable part of the process of transferring cheese (either by traditional shovel, or by auger, or pneumatically by air) from one point in the process and into a form. Furthermore, with customers typically wanting fuller and fuller forms (to reduce trim losses at cutting/conversion operations), this results in even more curd loss as plants try and stuff every last pound of curd into the form (particularly 640 forms). Again, this cheese curd is 1/3 milkfat, and these losses represent a significant loss of milkfat which is totally lost from the system as it is disposed of as waste.

Equipment surfaces: All cheese product contact surfaces must be cleaned at least 1 time per 24 hours. The reason for this is that these contact surfaces become coated with product over the course of the day, primarily milkfat and milk protein. This can be easily demonstrated by seeing how greasy they become. One only has to look inside an alkaline wash solution tank of a CIP system after it has washed this equipment to see how much fat has been removed during the washing of the equipment. This too represents loss of pounds of fat in the system.

MILKFAT RECOVERY EFFORTS

Cheese plants do everything they reasonably can to recover milkfat lost in the whey and fines. Milkfat recovered from whey is called whey cream. It should be noted that this cream is of lower value to the industry than is sweet cream. This cream typically cannot be used in AA butter manufacture. The value of whey cream varies regionally depending on the availability of alternative markets for this product. Not all milkfat in whey can be recovered. Much of this milkfat represents physically damaged fat which cannot be recovered in a typical separator. This is especially true of salt whey cream, where the skimmed salt whey is typically disposed of and any remaining milkfat in it is totally lost. Milkfat lost in skimmed sweet whey will end up in the finished dry sweet whey, that is why we typically see a fat content in dry sweet whey of around 1%. Nevertheless, this represents a significant loss of value compared to if this milkfat could have been recovered in cheese or even whey cream.

Many plant use a whey clarifier prior to whey cream separation to improve the efficiency of milkfat recovery at this point. However, one will see a significant volume of sludge generated at this point (which represents very small cheese fines that couldn't be captured at upstream points). This sludge is typically disposed of at a total loss. In many cases cheese fines are captured in some sort of a sieving process prior to the clarifier. If these fines are not returned to the cheese (which in my opinion they should not be due to microbiological risks, unless the cheese is barrel cheddar for further processing and pasteurization anyway) they are typically pressed in some sort of form and sold for process cheese manufacture at perhaps around 50% or less of the value of the finished cheese.

CONCLUSIONS

The capture of the maximum amount of milkfat in the finished cheese is the goal of every cheese plant. The Van Slyke equation has historically used a maximum figure of 93% for this milkfat recovery effort. My 18 years at Alto Dairy followed by nearly 4 years at the University of Wisconsin Center for Dairy Research has indicated to me that cheddar cheeseplants typically achieve significantly less milkfat recovery than this. I even believe that many cheeseplants, when they casually talk about their own milkfat recovery, are specifically and somewhat misguidedly referring to only the loss of milkfat at whey draw and not at the overall loss of milkfat that occurs during the entire cheesemaking process from starting milk to finished cheese product. However, as I have discussed, milkfat recovery into cheese is a function not only of the loss of milkfat at whey draw, but also of the recovery efficiency and subsequent losses at the numerous other typical milkfat loss points that I have outlined above. In my experience at Alto and in the general industry, my belief is that an average cheddar cheese milkfat recovery percentage in the entire industry would be in the area of 90%.

I have the following comments regarding the written statement of Ben Yale (Exhibit 32).

1. Definition of commodity cheddar (p. 26)- the written definitions used by the author of cheddar cheese are misleading and incorrect. Cheddar cheese doesn't come in many varieties- cheddar cheese is cheddar cheese. But it does come in many styles, some of which he has listed. Colby/Longhorn is not cheddar cheese; Colby cheese has its own standard of identity. I would dispute that because a cheese plant makes cheddar in some of the styles he has listed it cannot be counted. Any plant that makes cheddar in 40lb blocks can trade their cheese at the CME, and any 40# block cheddar has the potential to be commodity cheddar. Millions of pounds of 40# block commodity cheddar ends up in slices, dice, shreds and cubes. All cheddar cheese produced (other than that for manufacturing) needs to conform to the 21CFR 133.113 he has listed. It does not differentiate between commodity cheddar and specialty cheddar. These terms are not legally defined. Beauty is in the eyes of the beholder when it comes to differentiating between commodity cheddar and specialty cheddar.

2. There is not a total lack of data on cheese yields and fat retention in cheddar cheese making (p. 27). Although there is not a wealth of public information available, a number of studies including some by Dr. Dave Barbano of Cornell University as well as some studies of the Irish Dairy industry speak to the level of fat retention as well as overall cheese yields in cheddar manufacture. The reality is that cheese yield information generated by individual plants is widely considered as proprietary information that could result in competitive disadvantages if publicly disclosed. Furthermore, in my experience as VP Technical Services of Alto Dairy as well as in dealing with a number of cheese plant across the U.S. in my current capacity at the University of Wisconsin Center for Dairy Research it is my opinion that more often than not individual plants don't accurately know their own fat retention data because it is so difficult to determine. Finally, I think it is wrong to say that just because plants aren't complaining that means they have yields and fat recovery higher than the current USDA standards, or that all plants have yields above the current standards. I believe this to be untrue, for the reasons I have already discussed.

3. Whey cream sometimes is returned to the vat, but in my opinion it is an unwise practice. In my 18 years of work at Alto Dairy, a large commodity cheddar producer, we never once to my recollection returned whey cream to the vat. Lastly, I have had years worth of experience using ultrafiltrated milk in cheesemaking and it normally does not increase the recovery of butterfat and casein in the cheese. If used in extremely high concentrations it can capture some of the soluble proteins in the cheese matrix (i.e. whey proteins). Unfortunately this results in an inferior quality cheese normally not suitable for table cheddar.

4. The bases stated in the final decision for using the 90% fat recovery factor in cheese are still reasonable and very supportable (pp. 34-35). While I don't have direct experience with how Kraft makes their cheddar cheese, all cheddar cheese

is made using basically the same procedure with respect to cutting the coagulum and cooking the curd. The author refers to the making of a "higher quality cheese of different value". This is not true in my opinion. The cheese may indeed be of high quality, but it is not necessarily higher in quality than many other commodity cheddar produced, only different. These differences have nothing to do with the basic, time honored cheddar manufacturing techniques, rather they are driven by different cultures used, the use of flavor producing enzymes, the expertise of the cheesemaker in handling the curd, as well as different aging regiments. This does nothing to alter the basic milkfat recovery. Finally, using milkfat recovery numbers from vats over 20 years old is not wrong. Rather, it is the right thing to do to incorporate some of these data to obtain a valid overall picture of the current industry. In many cases these vats are still the workhorses of the industry and represent current standard cheesemaking practices. Furthermore, most of these vats have been mechanically updated to significantly improve their milkfat recovery efficiencies compared to when they were new. To me it would be a huge mistake to only use milkfat recoveries from ideal conditions using only the latest, newest vats when these vats represent only a fraction of the current reality of vats in use. This would not accurately reflect current overall industry results. Furthermore, even these newest, most efficient vats will lose milkfat recovery efficiency as they age, wear, and their knives become dull.

5. Obtaining a 90% milkfat recovery is not low, it is reality (p.35). The truth is there are plants that are below this level, whether they know it or not. There is no doubt in my mind that some plants, more than a few, are on the short side of this factor. As I indicated in my own testimony, at Alto Dairy, even though we were a very large, modern cheddar cheese plant, didn't always obtain 90% fat recovery. In reality, the higher quality cheese the plant produces, the lower their fat recovery will be. Why? Because they won't succumb to ill advised practices to boost their fat recovery such as putting fines back in the cheese or adding whey cream back to the cheese milk. Those cheese plants that have the best chance of having highly efficient milkfat recovery rates are those that produce a cheddar cheese destined for manufacturing (process cheese) where they feel they can get away with using inferior whey cream and poor quality fines in their finished cheese since their cheese is just going to be ground up, repasteurized, mixed with emulsifying salts and made into process cheese, or those that just make a substandard quality cheddar cheese at a discount price. But this does not represent the norm for producing cheddar cheese across the country that needs to meet typical customer expectations and standards as well as meet the standard of identity for cheddar cheese.

6. The author cited a number of California studies showing higher yields (p. 36). The reality is these data have little or nothing to do with efficient milkfat recovery during cheesemaking. What these data show is that these cheese plants are heavily fortifying their raw milk with additional milk solids, most likely concentrated milk of some sort, and/or sweet cream, and/or whey cream, and/or condensed skim milk, and/or nonfat dry milk solids. One needs to remember that **higher**

cheese yields do not automatically translate into higher cheese plant profitability. All too often I have seen cheese plants increase their yield through fortification of their raw milk with additional milk solids without realizing that they have increased their input costs higher than they are able to recover with their output (i.e. cheese, whey solids, whey cream) gains. I believe the data the author cites in this section have no merit in his case he is presenting.

7. I do not believe the calculation the author apparently did to estimate the butterfat recovery in California cheese plants is accurate. While this does not appear in his written testimony I am informed that he provided a range of 93 to 95% in his oral testimony. The estimation of milkfat recovery in cheesemaking is not as simple of a process as the author would have one believe, There are too many other complex interactions involved to calculate milkfat recovery in this way, including protein recovery rates, the factor used for recovery of other solids (typically 1.09 used for cheddar cheese but in my work at Alto we demonstrated that this too varies and can lead to errors in estimating milkfat recovery efficiencies), moisture levels, and laboratory inaccuracies in testing the various components. Furthermore, it is incorrect to assume that all the additional fat in cheese milk above levels seen in producer milk is whey cream fat. This is not true. Cheese plants can and do use other sources of milk, namely concentrated milk and sweet cream, to boost the levels of milkfat in their cheese milk prior to cheesemaking. Also, the author says that cheesemakers add butter to their vats, this is absolutely untrue, they can only add fat in the form of cream or milk streams. Lastly, looking at California cheese plants in isolation does not give you a true picture of the entire nation's cheese industry.

8. The statement that the FMMO data shows that for milk that goes into Class III that virtually 100% of the milkfat remains in the cheese is a just plain wrong assumption (p.41). This would imply that no whey cream is generated that doesn't go back into cheese, which is patently false, that all cheese plants are perfect and no cheese ever is lost to the floor, or milk is lost for that matter, or liquid whey is lost for that matter, that all milkfat can be recovered from whey, that the fat content of dry whey powder would be zero (since all the milkfat was captured in the cheese, which it obviously isn't, and that all fat is captured from salt whey, which it isn't.

The author states that they know that the butterfat recovery in the cheesemaking process is far greater than the current 90% used in the formula and that this figure grossly understates the butterfat recovery that cheese plants currently obtain in the making of cheddar cheese (p.41). The figure of 90% recovery of milkfat in cheesemaking remains a valid number to estimate the reasonable amount of milkfat that cheesemakers across the country making cheddar cheese can expect to achieve if using reasonable equipment in good repair and also using generally regarded as acceptable cheesemaking practices.