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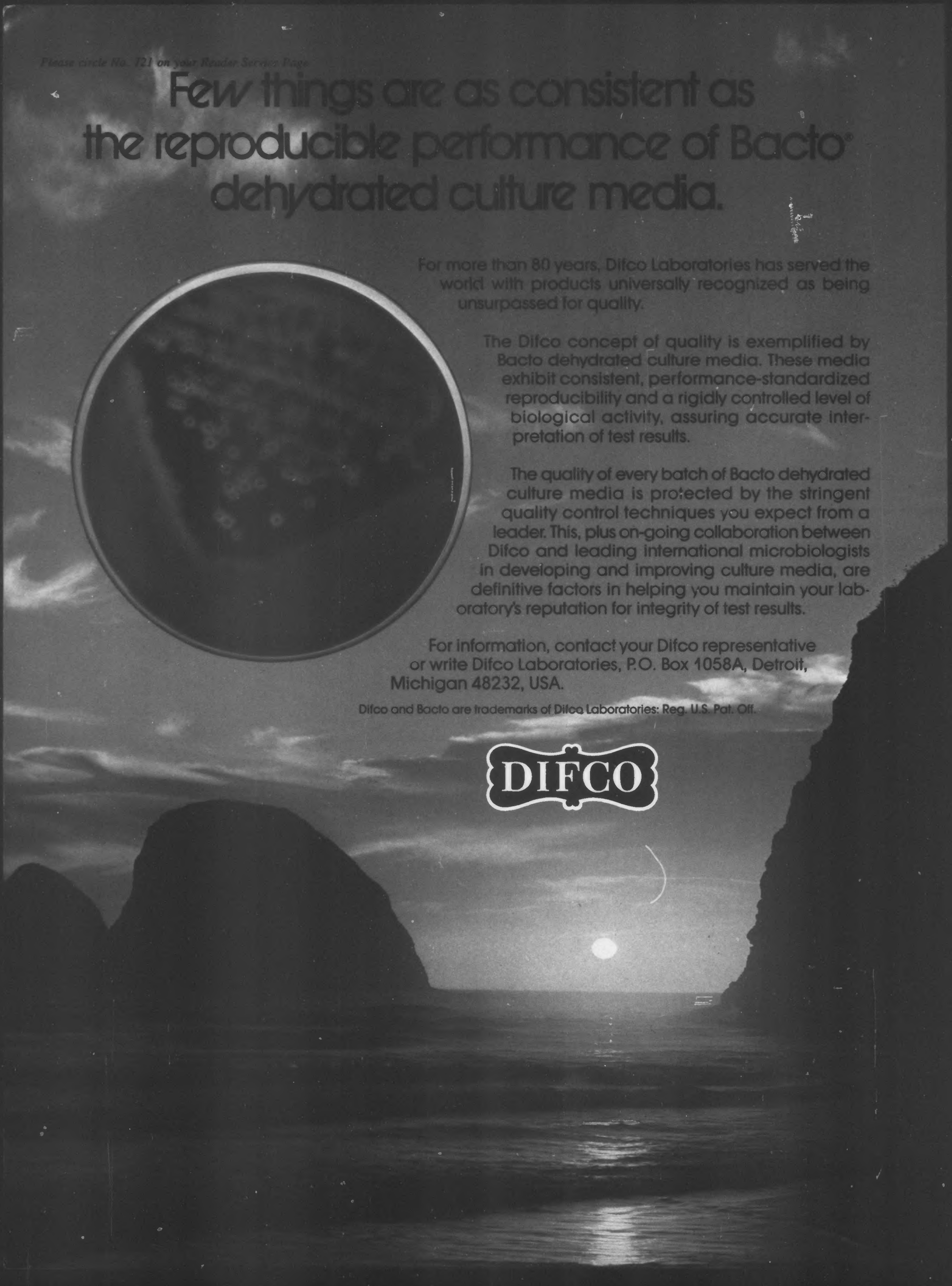
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The Components of Milk: Some Factors to Consider in Component Pricing Plans

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Traditionally, milk has been purchased on the basis of its fat content, with a uniform adjustment in price for levels above and below 3.5%. Now milkfat and other milk components are being considered or used in milk purchase programs. As a result, a number of compositional and testing factors have taken on new significance; dairy farmers face a new array of management decisions; a variety of industry issues need be addressed. It is the purpose of this publication to review (1) the composition of milk, the major causes and significance of sources of variation in composition, and the testing of milk components for pricing purposes, and (2) to focus attention on some of the issues the preceding factors appear to raise.

TABLE 1. *Major components of milk (average, 1435 herd samples).*

		Component	Average (%)	Range (%)
		Water	87.4	
Total		Fat	3.8	2.84-4.78
Solids	Solids-	Protein	3.2	2.66-3.70
12.6%	not-fat	Lactose	4.9	4.55-5.24
	8.8%	Minerals (ash)	0.7	8.14-9.46

MILK COMPOSITION

The major components of milk are water, fat, proteins, lactose (milk sugar), and minerals.

The proteins separate naturally into (1) casein(s), the protein of cheese curd, and (2) whey proteins. The latter consist of several different proteins, all of which remain in whey when casein is caused to form curd through the action of acid and/or rennet.

Component pricing also recognizes groups of milk components, namely solids-not-fat (SNF) and total solids. The former considers all solids in milk except fat, i.e., mainly proteins, lactose, and minerals, but also minor amounts of other water-soluble constituents. Total solids includes SNF *and* fat -- everything except water.

Table 1 shows the major components of milk in a sampling of 1435 Minnesota herds.

Figures in Table 1 reflect values for this particular sampling of milk using certain methods of testing. At the outset, please note that data of these kinds are always representative of the specific herds sampled. Such data also always carry the inherent errors and/or variability of the methods used to test the components(s) in question. These aspects will be discussed later. At this point, consider the relationship between various components.

RELATIONSHIP BETWEEN COMPONENTS

When fat content alone is the basis for establishing the price of milk, the base level for adjusting price is 3.5%. That is, for every 0.1% above and below that level of fat, an equivalent value is added and deducted, respectively, from the price of milk.

Note, however, that 3.5% fat *is not the average* level of fat in milk. That level, as evidenced in Table 1, is more nearly 3.8%, at least for these samples. The U.S. average, for pricing purposes, is given as 3.67%. Because a general relationship exists between level of various milk components, the *average* amount of protein and SNF would also be expected to be higher in milk testing above 3.5% fat than in milk testing at or below 3.5% fat.

Research generally confirms this fact. In general, level of SNF goes up 0.4% for every 1.0% increase in fat and vice versa. However, there are exceptions, and the exceptions are significant enough that payment of milk on a protein or SNF basis does in fact require that testing be done to verify precisely the level of these components in individual herd samples.

Nonetheless, the question arises: If the base level of fat in pricing of milk is 3.5%, should the base level for pricing protein or SNF reflect the amount of these components generally found in milk of 3.5% fat? Or should the base levels relfect overall *average* values of protein and SNF conent?

Evidence suggests that the average level of protein, as measured by the Kjeldahl method, is about 3.2%, the average level of SNF probably between 8.7 and 8.8% (depending upon the method of analysis). The level of these two components in milk testing 3.5% fat is more nearly 3.1 and 8.6-8.7%, respectively. In both cases, the level of SNF is considerably higher than the present federal minimum requirements for fluid milk, which is 8.25%. Moreover, the pricing system for fluid milk (Federal Market Orders) does not currently provide for higher retail prices for milk supplies of higher than 8.25% SNF. This fact, too, has implications in component pricing of milk. That is, a fluid milk plant cannot recover a premium paid for milk of over 8.25% SNF in higher sales price of fluid milk product (Class I sales).

In addition, it is generally recognized that cheese yield is highest when protein content of milk is about 80% of the level of fat. In this respect, no one breed of dairy cows provides "ideal" milk on the average. Most milk for cheesemaking is standardized in the plant prior to further processing.

In general, higher levels of fat are accomplished by higher levels of protein, SNF, and total solids in a given milk supply. Higher levels of protein are usually associated with higher levels of SNF and total solids. Thus the amount of most major components varies similiarly, though not in equal increments. In other words, a 1.0% higher level of fat would presume a higher level of protein and SNF, but at some level less than 1.0% for each of these latter components. Individual herd milk supplies may well vary significantly from this general relationship.

FAT OF MILK

Milkfat is by far the most variable of all milk components. Day to day differences of 1-2% in individual cows are not uncommon.

On an average, percentage of fat in various breeds runs from lowest to highest as follows: Holstein, Ayrshire, Brown Swiss, Guernsey, Jersey. Very wide variations occur within individual breeds, however.

Percentage of fat in milk varies under the influence of (1) stage of lactation, (2) season of the year, (3) milking interval, (4) moderate exercise, (5) feed, (6) age, (7) illness, (8) milking management practices, and (9) completeness of milking.

Stage of Lactation: Percentage of fat decreases over the first 2-3 months after calving and gradually increases to its highest level during late lactation.

Season of the Year: Cows respond to changes in temperature, with fat test tending to decrease during warm summer months and increase during cold winter months.

Milking Interval: Generally, shorter milking intervals are accompanied by higher percentages of fat and lower overall yield of milk.

Exercise: Moderate exercise (compared with no exercise) usually results in a higher content of fat in milk.

Feed: Cows must be fed adequate amounts of good quality feed if they are to produce to maximum potential. Cows fed grain at levels needed for efficient production will likely not yield a higher percentage of fat at higher levels of grain feeding; total yield may increase, however.

Feeding finely ground hay, drastically reducing forage intake, and turning cows out on immature spring pasture all tend to lower percent of fat in milk. Feeds high in fat content will not necessarily cause the percentage of fat to increase, and may cause the percentage of protein to *decrease*. Forcing cows to maximize protein output by feeding high levels of grain or energy may ultimately cause a *decrease* in percentage of fat.

Age of Cow: Percentage of fat tends to decrease gradually as cows grow older, but may decrease by no more than 0.2% over a lifetime.

Illness: Severe mastitis generally results in a drop in percentage of fat. Sometimes other illnesses may cause a lowering of yield with a somewhat higher test in fat.

Milking Management: Milkfat production is maximized by preventing cows from becoming nervous or excited, by practicing good uniform milking procedures, preparing cows for milk letdown, attaching milking units without delay (within 1-2 minutes), and completing the milking process within 3-5 minutes.

Fat Test During Milking: "First" milk tests very low in fat, usually around 1%. As milking progresses, the percentage of fat gradually increases, with the highest test usually coming in "stripper" milk.

MILK PROTEINS

Milk contains two major protein components, casein(s) and whey proteins. Casein forms the curd which cheese is made. Whey proteins are a collection of proteins that are lost to the whey in the manufacture of cheese.

Whey proteins have excellent nutritional (biological) value, even better than casein. However, they do not add to yield of cheese under most current manufacturing methods and therefore provide no basis for payment of premiums for milk for cheesemaking. To the extent that whey products may one day find greater value in the marketplace, whey proteins can be seen as valuable components in their own right.

Level in Milk: Possibly the most commonly cited average level of protein in milk is 3.2%. At this level of total protein content, casein averages 2.5-2.6%, whey proteins 0.6-0.7%. In a Minneapolis study of 1435 samples of herd milk, total protein content ranged from 2.7-3.7%.

True versus Crude Protein: The Kjeldahl method is the reference procedure for measuring protein content of milk. As such, it is the basis for calibrating infra-red and dye-binding methods, i.e., the routine methods used in dairy industry laboratories for determining protein content. *Calibration* is the process of bringing testing equipment into initial adjustment. If the Kjeldahl method indicates the level of protein in one of a set of calibration samples to be 3.2%, the routine equipment is then adjusted to show a similar reading for that sample. Thus the Kjeldahl method takes on considerable significance, i.e., all testing equipment is adjusted and maintained to detect levels of protein consistent with findings of this specific procedure.

The Kjeldahl method measures nitrogen content, not protein per se. The level of nitrogen in milk then, is converted to protein by multiplying by a factor of 6.38. (This factor derives from the fact that milk protein contains 15.65% nitrogen. Therefore, $100 \div 15.65 = 6.38$). This procedure would pose no special problem except that not all of the nitrogen in milk originates in protein. A small but significant amount arises from a number of compounds, like urea and uric acid, which are not protein at all. Collectively, these compounds are referred to as *nonprotein nitrogen* (NPN).

Thus, the Kjeldahl method, applied to milk, provides a crude measure of protein content or, as usually stated, a measure of "*crude*" protein. Crude protein should be distinguished, therefore, from "*true*" protein. Just as iron ore is not pure iron, neither is crude protein pure protein.

In milk, the level of true protein is taken to mean Total Nitrogen - NPN $\times$ 6.38.

Significance of Nonprotein Nitrogen: Level of NPN varies to some extent from one region to another. The average is usually cited at 5.0% of total nitrogen of milk. Taking this average and expressing the major nitrogen-containing components of milk as percent protein, you find the following approximate distribution:

Component	Percentage
Casein	2.5
Whey Proteins	0.54
Nonprotein Nitrogen	0.16
TOTAL	3.20

The above figures assume an average of 3.2% protein in milk. At 5.0% NPN, the percentage expressed as protein becomes $0.05 \times 3.2 = 0.16\%$.

This example, close to reality, indicates that the Kjeldahl procedure in fact mis-measures true protein content by about 0.16%. The range may run from 0.1-0.2%. Both Kjeldahl readings and readings of all testing devices calibrated against the Kjeldahl method, therefore, overstate the true protein content. In other words, the tests read too high. How much do they read? The answer is: by whatever the amount of NPN in milk used for calibration and monitoring purposes.

These facts do not imply any difference in price paid for milk based on true rather than crude protein content. The dairy farmer would not receive any more money for milk on one than the other system. The base would simply change. If 3.2% is taken as the base on a crude protein payment program, then, by the above example, the base for payment for true protein becomes 3.04% (i.e., 3.2-0.16=3.04%).

Why make a point of this particular issue if it merely reflects a change in base? The reaons are several:

* Nonprotein nitrogen does not have biological value as protein, i.e., for the most part, it cannot be used by the body to perform functions characteristic of protein.

* Nonprotein nitrogen does not add to cheese yield. It has no place in a purchase plan for milk in which cheese yield is the major consideration.

* If all dairy plants are not on the same program -- either crude or true protein -- the difference becomes a source of confusion. One plant may appear to be using a lower base than an other, when in fact the two bases are essential equivalent.

* Level of nonprotein nitrogen is highly variable in milk. Because the Kjeldahl method is used as the "official" method for calibration and daily control of infra-red and dye-binding testing devices, NPN becomes a source of variability in these other methods -- even though they do not measure NPN as such.

In general, what this means is that plants will not be able to agree on identical samples as well as they might otherwise agree. In addition, small but meaningful fractions of protein go unaccounted for. These fractions become a potential source of inequity, either for producer or processor. Even within the same laboratory, NPN will be a cause of greater variability in testing than would otherwise be the case.

* Seasonal variations in NPN -- and these are significant -- must either be ignored (wider variations in test results allowed) or adjustments in equipment made on a seasonal basis.

* Breeding programs for protein can be more tightly monitored on true than crude protein. Because increases in percentage of protein in milk come very slowly and in very small increments, NPN may mask these changes. In other words, "true" protein is by far the better basis for evaluating progress of breeding programs.

Please note: Of the several factors that have some influence on NPN level in milk, feeding practices on the farm may be the most important. Whenever the ratio of protein to energy in the feed goes up, NPN level increases. Feed more protein and less grain, and not protein but NPN level (percentage) increases in milk. This kind of change in protein/energy ratio is characteristic, in some parts of the country, of the change from winter to summer (pasture) feeding. As a rule, NPN percentage increases in the summer and drops in the winter.

Considering the preceding factors, compelling reasons appear to exist for basing protein purchase on true rather than crude protein, as is done in most European nations. In doing so, a regional policy and, preferably, a national policy to that effect becomes essential, so that neighboring plants and states are all testing on the same basis.

Causes of Variation in Protein Test: Like fat of milk, protein percentage responds to or reflects the influence of various factors. In general, however, the magnitude of change is less for protein than for fat. Following are major causes of variations in percentage of protein milk.

* Stage of lactation: Colostrum is very high in protein content, a major amount being contributed by immune proteins, i.e., those proteins needed by the calf to ward off disease. Protein content declines sharply over the first few days of lactation, then either declines slightly through the next two or three months or remains quite stable until very late in lactation, when percentage again rises to some extent.

* Season of the year: Presence of protein tends to go down in summer months and up during fall and winter. For Holsteins, the overall seasonal change may range from 0.2-0.3%. Colored breeds (Guernseys, Jerseys) may show differences of 0.3-0.5%. Such changes result in part from an absolute lowering of level of casein in milk, and also as a "passive" shift (lowering in this case) in percentage of casein in relation to increases in percentage of whey proteins and NPN.

Seasonal influences tend to reflect changes in temperature. In general, temperatures above 85°F, especially if associated with high humidity, cause both lower yield and lower percentage of protein (and solids-not-fat). From 40°F down to 5°F and lower, protein and solids-not-fat levels tend to rise. Temperatures ranging between 30° and 75°F may cause some slight decrease in percentage of fat but little or no change in protein content.

* Feed: A few general tendencies are worthy of note:

1) Underfeeding -- to 70% or less of required dietary energy intake -- tends to cause a drop in both yield and percentage of protein. Overall percentage may decrease by 5 to 6% of "normal."

2) Feeding higher levels of grain produces a higher percentage of protein in milk. This kind of diet, however, is typically low (lower) in roughage (fiber); fat test may go down as a result.

3) Research suggests that a 1.0% increase in dietary protein yields about 0.02% increase in protein level in milk. One mega calorie increase in energy intake from feed is accompanied by about 0.015% increase in milk protein content. High levels of protein in feed favor increases in yield, mainly, and, to a far lesser extent, percentage of protein.

4) A diet designed to *maximize* protein content of milk causes some reduction in percentage of fat. This fact should be considered in relation to specific milk pricing programs, and feeding practices altered accordingly.

5) A diet abnormally high in roughage (forage) will tend to lower protein level in milk.

6) A diet high in grain, low in roughage tends to reduce percentage of *fat* in milk, but protein content remains fairly stable.

7) Diets high in fat content, especially animal fat (tallow), have been found to lower protein test.

8) Diets high in protein content, low in energy (i.e., pasture feeding) increase NPN level but not protein content of milk.

9) When rations are properly balanced for optimal milk production, individual feed components will produce little or no change in protein content.

* Genetics: Protein content of milk can be increased and maintained at a higher level of output by selecting for high milk yields and high levels of fat and protein.

* Age: Percentage of protein trends downward with age, but to a lesser extent than fat.

* Milking interval: Twice-a-day milking at equal intervals results in milk of similar composition at both milkings. At unequal milking intervals, yield and fat content are higher following the longer interval, but solids-not-fat (therefore, protein) level remains unchanged.

* Milking process: As milking progresses, no change occurs in level of solids-not-fat calculated as a percentage of fat-free plasma.

Keep in mind that protein is a major component, and *the* most variable component of solids-not-fat (SNF). Factors that cause changes in level of protein will usually cause similar changes in level of SNF.

RATIO OF CASEIN TO TOTAL PROTEIN (NITROGEN)

There is no simple, direct measure for casein in milk. Nevertheless, casein content is an essential factor in calculating cheese yield. For this reason, therefore, most dairy plants estimate casein content. This is done by assuming a stable percentage of casein to total protein. If protein content is established by the Kjeldahl method, then casein is taken as 78% of this crude protein value. On a "true" protein basis, casein averages 82% of this value. These relationships are shown in the following table.

	Percentage		
	In Milk	Of True Protein	Of Crude Protein
Crude Protein	3.2		100
True Protein	3.04	100	95
Casein	2.5	82.2	78.1
Whey Proteins	0.54	17.8	16.9
NPN	0.16		5.0

In preceding table, the percentage of casein to crude protein is determined as follows: $2.5 \div 3.2 \times 100 = 78.1$. Please note that the level of NPN figures into this calculation. On a true protein basis, the calculation becomes $2.5 \div 3.04 \times 100 = 82.2$. Here the NPN level if discounted, i.e., crude protein-NPN = true protein, or 3.2-0.16 = 3.04.

In a study of milk samples from Minnesota herds, the range of percentages of casein to total crude protein went from 74.2-81.3. However, the average level was found to be stable enough that estimates of casein content from total crude protein, using the average value, agreed with *measured* values for casein to within ±0.09%. This accuracy could be expected with 95% confidence. Even greater accuracy could be obtained using percentage of *true* protein in the estimate.

CHEESE YIELD

Knowing the level of casein in milk, it is possible to estimate the yield of cheese. Cheese solids consist essentially of casein and milkfat. The oldest and perhaps best known formula for estimating yield of cheese is one developed by and referred to as the Van Slyke and Price Formula. It is given as follows:

$$Y = \frac{(0.93\ F + C - 0.1)\ 1.09}{1 - W}$$

where: Y = yield of cheddar cheese/100 pounds of milk

F = % fat; 0.93 assumes 93% recovery of fat in the cheese

C = casein; 0.1% deduction assumes that much loss. The factor 1.09 considers presence of salt in cheese and also recovery of a certain amount of other milk solids in the cheese

W = pounds of moisture per pound of cheese

As an example, assume 3.5% fat, 2.5% casein in milk. Then:

$$Y = \frac{(.93 \times 3.5 + (2.5 - 0.1))\ 1.09}{1 - .38}$$

$$= \frac{(3.26 + 2.4)\ 1.09}{.62} = 9.94$$

(lbs. of cheddar cheese per 100 lbs. milk)

A more recently developed formula for cheese yield assumes a somewhat greater loss of fat. At the same time, casein content is considered to be 78% of the crude protein level in milk. This modified version of the estimation of cheese yield as given as follows:

$$Y = \frac{(0.9F + 0.78P - 0.1)\ 1.09}{1 - W}$$

In this formula, P is taken as total crude protein. If true protein were known, P could designate that value, but 0.78 would become 0.82 (the average percentage of casein to total *true* protein content of milk).

It is important to note that these formulas were developed for the estimation of yield of cheddar cheese. Calculation of yield of other cheese varieties requires modification of the formulas. Nevertheless, it is by calculations like these that some dairy processors may determine a price for milk from dairy farmers. In such instances, the price paid for milk will depend on level of fat and casein. It will be assumed that casein is a constant percentage of total crude protein (or true protein, if this component is in fact the basis of the test done in the milk). Also keep in mind that best yield of cheese is obtained in milk in which crude protein equals 80% and casein 70% of the fat content.

SOLIDS-NOT-FAT (SNF)

Solids-not-fat of milk consists of lactose, protein, minerals, and various minor (in amount) constitutents. It can be considered a composite of milk components. Together, SNF and fat make up what is referred to as "total solids" -- all of the solid (non-water) constituents. A number of dairy plants have opted to purchase milk according to levels of SNF *and* fat, or on a total solids basis.

Of the components making up SNF, lactose and minerals show the least variability. That is, level of these two components remains remarkably stable in milk supplies. The major cause of changes in level of these constituents is mastitis, in which case lactose content usually decreases, and mineral content increases. In sum, however, the overall balance of lactose and mineral level is so consistent that the freezing point -- the method by which adulteration of milk with water is determined -- of any given milk supply varies only slightly. Of course, one of the advantages of pricing milk on a SNF/fat (total solids) basis is that added water does not enter into the price paid for milk; the plant pays only for solid matter. Nevertheless, added water continues to be a cost factor in operation of the dairy plant, both in cost of hauling milk and in processing water of milk and dairy products.

The mineral (ash) content of milk is considered to be 0.7%, varying little. Lactose content of milk varies with breed, Guernseys averaging 4.7%, Holsteins 4.9%, Jerseys 5.0%, and Brown Swiss 5.1%. The latter data come from a study done in Pennsylvania. The point is, however, that some slight differences exist, and the plant purchasing milk high in SNF in fact may be purchasing slightly higher-than-normal lactose levels as well. However, the major component influencing level of SNF is protein. A Minnesota study indicated that 72% of the variation in level of SNF could be explained by variation in protein content. In other words, factors influencing protein content of milk are most significant factors in determining levels of SNF in milk. Knowing this fact, the reader might wish to refer again to the section of this publication concerned with causes of variation in protein content in milk.

Solids-not-fat content of milk shows seasonal influences similar to, but to a lesser degree and with far more irregularity than, fat. Temperature, again, appears to be the most important consideration in this respect, and both protein and lactose content tend to respond to this factor, increasing at lower temperatures, decreasing at temperatures above 85°F.

Stage of lactation produces some changes in SNF, with levels decreasing over the first few weeks and gradually rising then through late lactation. Colostrum usually contains less lactose than normal milk, the level moving up over the first several milkings. Thereafter, level of lactose remains fairly constant until late lactation, when a slight decrease may occur.

Influence on Feed on Solids-Not-Fat: Some general comments appear warranted based upon the present state of scientific knowledge. First, tendency for cows to respond to feed seems to depend to some extent on the initial yield of milk, of milkfat, of SNF or level of SNF in the milk. The higher these values the more responsive the animal. To enhance output of SNF then requires the feeding of energy/concentrates. High dietary energy levels increase SNF levels, and vice versa. Thus, those feeding conditions that maximize protein output likewise favor greater yield of SNF. This might be expected based upon the fact that protein is the most variable -- most responsive -- component of the SNF fraction in milk. Some slight increase in lactose level might also be anticipated under feeding conditions that favor SNF production.

If feeding conditions are poor during winter months, some improvement in level of SNF might occur in the spring when and if lush pasture feed comes available. However, pasture feeding could well result in a decrease in SNF if winter feeding conditions have been good.

In general, therefore, protein and SNF production require a balance in feeding practices -- the meeting of energy needs without too great a reduction in fiber (which will cause a drop in fat test).

Testing for Solids-Not-Fat: In the official test for SNF, milk is placed in an oven and all the water evaporated under precise conditions. A fat test is also made, then SNF is calculated by subtracting percentage of fat from percentage of total solids.

Assume a total solids content of 12.5%, a fat percentage of 4.0%. Then SNF = 12.5 − 4.0 = 8.5%.

Obviously such measurements are not absolutely precise. That is, some variability exists in the test for total solids, some variability exists in the test for milkfat. Both of these variabilities enter into the final calculation. Therefore, general speaking, tests for SNF may be expected to show wider variations than those of individual components like fat or protein.

A lactometer (a device for measuring specific gravity) may be used for determining SNF, and the Watson lactometer is usually considered the most accurate. This lactometer allows the measurement to be made at 102°F, a temperature at which all fat is liquid, thereby eliminating one source of variability. However, the lactometer methods generally are not considered as precise as other methods.

Solids-not-fat can also be determined by measuring lactose and protein content and then assuming mineral and other minor constituents to equal 0.7%. This method, however, includes whatever errors are associated with a lactose and protein test and also any variations from 0.7% in the level of other nonfat components. In a sense, this method is similar to the way in which infra-red testing units measure SNF. There is one major difference, however. That difference lies in the factor that is applied. In the infra-red method of analysis the testing device is calibrated against a reference procedure. That is, it is adjusted to agree with findings for SNF as determined by the oven method for total solids minus the percentage of fat (as obtained by a reference method). Infra-red units measure lactose and protein content and are set to add whatever factor is needed to adjust readings to those found by the reference test. Depending upon the procedures against which the lactose and protein infra-red measurements are referenced, the factor may vary from 0.7%. But the point is this: The infra-red units are adjusted and maintained to read results in agreement with a reference test result.

All of the above variations in methods of determining SNF give rise to slightly different estimates of SNF in milk. Such differences have to be taken into account in establishing a base level of SNF or in interpreting relevant data as currently found in the scientific literature. Such differences likewise emphasize the need to standardize the method(s) used to determine SNF.

Interpreting Changes in Level of SNF: To estimate more truly any real change in SNF level in milk, express SNF as a percentage of the fat-free serum (skimmilk). Otherwise variations in fat test -- and these can be significant -- will be reflected as variations in SNF of the wholemilk whether or not any change has in fact taken place. The calculation of SNF in the fat-free phase of milk is as follows:

$$\text{Percent solids in fat-free serum} = \frac{\text{Percent SNF in whole milk}}{100 - \text{percent fat in whole milk}} \times 100$$

MASTITIS

The one major cause of changes in level of various milk components or groups of components is mastitis. Not only is amount of constituents caused to change (increase or decrease) but subtle chemical and/or physical changes take place in the milk system. Thus, yield of cheese may be lowered at levels of somatic cell counts not known to cause decreases in level of casein (or fat). In this latter instance, the casein itself is altered (by enzymes) and either made more soluble or more crumbly, both conditions of which result in greater loss of casein to the whey. This same problem occurs as a result of high bacteria counts, especially of bacteria that are able to grow at cold temperatures (psychrotrophs).

Because the value of milk is lowered in several ways by high bacteria counts and mastitis, some dairy plants pay no premiums for protein or SNF until bacteria and somatic cell standards are first met. Not infrequently, those standards range around 25,000 bacteria and 500,000 or less somatic cell count/ml.

Causes of High Somatic Cell Counts: Mastitis, of course, is the most common cause of higher-than-average somatic cell counts in milk. Cows with a prior history of mastitis will often show long-term increased numbers of cells. Early (colostrum) the late lactation milk also will be uncommonly high in cell count. Age -- number of lactations -- likewise results in above-average counts, with an increase of as many as 100,000 somatic cells per ml in milk of individual cows with each successive lactation. A herd consisting predominantly of "old" cows, therefore, might be expected to produce milk of significantly higher overall somatic cell count than a "younger" herd. Stress, too, from excessively high temperatures, disturbances in the milking environment, stray voltage, etc. may also cause an increase in counts, especially if aggravating a mastitic condition that already exists.

Influence of Mastitis on Milk Composition: Much confusion exists over the net effect of mastitis on various components of milk. This is due in large part to variations in experimental conditions under which research has been carried out, also to lack of sensitivity of tests used to determine cell counts, and failure to define precisely the range of counts considered indicative of "mastitis."

The following chart provides an indication of expected changes in milk composition at two levels of somatic cell count. It is the author's best judgement based upon what appears to be the scientific consensus at the moment. At counts below 500,000/ml, it may be assumed that changes in level of any component, if a change in fact takes place, is likely undetectable by most current methods of analysis.

Please note that the chart relates to changes that are likely to be noted in *pooled herd milk supplies.* Some differences, at least in magnitude, might be expected in milk of individual cows or individual quarters.

Total protein content could show little or no change at counts of 500,000 to 1.5 million/ml, mainly because decreases in casein will compensate for increases in whey protein. At counts beyond 1.5 million, whey protein (immune proteins) output increases to such an extent that total protein content may show measurable increases over normal levels.

Because total protein may or may not increase, and because the protein component that does increase is the whey fraction, with casein level decreasing, it appears inappropriate to raise the protein base as a means of accounting for changes in mastitis status in protein pricing plans. This has been done in some instances. Certainly mastitis is an important consideration and a definite factor in lowered yield of cheese (and other quality and efficiency problems in dairy processing). But standards should be based on somatic cell counts as such rather than changes in the base level of protein.

Casein to total protein ratio is important in estimating casein content, thus cheese yield potential of a given milk supply. This ratio will be seen to go down as cell counts progress upward to 1.5 million, and could drop to levels of 0.70-0.75. that is, if casein level normally runs at 78% of total protein, it would range from perhaps 70-75% of total protein in milk approaching 1.5 million in somatic cell count. At counts above 1.5 million, this percentage could drop well below 70. In a Minnesota study of her milk supplies, the normal percentage of casein to total crude protein ranged from 74.2 to 81.3%. The tendency to vary from the average level was low, however (±1.4% for two-thirds of the samples.).

The extent to which *casein content* decreases at cell counts over 500,000 is a matter of no small confusion, much of which possibly derives from differences in design of research work that has been done. Some studies have focused on individual quarters, others on individual cows. Little work has been done on pooled herd milk per se. In addition, test methods used in the past have lacked sensitivity. Results can only be assessed in terms of broad generalities.

From those few recent studies of the influence of mastitis on casein level in herd milk, it appears as though the overall decrease ranges near 2% of normal levels for every one log unit increase in somatic cell count. At a cell count of 1.0 million/ml compared with 100,000/ml, level of casein would be expected to decrease by 2%. If the normal level is 2.6%, then $2.6 \times 0.02 = 0.052\%$ decrease ($2.6 = 0.052 = 2.55\%$ casein). Where the casein content was 2.6% at 100,000 count, it is now more nearly 2.55% at a count of 1.0 million. Although this difference in casein content may seem slight, it will account for a loss of over 300,000 pounds of cheese yearly in a plant receiving one million pounds of milk daily. Because of other changes in the nature of the casein and/or factors acting on it, the losses in fact could range even higher. A Wisconsin study of actual plant performance indicated that a level of mastitic milk equal to 10% of the total intake reduced cheese yield by over 200,000 pounds annually in a plant handling 500,000 pounds of milk daily.

In the chart showing the influence of somatic cell count on composition of milk, question marks have been placed after *SNF* and *total solids* at levels of counts under

	Somatic Cell Count/ml, Herd Milk	
Component:	500,000 - 1.5 Million	Over 1.5 Million
Fat	down (slightly)	down
Protein (total)	no change	up
Casein	down (slightly)	down
Whey Protein	up (slightly)	up
Casein to Total Protein Ratio	down (slightly)	down
Solids-Not-Fat	?	down
Total Solids	?	down
Lactose	down (slightly)	down
Sodium/Chlorides	up (slightly)	up
Calcium, Phosphorus	down (slightly)	down
pH	up (slightly)	up

1.5 million. Although it is possible that amount of these composites of components might go down slightly, it is also possible that on balance little or no change would be detectable. At counts over 1.5 million, measurable decreases likely take place.

As mentioned earlier, decreases in *lactose content* are generally matched by increases in chlorides, thus freezing point of milk may not show significant changes. However, the decrease in level of lactose is so closely tied to mastitic conditions in herds that some researchers have suggested a lactose test as evidence that a disease condition does in fact exist, something that a cell count alone may or may not prove. To use a lactose analysis in this manner, it is necessary to know the average lactose content of the breed (or herd) in question, and to know, from a freezing point determination, that the milk has little or no added water (which would also lower the percentage of lactose).

For most herd milk supplies, consisting largely of Holstein cows, a lactose level of 4.6-4.7% is indicative of mastitis problems. Normal level is 4.9%. Normal lactose content of Guernsey herds is 4.6-4.7%, Jersey herds 5.0%, and Brown Swiss herds 5.15%. A decrease of 0.2-0.3% from these average values is suggestive of active mastitis infections in the herd. Thus the infra-red testing devices, because they are able to measure lactose content, can provide supplemental evidence of mastitis in a herd.

Losses in calcium and phosphorus are likely so small as not to be of nutritional significance, but could, in the case of calcium, represent a potential loss in processing quality for cheese manufacture.

Mastitis: Dairy Plant Considerations: As indicated in the previous section, mastitic milk results in lowered yield of cheese. Losses not only occur at counts of over 500,000 somatic cells/ml, but evidence suggests improved yield potential even as counts fall from 500,000 to 100,000 or less. Sub-clinical mastitis, therefore, must be considered a significant factor in plant efficiency. The reason, in this instance, probably lies in the change in proportion of gamma to beta casein, the latter being less subject to loss during processing. Higher losses in fat also occur as cell counts go up. Moreover, mastitic milk also tends to increase rennet clotting time, to slow starter culture growth, and to produce a weak curd. Cheese quality may be lowered, with more cheese being downgraded and shelf-life shortened.

For milk that goes into fluid products, mastitis lowers quality through increased susceptibility to rancidity; shelf-life is shortened, and stability to heat is lowered. The latter defect has major significance in milk destined for Ultra-High Temperature (UHT) processing.

Whether or not quality of milk is made a part of the component pricing program, it remains a factor of major importance in processing efficiency and market appeal of dairy products. Both low bacteria and somatic cell counts become essential aspects. Premium payment programs do well to recognize and reward high quality milk with high levels of various milk components.

LABORATORY CONSIDERATIONS

No component pricing program can be any better than the analytical tools available to test for the component(s) in question. Today, some highly precise routine methods find uses in this process. However, all routine methods (such as infra-red and dye-binding procedures) must be adjusted intially (calibrated) and maintained to read results in agreement with a reference procedure. The reference procedures, therefore, become critical elements in the anlayses. They also introduce a variety of complications, as, for example, the measurement of nonprotein components in the test for protein.

That analytical process in most equitable to both producer and processor that most accurately measures the component in question with the least amount of variability between replicate tests, different technicians, and different laboratories.

Defining the "Quality" of Test Methods: The question often put is: How good is the test method? To answer that question requires the use of a definition of the word good. In this context "good" has three essential facets. These are:

1) Repeatability -- how well the method is able to repeat itself on the same sample of milk.

2) Accuracy -- how well the routine method is able to agree with the reference method(s).

3) Between-laboratory variability (reproducibility) -- how well two or more laboratories are able to agree on results of tests on the same samples of milk.

In general, repeatability is a more precise measure (smaller differences result) than accuracy. Accuracy is usually less variable (more precise) than between-laboratory differences. To say it differently, least discrepancies occur in tests made on the same sample. Wider discrepancies occur when comparing routine to reference test results. Greatest variations usually occur when results of two or more laboratories are compared.

The Methods: The following chart indicates the most common routine and reference methods used in determining fat, protein, lactose, and SNF of milk. By "routine" is meant the procedure most likely to be used by the dairy plant. "Reference" method is the procedure against which the routine method is adjusted and maintained.

Component	Routine Method	Reference
Fat	Babcock, Milko-Tester, Infra-red	Babcock, Roese-Gottlieb, Mojonnier
Protein	Dye-binding (orange G, amido-black), infra-red	Kjeldahl
SNF	Infra-red	Mojonnier (total solids minus fat) Oven method (total solids) minus fat by Mojonnier or Babcock method
Lactose	Infra-red	Polarimeter, copper sulfate (gravimetric)

Infra-red units have the advantage of being able to mesure more than one component -- in fact all major components. Dye-binding methods mesure only protein but can do so with an "accuracy" the equivalent of infra-red units. They are considerably slower, however,

Please note that all of the above methods measure different properties of milk. Note also that the process of calibrating dye-binding and infra-red units against the Kjeldahl method for protein causes the readings to be high by the level of NPN in the milk (0.1-0.2%).

Official Requirements for Repeatability and Accuracy: The Association of Official Analytical Chemists (AOAC) usually serves as the official agency in setting standards for analytical methods in the United States. Regultory agencies often use AOAC guidelines as their enforcement code. A table follows showing the requirements for repeatability and accuracy of infra-red testing devices. Note as well, please, that dye-binding methods are the equivalent of infra-red units in both these criteria of performance. The standards are as follows and reflect officially acceptable variations for analyses of *eight* samples of milk of widely varying level of component(s).

It is emphasized that the above variances are established for an eight-sample testing regimen. Mean differences are average differences between two sets of determinations, either duplicate tests on the same sample or infra-red versus the given reference procedure.

The columns headed Standard Deviation of the Difference give specifications as related to a total population of samples. The values reflect requirements for two-thirds of the analyses made. A value of twice those shown reflects requirements for 95% of the samples. The latter is perhaps the more practical term, and the following example is drawn from that level of confidence to illustrate the implications of these values.

Note the value for protein analyses in the fourth column. The Standard Deviation of the Difference cannot exceed 0.06%. That value is percentage of crude protein. It says that, having made the analyses on eight different samples by both the Kjeldahl and the infra-red unit, the overall standard difference between the eight pairs of results should be no more than 0.06%. This value, however, is valid for only two-thirds of the samples. To get a more realistic notion of the meaning, multiply that figure by 2, i.e., $2 \times 0.06 = 0.12\%$. Now you have the requirement for 95% of the samples. In other words, the test procedures themselves vary to the extent that a difference as great as 0.12% is considered acceptable 95 times out of 100. If the Kjeldahl reads 3.2%, the infra-red reading could range, acceptably so, anywhere from 3.08 to 3.32, i.e., $\pm 0.12\%$. On total solids analyses, at that same percentage of confidence (95%), the value is twice that, i.e., $\pm 0.24\%$. This is the essence of the values given in the fourth column of the table. Similar interpretation can be assigned to the values in the second column, but refer to duplicate analyses by the infra-red devices.

Such variations, therefore, become the standards within which test equipment must be operated and maintained. Although the fractions may seem small to some, they truly represent significant amounts of the components in question. At a plant intake of 1.0 million pounds of milk per day, 0.1% average or underage is equivalent to 365,000 pounds of the component annually. At a sales value of even $1.00/lb. of the component, the significance of such variations become clear. For this reason, every attempt should be made to reduce variability in test results. Among ways to do so, consider the following:

* Use local or regional samples of milk for both calibration and daily control of test equipment.

* Calibrate equipment over a wide range of test component(s).

* Centralize the calibration and monitoring process on a local or regional basis.

* For protein analyses, use true rather than crude protein as the standard.

Although many other details are essential in lowering differences in test results, the above appear to have rather major significance. By item, the reasons follow:

Use Local or Regional Samples: Samples of milk used to calibrate equipment -- establish initial adjustment -- and to monitor equipment on a daily basis should reflect as closely as possible the composition of the milk supply of the area. Subtle but meaningful differences may exist

	Duplicate Readings		Instrument vs. Reference Test	
Component	Mean Diff. (%)[a] (≤)[c]	Std. Dev. of Diff. (%)[b] (≤)	Mean Diff. (%)[a] (≤)	Std. Dev. of Diff. (%)[b] (≤)
Fat[d]	0.02	0.02	0.05	0.06
Protein[e]	0.02	0.02	0.05	0.06
Lactose[f]	0.02	0.02	0.05	0.06
Total Solids[g]	0.03	0.04	0.09	0.12

[a]Mean (average) difference.

[b]Standard deviation of difference.

[c]Equal to or less than.

[d]Reference procedure for fat is the Roese-Gottlieb method

[e]Reference procedure for protein is the Kjeldahl method for total nitrogen (crude protein).

[f]Reference procedures for lactose include the polarimeter and the copper sulfate gravimetric analyses.

[g]The reference procedure for total solids is given as the oven method.

among various regions of the country. Level of NPN is one example. If crude protein is the standard for protein analyses, then the average level and seasonal variations are more appropriately expressed in milk produced within the region. There is value, too, in using only the freshest of raw milk samples for control purposes.

Calibrate Equipment Over a Wide Range of Component(s) Levels: Samples used to calibrate equipment should reflect at very least the entire range of test results anticipated in the milk supplies analyzed by a given laboratory. Samples of wider variations than these would serve even better. If a plant anticipates milk supplies to run between 2.9-3.9% protein, then the routine method is best calibrated on milk samples that express that range in test.

Calibrating over a wide range of component levels is necessary to even out variations in test results over the entire range. Assume, for example, that an infra-red unit is calibrated at the average level of protein in milk -- 3.2%. At this level of protein, the equipment will test very precisely, but at higher and lower levels of protein, the results will be far more variable.

In work done in Minnesota, where plants had in fact calibrated dye-binding equipment at or near 3.2% protein, the agreement among plants (the between-plant variability) was found to be 0.05% protein at this specific level. In other words plants analyzing the same sample of milk agreed to within 0.05% at 3.2% protein. At 2.6% protein content, however, the agreement was within 0.10%, and at 4.0% protein, 0.18%. Milk of high and low protein content, therefore, was being tested far less precisely than milk at mid-range. This would be true both among plants and also within the same plant laboratory, though at different levels of magnitude in the latter instance. Both processor and producer are better served when the variation in test is about the same no matter what the level of component in the milk supply. What this means is that the variability will be larger at mid-range than it might otherwise be, but it will be smaller at both high and low extremes in test. In this respect, valid accounting and smaller potential inequities must be seen as advantages.

Centralize Calibration and Monitoring Process: Milk samples must be collected and analyzed by a reference procedure for the initial calibration of equipment. Additional samples must also be assembled and tested by the reference procedure to serve as daily checks on equipment adjustment. For both of these kinds of "control" samples, much is to be gained by selecting one laboratory within an organization or one regional laboratory to serve as the central testing service. That is, one laboratory does all of the sample collection and reference testing work, and supplies all of the "control" samples to participating laboratories. By doing so, errors inherent in reference testing and sample handling are restricted to one laboratory. And because all laboratories receive the same set of control samples, as evaluated by this centralized service center, testing devices are adjusted to identical standards. Variability is thereby greatly reduced.

The extent to which variations in test results among laboratories can be reduced by this procedure is illustrated by a study done in Poland. Nineteen laboratories were involved, and variation in test results observed *before* and *after* centralization of the system. For both fat and protein, percentage of test results varying by more than 0.1% were:

	Protein	Fat
Before	39	37
After	0.7	4.2

The above figures provide good evidence of the potential advantage of a central control service.

Use True Protein as the Standard: This consideration has already been mentioned. It may simply be added, however, that variations in test results should be less on a true than crude protein standard. By eliminating the influence of nonprotein nitrogen (NPN) on the reference (Kjeldahl) procedure, you eliminate a factor that varies on a seasonal basis or as a direct result of changes in feeding practices. Results of reference analyses will range that much lower in variance as a result. Conversely, inclusion of NPN causes variations in the reference test results that must either be reflected in frequent adjustments of testing devices or in more loose overall control (i.e., allowances for differences in test between reference and routine methods without demanding an adjustment). In this latter regard, it is worth recalling that AOAC provides for discrepancies between reference and infra-red test results of 0.12%, at 95% confidence. Part of the reason the tolerance is no less than 0.12% is due to the influence of NPN.

To calibrate and monitor on a true protein basis, the following procedure may be used:

1. Assemble a cross-section of samples representative of the region (100 samples may be required initially).
2. Determine the *average* level of NPN for these samples.
3. Assemble eight samples of widely varying protein content.
   a) determine the crude protein (total nitrogen) content of each sample.
   b) subtract the average NPN as determined in (2) above from each of the eight samples.
4. Divide the eight samples into enough lots that each participating laboratory gets one lot for calibration purposes.
5. Calibrate all equipment on true protein as represented in these eight samples.

DAILY CONTROL SAMPLES

On samples used for daily control:

1. Determine average content of total nitrogen and NPN in 3-5 replicates analyses.
2. Deduct average NPN from average total nitrogen content.

3. Use true protein as the "control" level in daily checks on adjustment of infra-red or dye-binding equipment.

IN SUMMARY

Pricing of milk on fat and protein, solids-not-fat (SNF), or total solids basis poses a variety of new or heretofore irrelevant problems for the dairy industry. Among these is the fact that milk has several different end-uses and not each of the products thus derived is valued higher in the marketplace for higher levels of various components. Fluid milk prices, for example, do not rise in relation to higher-than-average levels of protein or SNF; cheese yield, however, does increase with increase in protein (casein) level.

Secondly, if component pricing is to follow the pattern set by pricing on a milkfat basis, then it must consist of more than a premium payment for milk supplies carrying levels of the component(s) above the base. Indeed, a uniform differential -- a uniform addition to or deduction in price from the base level -- would be required.

Thirdly, the question arises: Should the base for protein or SNF be taken as the *average* level in milk or the level of these components expected in milk supplies in which the fat test is 3.5% (the *base* for payment on a milkfat basis). The average crude protein level is 3.2%; the average SNF level is 8.7-8.8%. In milk of 3.5% fat, however, the level of these two components is more nearly 3.1 and 8.6-8.7%, respectively.

The preceding facts emphasize the need for broader management considerations on the farm. Depending upon the specific pricing system used, the dairy farmer will have to weigh and balance those management practices that minimize variations in test and maximize levels of specific components, keeping in mind that a practice that may result in maximum output of one component may lower percentage output of another. Factors such a stage of lactation, season of the year, feeding practices, age of the cow, breeding practices, and mastitis, among others, all meaningful roles in the composition -- thus the value -- of milk at any one time.

And lastly, component pricing of milk carries with it significant new issues in laboratory testing. Should milk be purchased on a "true" or "crude" protein basis? Advantages of the former are several. What variations in test(s) within and between laboratories can be considered acceptable? How can test variations be minimized? The answer to the latter requires the use of local or regional milk samples for calibration and daily control, calibration over a wide range of component content, and centralized control.

These and other issues are discussed in the paper.

REFERENCES

1. Ashworth, U. S. 1965. Rapid method for the determination of casein in milk by the dye-binding method and for the detection of mastitis. J. Dairy Sci. 48:537-540.
2. Ashworth, U. S., T. Forster and L. Luedecke. 1967. Relationship between California Mastitis Test reaction and composition of milk from opposite quarters. J. Dairy Sci. 50(7):1078-1082.
3. Association of Official Analytical Chemists. 1980. Official Methods of Analysis. William Horowitz, Editor. Washington, D.C.
4. Broster, W. H., J. Broster, J. Clements and T. Smith. 1981. The relationship between yield of milk solids of dairy cows and response to change in plane of nutrition. J. Agric. Sci., Camb. 97:643-647.
5. Bruhn, J. C. and A. A. Franke. 1977. Monthly variations in gross composition of California herd milks. J. Dairy Sci. 60:696-700.
6. Bruhn, J. C. and A. A. Franke. 1979. Regional differences in nitrogen fractions in California milk herds. J. Dairy Sci. 62:1326-1328.
7. Cerbulis, J. and H. Farrell, Jr. 1974. Composition of milks of dairy cattle. I. Protein, lactose, and fat contents and distribution of protein fraction. J. Dairy Sci. 58(6):817-827.
8. Grappin, R., V. S. Packard and R. E. Ginn. 1980. Repeatability and accuracy of dye-binding and infra-red methods of analyzing protein and other milk components. J. Food Prot. 43(5):374-375.
9. Grappin, R., V. S. Packard, R. E. Ginn and J. Mellema. 1980. Precision of the Pro-Milk method in routine determination of protein in dairy testing laboratories. J. Food Prot. 43:52-53.
10. Grappin, R., V. S. Packard and R. E. Ginn. 1981. Variability and interrelationship of various herd milk components. J. Food Prot. 44:69-72.
11. Haenlein, G. F. W., L. Schultz and J. Zikakis. 1972. Composition of proteins in milk with varying leucocyte contents. J. Dairy Sci. 56(8):1017-1024.
12. Huber, J. and R. Boman. 1966. Nutritional factors affecting the solids-not-fat content of milk. J. Dairy Sci. 49:816-821.
13. Jenness, R. J. and S. Patton. 1959. *Principles of Dairy Chemistry.* John Wiley and Sons, Inc., New York, New York.
14. Kitchen, B. J. 1981. Review of the progress of dairy science: Bovine mastitis: milk compositional changes and related diagnostic tests. J. Dairy Res. 48:167-188.
15. Kosikowski, F. 1982. Cheese yield prediction simplified. Dairy Field 165(11):27.
16. Lamb, R. C. Managing dairy cows to improve protein content of milk. Utah Agric. Experiment Sta. Res. Report 60. Utah State University, Logan, Utah.
17. Lindamood, G. and T. Kristoffersen. 1978. Composition and nutritional value of milk and milk products. Leaflet D6 204. Ohio Cooperative Extension Service Dairy Guide. Ohio State University, Colulmbus, OH.
18. Linn, J. G. and D. F. Otterby. 1983. Factors affecting the protein and solids-not-fat content of milk. Dairy Update, University of Minnesota, Issue 67.
19. Macleod, G. K., D. Grieve and I. McMillan. 1982. Performance of first lactation dairy cows fed complete rations of several ratios of forage to concentrate. J. Dairy Sci. 66:1668-1674.
20. Maes, L. 1979. Processor views on the California experience with component pricing for fluid milk. Am. Dairy Rev. 41(9):74H-74L.
21. Michalak, W., H. Cynalewska and H. Oczkowicz. 1978. Collaborative testing among laboratories routinely testing fat and protein in milk. J. Dairy Sci. 61:1634-1636.
22. Park, K., W. C. Green and B. Wolf. 1982. A regression equation for estimating solids-not-fat from fat, protein, and lactose of fluid milk. J. Food Prot. 45(6):511-512.
23. Randolph, H. E., R. Erwin and R. Richter. 1974. Influence of mastitis on properties of milk. VII. Distribution of milk proteins. J. Dairy Sci. 57(1):15-18.
24. Reimerdes, E. H. 1983. New aspects of naturally occurring proteases of bovine milk. J. Dairy Sci. 66:1591-1600.
25. Rogers, G. and J. Stewart. 1982. The effects of some nutritional and nonnutritional factors on milk protein concentration and yield. Aust. J. Dairy Technol. 37:26-32.
26. Schultz, L. H. 1974. Changes in nutritional value mediated by the cow. J. Dairy Sci. 57:729-737.
27. Schultz, L. H. 1977. Somatic cell in milk-physiological aspects and relationship to amount and composition of milk. J. Food Prot. 40(2):125-131.

28. Sharma, K. K. and H. Randolph. 1974. Influence of mastitis on properties of milk. VIII. Distribution of soluble and micellar casein. J. Dairy Sci. 57(1):19-23.
29. Szijarto, L., D. A. Biggs and D. M. Irvine. 1973. Variability of casein, serum protein and nonprotein nitrogen in plant milk supplies in Ontario. J. Dairy Sci. 56(1):45-51.
30. Tallamy, P. T. and H. Randolph. 1970. Influence of mastitis on properties of milk. V. Total and free concentrations of major minerals in skimmilk. J. Dairy Sci. 53(10):1386.
31. Taylor, W. R. and H. Van Horn. 1962. Genetric and environmental influences on protein and solids-not-fat. Iowa State University, DYS-75, November 1962.
32. Thomas, P. C. 1976. Diet and milk protein production. J. Soc. Dairy Technol. 29(1):31-37.
33. Van Vleck, L. D. 1978. Breeding for increased protein content in milk. J. Dairy Sci. 61:815-824.
34. Young,R. S. 1977. Calibration and standardization of the Infrared Milk Analyzer. The California experience. J. Dairy Sci. 61:1279-1283.

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Handling News Media Concerns

C. Dee Clingman, R.S.

Vice President, Quality Control
Red Lobster Inns

Whenever a member of the news media contacts someone, they often become disoriented and excited. Whether it be a television station, newspaper, or magazine publication, everyone will either anticipate the best or the worst coming from the news media inquirer. Sometimes people see their names in lights and have visions of grandeur. At other times, people perceive their job or their organization going down the drain at each step of the news media interview. It is this fear that I plan to address by providing general guidelines which will be beneficial in reducing media frustrations: the better to enable one to professionally handle that next news worthy crisis.

Always keep in mind that a news person is employed just like everyone else. They are responsible for gathering news and news worthy items, and expressing them to the general public in an exciting and enjoyable fashion. That *is* their job. Like all jobs, some people work a little harder at them than others. Some are professional in their approach and some are less than professional. That same level of professionalism is in any area, whether it be doctors, lawyers, or within our own profession as sanitarians. We must recognize this basic human element and plan and act accordingly.

Most reporters are not technically knowledgeable about topics they report on. Take time to educate them and become a resource for them. However, it is important to avoid a condescending tone when discussing situations with them. In the public health profession, when we are contacted by the news media it is, for the most part, regarding a crisis or an unpleasant situation. It is these types of situations that we will need to address.

When the news media contacts you, the first thing you should do is to maintain your composure. Maintain control of yourself, your organization, and your staff. If you are not ready to talk to them - don't. Delay them in order to get your thoughts together. This can be done by merely indicating to them that you need to obtain additional information and that you will call them back shortly. They will often come back to you with,"Oh, but I have a deadline to meet in 30 minutes." Again, indicate that you will get back with them as soon as you can, and that you understand that they are working under a deadline. It is essential that *you* maintain control of the situation from the very beginning. Be careful not to become frustrated and say something or elude to something that you will later regret when it appears in print or is seen on the 6 o'clock news. After you have had time to get your thoughts together and your statement prepared, contact the calling party. If you fail to, it will only aggravate their inquisitiveness, and they will assume that you have something to hide.

The first few hours of a crisis situation will always work in your behalf. If it is a major crisis, decline all interviews until you have the situation under some control. If people are injured or if people's lives are in imminent danger, indicate to the news media that you do not intend to give any interviews or statements until the health and safety of those in jeopardy are taken care of. Even the news media will be receptive and cooperative to this end. Another benefit to this delay is that since the first hours work to your behalf, they also make the news less"newsy." As the situation progresses and gets older by the hour, it becomes less and less of an interesting topic.

When any situation occurs and the news media is involved, the first thing you should say to yourself is,"How can I turn this negative into a positive?" Wherever and whenever possible, it is essential that the positive side of the situation be stressed. It will be the newsman's questions or comments which will try to lead you to a negative or more exciting statement. By continually looking at the positives of the situation, it will make it increasingly more difficult for any direct quotes from you to reflect negatively upon yourself or your organization.

When giving interviews, always be consistent. Do not give a different story to the TV crew that you gave to the newspaper writer or to the local radio station. It is essential that whatever you state is consistent each time. And, if you don't want to read it, don't say it!

When you are being interviewed by the news media, always go back to your policies. If necessary, repeat your policies or your policy statement in a continuous fashion back to the interviewer. Do not try to please the news media and let them have *their* way by having you interpret events. Avoid editorial comments about subjects you are not totally aware of.

Most importantly, be a dull interviewee. Don't be dramatic and don't attempt to win any academy award performances. In all cases, you must stay in control--don't let the interviewer hassle you into making rash statements or aside comments. When the interviewer asks questions regarding what someone else said, do not try to respond to these inquiries. *Never* try to answer questions trying to explain what someone else said. Tell the interviewer if he would like to know that information, he should ask the person who made the statement. It is important that you provide factual information and not try to be an interpreter or a philosopher. In addition, only answer the questions that were asked; do not volunteer information.

It is essential that in any organization, people at many different levels of supervision be trained in crisis management. It is always a good idea to have individuals understand these basic public relations techniques, in case they may become involved in a crisis situation in the future. If a situation occurs away from your central location, it is also essential that the people at the site are given good directions on what to do and what to say. In many instances, it is best to have individuals on the site channel all inquiries for interviews or public statements to one individual assigned that responsibility.

Of equal importance is to have a"Crisis Committee" in your organization. This small but select group should have complete responsibility for addressing these situations and responding to news media inquiries.

If you happen to get yourself into something really big and have national news attention, you will want to play the news media game. When national TV is involved, it is imperative that you go out and get someone that is good on TV to be your spokesperson. The individual needs to look good and come across in a positive fashion on the TV screen. When it comes to television, one must put their best *face* forward and create an excellent TV image. The goal here is not what you say, but how you say it. It is important that people viewing the TV screen will like that person and have trust in what they say.

At times you may hear of something that occurred on television that relates to your company or agency; however, you did not have an opportunity to see the telecast. If you wish to receive a copy of what was stated, most television stations are willing to provide a transcript of the audio portion of the telecast. In these situations, a phone call to the station manager will generally produce you a transcript of the news item you are seeking.

In conclusion, when you are contacted by the news media, maintain your composure, speak only when spoken to, answer yes or no as often as possible, and, when you cannot emphasize the positive, revert back to your policies consistently. Don't try to be flamboyant but extremely dull, and if you have something big going, get a professional to help you out.

New Report Explains Safe Use of Pesticides

Advice on how to deal with ants, mosquitoes, crabgrass and other pests effectively and safely is given in *Pesticides in Your Home and Garden,* a new report by the American Council on Science and Health (ACSH).

Safety precautions are stressed in the report, because few people take adequate precautions when using pesticides and household chemicals.

"One study showed that 90 percent of the people who had pesticides in their homes kept them in unlocked storage areas," said ACSH Research Associate Kathleen A. Meister. "Sixty-five percent kept them within easy reach of children. Fifty percent stored them near food or medicine. Clearly, there is room for improvement."

ACSH offers these eight safety tips:

1. Read the product label thoroughly *before* using any pesticide or other household chemical. Make sure that you understand the directions for use, precautionary statements and first aid instructions. *Always* follow the label directions.
2. Store these products in a locked place, out of children's reach.
3. Don't leave any pesticide or household chemical unattended, especially if children are present.
4. Keep emergency phone numbers handy.
5. Don't mix or measure chemicals with food preparation utensils.
6. Don't mix chemicals with each other unless the label says so.
7. Wear rubber gloves when handling these products.
8. Store these products only in the manufacturer's container.

"Our report emphasizes accident prevention, because accidents are the number one cause of pesticide-related health problems," said ACSH Associate Director Dr. Richard A. Greenberg. "The safety record of pesticides has improved dramatically in the past 30 years, and it can continue to improve if consumers use these products carefully.

"Some people become alarmed if they hear that a pesticide is associated with an adverse health effect, and they wonder why that pesticide may still be on the market," Dr. Greenberg continued. "These concerns reflect a misunderstanding of pesticide safety regulation. In large quantities, many pesticides can cause serious illness or even be fatal. This is to be expected; their purpose, after all, is to kill pests. They can be sold legally and used safely, however, because normal, correct use does not expose the user to dangerously large amounts."

The American Council on Science and Health is an independent, nonprofit consumer education organization promoting scientifically balanced evaluations of food, chemicals, the environment, and health. ACSH has offices in New York, New Jersey, and Washington, D.C.

To obtain a complimentary copy of *Pesticides in Your Home and Garden,* send a stamped (37 cents postage), self-addressed, business-size (#10) envelope to Pesticide Report, ACSH, 47 Maple St., Summit, NJ 07901.

ANDREW T. POLEDOR

The IAMFES office has been informed of the untimely death of Andrew T. Poledor. Mr. Poledor died at home on July 19, 1984 of a heart attack. He was the director of Technical Services at the National Restaurant Association.

For many years he worked with professional and equipment standards organizations as well as regulatory agencies in promoting public health and safety in food service.

Selecting Low-Salt Cheese

When it comes to salt, not all cheeses are created equal. So careful selection from among the many natural and "low-sodium" cheeses on the market is needed if you want to reduce your salt intake, says Texas A&M Agricultural Extension Service nutritionist Dr. Alice Hunt.

Salt has an important part in producing the distinctive flavors of many varieties of cheese, she explains. It may be added to curds during mixing, as it is with some soft cheeses, or it may be sprayed, sprinkled or rubbed on the rind of a cheese as it ages.

But not all natural cheeses are equally salty, says Hunt. For example, one ounce of swiss contains 74 milligrams of sodium, while one ounce of edam has

274 milligrams. Cheeses produced in different dairies may also vary significantly in sodium content.

It's possible to moderate your salt intake by selecting those cheeses naturally lower in sodium, suggests the nutritionist. A switch from creamed cottage cheese to ricotta, for example, or from edam to gruyere or swiss will save 100 milligrams or more of sodium per ounce. Dry curd cottage cheese and uncreamed farmer or pot cheese should also be low in sodium, since the salt is usually added in the creaming mixture, she adds.

Some natural cheeses are available in no-salt versions. But they will still contain small amounts of sodium, since that mineral is found in milk, says Hunt. Gouda, swiss, cheddar, colby and a few other varieties made without salt generally have a sodium content of fewer than 10 mgs. per ounce.

A number of "low-sodium" and "reduced-sodium" cheeses are also on the market, she says. But because natural cheeses have different sodium levels to begin with, the variation in reduced sodium levels can be large. That's why it's helpful to read and compare the nutrition labels, cautions Hunt.

One market survey found that the sodium content of low-sodium products ranged from less than 10 mgs. per ounce to 200 mgs. per ounce.

Processed American cheese products are also sold at two levels of sodium reduction: 90 mgs. and 200 mgs. an ounce. However, the regular process cheeses, cheese foods and cheese spreads are high in sodium. So even when the salt is reduced, they will still contain more sodium than many natural cheeses, notes the nutritionist.

MSU Dairy Professor Receives Borden Award

John T. Huber, former Michigan State University professor of animal science, received the 1984 Borden Award for outstanding research and teaching in dairy science.

The presentation was made during the recent American Dairy Science Association meeting at Texas A&M University. The Borden Award is among the highest honors a dairy scientist can receive in the United States.

Huber was cited for his research that led to more economical rations for dairy cattle. His developments include the introduction of ammonia to enrich corn silage, the feeding of urea to lactating cows for better milk production, and the use of ammonia to inhibit mold and spoilage of ensiled forage.

He was one of the first scientists to study the metabolic effects of rumen bypass protein. He found that milk production increases when casein and other protein solutions bypass the rumen, and he demonstrated that heat-treated protein could be effectively combined with nonprotein nitrogen rations for high-producing cows.

Huber is the author of 92 research publications, 116 abstracts, 13 chapters in seven dairy nutrition books, and more than 60 articles in trade, industry and Extension publications. He is internationally recognized as a dairy nutritionist, lecturer and consultant. He has also guided more than 30 graduate students through master's and doctoral programs.

Huber did his undergraduate work at Arizona State University and received his master's degree and doctorate in dairy cattle nutrition from Iowa State University in 1958 and 1960, respectively.

1983 Dry Milk Census Now Available

The American Dry Milk Institute, national trade association of the dry milk industry, is pleased to announce the availability of its *Census of 1983 Dry Milk Distribution and Production Trends,* a yearly publication compiled by the Institute. This publication contains comprehensive industry data and reliably reflects domestic sales and specific markets of utilization for nonfat dry milk, dry whole milk, and dry buttermilk.

This industry-wide survey of the end-use of dry milks distributed in 1983 is intended to serve as a guide in directing promotional efforts to continue the expansion of commercial markets for dry milks. Continued research and development of new uses for the various dry milks are necessary for full expansion of this segment of the dairy industry and represents a program objective of the Institute.

This publication is available for purchase at $4.00 per copy; for further information, contact the American Dry Milk Institute, Inc., 130 North Franklin Street, Chicago, IL 60606. 312-782-4888.

Whey Products Conference Scheduled for Chicago October 25-26

The *1984 Whey Products Conference,* sponsored jointly by the Whey Products Institute and the Eastern Regional Research Center, Agricultural Research Service, U.S. Department of Agriculture, will be held on Thursday-Friday, October 25-26, 1984, at The Chicago O'Hare Marriott Hotel, Chicago, IL. This will be the eighth in a series of such whey conferences that have been held biennially since 1970.

The Conference will bring together manufacturers of whey and whey products, firms manufacturing equipment used in whey processing, business leaders of the industry, and government and university representatives, to discuss current topics of interest relating to whey production, research, marketing and utilization.

Persons interested in attending the *1984 Whey Products Conference* should contact: Dr. Warren S. Clark, Jr., Executive Director, Whey Products Institute, 130 N. Franklin Street, Chicago, IL 60606. 312-782-5455.

Babson Bros. Co. Appoints New Advertising Manager

Babson Bros. Co., builders of SURGE dairy farm equipment, announces the appointment of Gregory Q. Tiberend as Advertising Manager for the Oak Brook, Illinois based firm. Mr. Tiberend is a 1984 graduate of the University of Illinois at Champaign, where he earned a Bachelor of Science degree in Agriculture, with a major in Agricultural Communications. Most recently, Mr. Tiberend was an account executive for Grubb, Graham & Wilder, Inc., of Champaign. In the position of Advertising Manager, Mr. Tiberend will be responsible for the coordination of advertising planning and production between the company's agency and the Sales and Product Managers.

Program Conference Looks at Calcium

Calcium took center stage at Dairy Council's 1984 Program Conference, under the theme, "A Healthy America: The Calcium Connection." More than 200 participants learned about the latest calcium research, discovered ways to market dairy food calcium, and received National Dairy Council's latest calcium booklet aimed at health professionals.

Good news about calcium's health benefits has helped place dairy foods in the media spotlight. Dairy foods provide 72 percent of the calcium in the U.S. food supply, notes National Dairy Council President M. F. Brink, Ph.D., who opened the 3-day conference.

James P. "Tom" Camerlo, chairman of the board of United Dairy Industry Association (UDIA), told the audience that National Dairy Council is an important source of calcium information. NDC provides information and materials to the medical and allied health community, educators, opinion leaders in government, media professionals and consumers.

John Sliter, chief executive officer for UDIA, highlighted for participants the role that the National Dairy Promotion and Research Board legislation may play in funding expanded Nutrition Research and Nutrition Education programs about calcium and dairy foods.

Program Conference presentations also included updates on recent calcium research. Charles Chesnut, III, M.D., an internist who specializes in bone loss at the University of Washington in Seattle, emphasized the importance of calcium from dairy foods in preventing the brittle-bone disorder, osteoporosis. Lawrence Resnick, M.D., from Cornell Medical Center in New York City, discussed his research which links adequate calcium intake to lowering high blood pressure.

Several concurrent sessions focused on specific Dairy Council programming areas. Here is a sample of these activities:

* the introduction of *Food Encounters,* the newest NDC computer program that teaches elementary school pupils about good nutrition.

* the first look at *Calcium: A Summary of Current Research for the Health Professional,* a 3-page booklet, complete with master copies of consumer hand-outs.

* a discussion of ways to extend the use of *Food Power,* NDC's popular coach's guide to good nutrition for athletes.

* question-and-answer sessions involving both Dr. Chesnut and Dr. Resnick.

The Conference concluded with a workshop led by Ron Willingham of Amarillo, Texas. Willingham, a training professional, advised Dairy Council staff members on how they can take the calcium message to health professionals and consumers in their communities through health promotion activities.

During Program Conference, affiliated Dairy Council unit staff members from across the country shared success stories from their programming areas. "This cooperative spirit and close working relationship makes Dairy Council programming successful," Brink said. "Together, we add an important element to the dairy industry's promotion of milk and other dairy foods as a nutritious, healthful part of everyone's diet.

New Product News

The products included herein are not necessarily endorsed by Dairy and Food Sanitation.

New and Simple Comparative Photometer

• A new comparative photometer which affords simple and automatic testing of color and concentration by untrained personnel is now being marketed by QA Instruments, Division of TERRISS-CONSOLIDATED INDUSTRIES. Termed "ideal" for measuring critical product qualities of color and concentration, each QA Comparative Photometer operates by analyzing a known reference concentration for absorbance (optical density) and then recording this information. The percentage of concentration is specially programmed as a default value for the user, or may be keyed in by the operator prior to the analysis mode. An unknown product sample is then presented for analysis. During the analysis mode, the absorbance of the unknown sample is recorded and its concentration calculated from comparison with the reference values. The instrument also calculates a correction factor.

Featuring pushbutton ease and automatic concentration and correction factor calculations, each QA Comparative Photometer also offers simple zeroing and blanking. Reference standards are operator selected. Specifications include: Absorbance Range: 0.00 to 2.00; Reproducibility: typically -1 in the least significant digit; Liniarity: typically -1 in the least significant digit; Stability: typically less than -1 in the least significant digit drift within a 4 hour period (after a 15 minute warm-up); Printer/Computer Interface: RS-232 subset running at 300 or 4800 baud.

Catalogued as Model QA-1, the new QA Instrument Comparative Photometer is available now for the automatic testing of color and concentration. Manufacturers who have special testing requirements may order instruments programmed to meet their needs. Pre-packaged reference samples can be supplied. Prices vary according to user specifications, with the base unit priced at $1,495.00, F.O.B. Asbury Park, NJ. For more information or FREE details, please contact: QA INSTRUMENTS/DIVISION OF TERRISS-CONSOLIDATED INDUSTRIES, 807 Summerfield Avenue, P.O. Box 110, Asbury Park, NJ 07712. 201-988-0909.

Please circle No. 241 on your Reader Service Page

Automatic analysis of color and concentration with the new QA Instrument Comparative Photometer available through Terriss-Consolidated Industries, Asbury Park, New Jersey.

New Aeromet Systems MINILOG 1 Data Recorders

• The Aeromet Systems MINILOG I Data Recorders are self-powered, single-channel, data measuring and storage devices, primarily designed to replace fragile and often troublesome mechanical chart recorders. MINILOG 1 will automatically measure any voltage or current input at scan rates from 1/sec to 1/hour, and enter this measurement in Non-Volatile RAM Memory. Up to 2048 measurements can be stored in the RAM Memory. In addition, special function MINILOG 1 models are available with integral sensors for temperature, pressure, humidity, and other measurements. MINILOG I Data Recorders are packaged in water-tight housings, and operate from -40°C to 85°C environments for periods of up to 3 months on internal battery power.

Data Retrieval is made by connecting MINILOG 1 to most personal and scientific computer interfaces, or by removing only the RAM Memory Element to a Data Translator Module. Software packages are available for producing time-correlated data printouts and performing statistical data summaries.

For more information, contact AEROMET SYSTEMS, 7800 MacArthur Blvd., Oakland, CA 94605. 415-639-7860.

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"Universally" Adjustable Conveyor Guard Rails, Mounting Components Introduced

• Island Equipment Company, a manufacturer of conveyors and accessories, now produces a line of guard rails and mounting components. These conveyor accessories are "universally" adjustable in both horizontal and vertical directions. As a result, conveyor guard rails can be easily positioned in and out as well as up and down to accommodate a wide variety of container sizes. Product contact surfaces are available in steel, stainless steel, nylatron and UHMWP materials. Standard mounting components are plated and stainless steel. All stainless steel components are also available.

The "universally" adjustable design permits the guard rails to be readily mounted to many types and sizes of existing conveyors. This kind of design flexibility enables existing conveyor installations to be easily adapted in order to meet specific needs. For additional information, contact: Island Equipment Company, 75 Spring Street, Paterson, NJ 07501. 201-881-7075 or 212-246-6372.

Please circle No. 243 on your Reader Service Page

New Norprene™ Thermoplastic Elastomer Sheet

• Norprene™ thermoplastic elastomer sheet product is now available from Norton's Industrial Plastics Division.

Norton Norprene can be used as a serviceable replacement for a number of more expensive elastomers including nitrile, Viton[R], fluoroelastomer or ECO. Norprene features excellent physical properties and chemical resistance characteristics not normally found in any other single elastomer gasketing material. Norprene also holds tighter dimensional tolerances than other alternatives.

Some typical Norprene sheet product applications include conveyor belting, construction seals, flange gaskets, protective sheaths, and tank linings, to name a few.

For more information, contact Jim Pisula, Manager of Marketing, Norton Industrial Plastics, P.O. Box 350, Akron, OH 44309. 216-798-9240.

Please circle No. 244 on your Reader Service Page

New All-Products Brochure Available From Sprinter

• A colorful, information-packed, six-page brochure describing the packaging capabilities of Sprinter System, Inc., is now available at no charge.

Written for plant managers, engineers and company executives, the new brochure highlights the full range of Sprinter services available to prospective buyers. Topics include quotations, on-site visits, films, custom line layouts, cost/benefit analyses, and training materials.

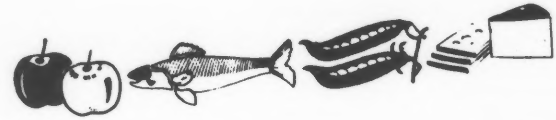
A second section describes the full range of standard and custom Sprinter systems available, from formers and fillers to closers and sealers. Specific design, construction and performance features are reviewed, with just enough technical information to whet the appetite of most any packaging engineer.

A third section explains how Sprinter systems are being used to cut costs and increase productivity in a variety of industries, from cosmetics and pharmaceuticals to food.

To receive a free copy, write: Sprinter System, 21 Thompson Road, East Windsor, CT 06088, and ask for Form No. 1-384.

Please circle No. 245 on your Reader Service Page

Food Science Facts
For The Sanitarian



Robert B. Gravani
Cornell University
Ithaca, NY

CHEMICAL FOODBORNE DISEASE
Metals and Chemical Products

Chemical foodborne disease is caused when people consume poisonous substances that may be intentionally or accidentally added to foods during harvesting, processing, transportation, storage or preparation. The consumption of toxic plants and animals can also result in chemical poisoning.

From 1975-1979, chemical poisonings have been responsible for about 23% of the confirmed foodborne disease outbreaks. It is important for people who work with food to be aware of chemical food poisoning and ways to prevent it from occurring.

There are four types of chemical food poisonings; they come from:

1) Metals
2) Chemical products
3) Toxic plants
4) Toxic animals.

METALS

Although small quantities of mineral elements are necessary for human health, excessive amounts of some metals can be toxic. These toxic metals can get into food through the use of equipment and utensils that are made of unsuitable materials. Acid foods such as fruit juices, fruit punches, sauerkraut, tomatoes and fruit gelatin have been involved in chemical poisonings. When these acid foods are stored or prepared in equipment containing antimony (gray enamelware), cadmium (plated utensils, refrigerator shelves), lead (glazed earthenware or pottery), tin (uncoated tin containers) and zinc (galvanized containers), the metals dissolve in the food. After consumption, the symptoms of chemical poisoning become apparent in a few minutes to a few hours, but usually the reaction time is less than one hour.

Other metals such as copper, which is used to safely carry potable water, can cause gastric disturbances when acid foods or carbonated liquids come in contact with it. This has occurred in vending machines and carbonated beverage dispensers which were equipped with faulty backflow preventor valves.

Nausea, vomiting, abdominal pain and diarrhea are the common symptoms of chemical food poisoning; a metallic taste may also be apparent.

Prevention and Control:

• Use only approved equipment and utensils for storing, transporting or cooking food.
• Check to see that the glaze on enameled cookware, earthenware and pottery is approved for food contact.
• Make sure backflow preventors in vending machines and carbonated beverage dispensers are installed and functioning properly.

CHEMICAL PRODUCTS

Since a wide variety of chemicals are used in food processing plants, food service establishments, retail stores and homes, it is important to take time to recognize the tremendous benefits and hazards of some of these products. Chemical compounds (such as cleaners, detergents, sanitizers, pesticides and food additives), when used for their intended purposes in the recommended amounts, are beneficial; however, when they are used for the wrong purpose or in excessive amounts, they can cause illness and sometimes death.

Cleaning Compounds. Detergents, cleaning compounds, polishes and sanitizers should be handled properly. When these and other chemicals find their way into food, it is usually through inadequate training, neglect, poor housekeeping practices or a variety of other reasons. People working with food should use these products with care and respect.

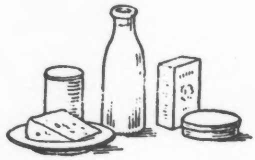
Pesticides. Today, many types of specialized pesticides are used to kill insects and rodents where food is grown, processed, stored, prepared and sold. Most pesticides are toxic chemicals and many can be harmful to humans. They should be handled carefully and safely and only by state certified applicators. Improperly used pesticides have caused poisonings when they were accidentally mixed in flour and sprayed on oatmeal. Fluoride poisoning has resulted when an insecticide containing sodium fluoride was mistaken for a food ingredient. The indiscriminate use of aerosol pesticides around foods, packaging materials and in food preparation areas should not be overlooked as a source of potential problems.

Food Additives. Food additives are used to enhance the flavor, texture and appearance of foods as well as to insure their keeping quality. One food additive, monosodium glutamate (MSG), commonly used to enhance the flavor of foods, particularly oriental foods, has been reported to cause illness when used in excessive amounts. People who are sensitive to MSG develop a flushing of the face, dizziness, headache and nausea after consuming foods that contain large amounts of this additive. This is often referred to as the "Chinese Restaurant Syndrome" and occurs in a few minutes to one hour after eating the food.

Prevention and Control:

- Use all chemical products for their intended purposes and in the amounts recommended on the label.
- Read and follow label directions carefully and accurately.
- Store toxic chemicals separately--away from food preparation and storage areas and food contact surfaces.
- Toxic chemicals should be properly labeled and kept in their original containers.
- Never store or transport chemicals in containers used to hold food.
- Pesticides should be handled and applied by State certified applicators.

Adequate training of newly hired employees and in-service training for long time employees is necessary to emphasize the importance of using equipment and chemical products safely.



Dairy Quality

by **Darrell Bigalke,** *Food & Dairy Quality Mgmt., Inc., St. Paul, MN*

COTTAGE CHEESE QUALITY

Considerations in Establishing Standards or Requirements for the Production of Quality Cottage Cheese.

A cottage cheese manufacturer who is able to produce a product with a high degree of consumer acceptance will no doubt have a competitive edge in the market. Also, when a processor can produce a product that meets consumer expectations, other products produced by that company are likely to benefit by increased consumer acceptance. The reputation for quality that a company may wish to have is not easily achieved or maintained. However, with an effective quality assurance program, a reputation for quality is more likely to be achieved.

A successful quality assurance program must include: (1) ingredients inspection and control, (2) manufacturing and process control, and (3) finished product inspection and distribution control. To maintain control or to help manage each of these three areas, a cottage cheese manufacturer should establish standards or requirements in each area. The intent of this newsletter and the next three newsletters is to discuss establishment of standards for cottage cheese manufacturing. Standards will be discussed and proposed for ingredients, manufacturing, and finished products.

Quality can be defined as conformance to standards or requirements. Standards should be established by a company's quality assurance department and given full support by the company's management. Company standards should be based on conformance to legal standards and/or on a high degree of consumer acceptance, considering flavor, texture, appearance, safety, and shelf life. Establishment of standards for production of quality cottage cheese should consider requirements for both physical and biological parameters. These standards must be measurable and reflect consumers' anticipation of the product.

When establishing standards for a quality cottage cheese, several physical parameters must be considered. For example, curd size, curd texture, ratio of curd to creamed dressing, percent fat, and other physical parameters may vary from plant to plant, depending upon consumers' anticipation of the product. However, an organization must establish standards based on their customers' perception of the product and strive for consistent production of physical parameters. Other standards must be established concerning physical defects of the product. For example, shattered curd, free whey, and improper packaging may be effectively controlled through process monitoring and control and establishing standards. Process control and monitoring must be based on establishing production procedures, controlling times and temperatures of heating and cooling, employee awareness, and the proper concern for management and quality control personnel.

Establishing standards for biological parameters is equally important in the production of quality cottage cheese. Standards must be established for ingredients, processing, and finished product. These parameters must consider freedom from biochemical defects such as oxidized flavors, rancid flavors, and other non-microbial flavors. Standards must be established for microbial quality and culture activity. Microbiological standards should be established for ingredients received at the plant, for processing, and for finished products. These microbiological standards should consider the organisms that will be responsible for public health concerns and product spoilage, keeping in mind the importance in establishing microbiological standards reflecting shelf life.

Establishment of both physical and biological standards should be based on measurable criteria. Once standards have been established, it is the function of the quality control and production departments to produce while meeting these requirements.

Table I indicates some biological and physical parameters for which a cottage cheese manufacturer might consider developing standards. This list is not an exhaustive list; however, it does point out areas with the need for establishing measurable standards for proper monitoring and controlling cottage cheese quality.

Upcoming Dairy Quality Control Update Newsletters will discuss and suggest standards for the parameters listed in Table I.

TABLE 1. *Cottage Cheese Quality - Parameters to Consider in Establishing Standards (Production and Product Requirements).*

Parameters	Ingredients	Process	Finished Product
SPC	x		
LPC	x		
Psychrotrophic Bacteria	x	x	x
Coliform		x	x
Yeast and molds		x	x
Fat %	x	x	x
Inhibitions	x		
Foreign materials	x		
T.A.	x		
Flavor	x	x	x
Texture		x	x
Appearance		x	x
PH		x	x
Culture-Activity		x	
Shelf-life			x
Temperature	x	x	x
Storage time	x		x
Washwater (pH chlorine conc.)		x	

Ideas For Reducing Mastitis

Barry Steevens, University of Missouri

Mastitis is a herd problem. If the majority of the cows have a high count, it is important to evaluate the situation and solve the problem. Mastitis is associated with faulty milking equipment, improper milking practices and unsuitable environment. A solid three-point program should include the following:

1. Maintaining Adequate Milking Equipment

- Dairy producers should make sure milking vacuum is stable and set at the correct operating level.
- Vacuum controllers should be kept clean and operating free.
- Dairy producers can make a simple test of the system. Drop one claw and allow air to enter. Vacuum level should drop no more than 1/2-inch on a small milking system. A larger milking system should have vacuum capacity capable of handling air entry from two units which have fallen off the cow.

2. Correct Milking Procedures

- Correct milking procedures include properly washing and prepping the cow to attach the milker unit on a clean, dry teat approximately 15 to 45 seconds after beginning of stimulation.
- Minimize machine stripping.

3. Clean Environment

- Maintain clean, dry housing for the dairy cows. This could be a clean pasture in the summer and fall and clean, dry free stalls, depending on the housing situation.
- Observe the fine points. For example, do cows lie down in the wet yard right after milking? This could be a problem.
- Always make sure the cow leaves the milk barn with a dry teat after milking.

Holders of 3-A Symbol Council Authorization on August 15, 1984

Questions or statements concerning any of the holders authorizations listed below, or the equipment fabricated, should be addressed to: Robert E. Holtgrieve, Ass't. Sec'y.-Treasurer, W255 N477 Grandview Blvd., Suite 100, Waukesha, Wisconsin 53186

01-06 Storage Tanks for Milk and Milk Products

115 Alfa-Laval, Ltd. (9/28/58)
(not available in USA)
113 Park Street South
Peterborough, Ontario, Canada K9J 3R8

28 Cherry-Burrell Corporation (10/3/56)
(A Unit of AMCA Int'l., Inc.)
575 E. Mill St.
Little Falls, New York 13365

102 Chester-Jensen Co., Inc. (6/6/58)
5th & Tilghman Sts., P.O. Box 908
Chester, Pennsylvania 19016

2 Crepaco, Inc. (5/1/56)
100 South CP Ave.
Lake Mills, Wisconsin 53551

117 DCI, Inc. (10/28/59)
P.O. Box 1227, 600 No. 54th Ave.
St. Cloud, Minnesota 56301

76 Damrow Company (10/31/57)
(A Div. of DEC Int'l., Inc.)
196 Western Ave., P.O. Box 750
Fond du Lac, Wisconsin 54935-0750

127 Paul Mueller Co. (6/29/60)
P.O. Box 828
Springfield, Missouri 65801

31 Walker Stainless Equipment Co., Inc. (10/4/56)
Elroy, Wisconsin 53929

02-08 Pumps for Milk and Milk Products

325 Albin Pump, Inc. (12/19/79)
1260 Winchester Pkwy., Suite 209
Smyrna, Georgia 30080

65R Alfa-Laval, Inc. (5/22/57)
(Flow Equipment Division)
5718-52nd St.
Kenosha, Wisconsin 53141

214R Ben H. Anderson Manufactures (5/20/70)
Morrisonville, Wisconsin 53571

212R Babson Brothers Co. (2/20/70)
2100 S. York Rd.
Oak Brook, Illinois 60521

29R Cherry-Burrell Corp. (10/3/56)
(A Unit of AMCA Int'l., Inc.)
2400-6th St. SW, P.O. Box 3000
Cedar rapids, Iowa 52406

63R Crepaco, Inc. (4/29/57)
100 South CP Ave.
Lake Mills, Wisconsin 53551

205R Dairy Equipment Co. (5/22/69)
1919 S. Stoughton Rd., P.O. Box 8050
Madison, Wisconsin 53716

377 Energy Service Co. (2/4/83)
B200 Walker Bldg., 734 15th St., NW
Washington, DC 20005

404 Fullwood-Packo N.V. (8/25/83)
(Not available in USA)
Cardijnlaan 10
8160 Diksmuide, Belgium

348 ITT Jabsco Ltd. (12/3/81)
(A Unit of ITT MARC Div.)
3200 Bristol St., Suite 701
Costa Mesa, California 92626

145R ITT Jabsco Products (11/20/63)
1485 Dale Way
Costa Mesa, California 92626

314 Len E. Ivarson, Inc. (12/22/78)
3100 W. Green Tree Rd.
Milwaukee, Wisconsin 53209

372 The Kontro Co., Inc. (12/20/82)
450 W. River St., P.O. Box 30
Orange, Massachusetts 01364

26R Ladish Co., Tri-Clover Div. (9/29/56)
9201 Wilmot Rd.
Kenosha, Wisconsin 53141

373 Luwa Corporation (12/27/82)
4404 Chesapeake Dr.
Charlotte, North Carolina 28216

364 M D Pneumatics, Inc. (7/28/82)
4840 W. Kearney
Springfield, Missouri 65803

319 Mono Group, Inc. (3/21/79)
847 Industrial Dr.
Bensenville, Illinois 60106

400 Netzsch Incorporated (8/15/83)
119 Pickering Way
Exton, PA 19341-1393

375 Pasilac, Inc. (1/25/83)
660 Taft St., NE
Minneapolis, Minnesota 55413

241 Puriti, S.A. de C V. (9/12/72)
(not available in USA)
Alfredo Nobel 39
Industrial Puente de Vigas
Tlalnepantla, Mexico

148R Robbins & Myers, Inc. (4/22/64)
1895 W. Jefferson St.
Springfield, Ohio 45506

306 Stamp Corporation (5/2/78)
2410 Parview Rd.
Middleton, Wisconsin 53562

332 Superior Stainless, Inc. (12/10/80)
611 Sugar Creek Rd.
Delavan, Wisconsin 53115

370 Texas Process Equipment Co. (11/9/82)
5880 Bingle Rd.
Houston, Texas 77092

72R L. C. Thomsen & Sons, Inc. (9/14/57)
1303-43rd St.
Kenosha, Wisconsin 53140

219 Tri-Canada, Inc. (2/15/72)
6500 Northwest Dr.
Mississauga, Toronto
Ontario, Canada L4V 1K4

175R Universal Milking Machine Division (12/26/65)
Universal Cooperatives, Inc.
408 South First Ave.
Albert Lea, Minnesota 56007

329 Valex Products Corp. (6/10/80)
20447 Nordhoff St.
Chatsworth, California 91311

52R Viking Pump Division (12/31/56)
Houdaille Industries, Inc.
406 State St.
Cedar Falls, Iowa 50613

5R Waukesha Foundry Division (5/6/56)
Abex Corporation
1300 Lincoln Avenue
Waukesha, Wisconsin 53186

408 Westfalia Systemat (10/18/83
1862 Brummel Drive
Elk Grove Village, IL 60007

04-03 Homogenizers and High Pressure Pumps of the Plunger Type

344 Alfa-Laval, Inc. (8/23/81)
2115 Linwood Ave.
Ft. Lee, New Jersey 07024

390 American Lewa, Inc. (6/9/83)
11 Mercer Rd.
Natick, Massachusetts 01760

247 Bran & Lubbe, Inc. (4/14/73)
512 Northgate Pkwy.
Wheeling, Illinois 60090

87 Cherry-Burrell Corp. (12/20/57)
(A Unit of AMCA Int'l., Inc.)
2400-6th St., SW, P.O. Box 3000
Cedar Rapids, Iowa 52406

37 Crepaco, Inc. (10/19/56)
100 South CP Ave.
Lake Mills, Wisconsin 53551

75 Gaulin Corporation (9/26/57)
44 Garden St.
Everett, Massachusetts 02149

256 Liquipak Int'l. Inc. (1/23/74)
2285 University Ave.
St. Paul, Minnesota 55114

309 PASILAC Incorp. (7/19/78)
660 Taft St. NE
Minneapolis, Minnesota 55413

05-13 Stainless Steel Automotive Milk Transportation Tanks for Bulk Delivery and/or Farm Pick-up Service

379 Bar-Bel Fabricating Co., Inc. (3/15/83)
RR 2
Mauston, Wisconsin 53948

70R Brenner Tank, Inc. (8/5/57)
450 Arlington Ave., P.O. Box 670
Fond du Lac, Wisconsin 54935

388 Frell, Inc. (5/24/83)
1313 Corn Products Rd.
Corpus Christi, Texas 78408

45 The Heil Co. (10/26/56)
3000 W. Montana P.O. Box 593
Milwaukee, Wisconsin 53201

40 Hills Stainless Steel & Equip., Inc. (10/20/56)
405 S. Water
Hills, MN 56138

297 Indiana Tank Co., Inc. (8/29/77)
P.O. Box 366, N. Main St. Rd.
Summitville, Indiana 46070

201 Paul Krohnert Mfg. Ltd. (4/1/68)
(not available in USA)
811 Steeles Ave., P.O. Box 126
Milton, Ontario Canada L9T 2Y3

305 Light Industrial Design Co., Inc. (3/23/78)
8631-A Depot Rd.
Lynden, Washington 98264

85 Polar Manufacturing Co. (12/20/57)
Holdingford, Minnesota 56340

121 Technova, Inc. (12/9/59)
(not available in USA)
1450 Hebert St. CP758
Drummondville, Quebec
Canada J2C 2A1

189 A & L Tougas, Ltee (10/3/66)
(not available in USA)
1 Tougas St.
Iberville, Quebec, Canada

25 Walker Stainless Equipment Co. (9/28/56)
New Lisbon, Wisconsin 53950

08-17 Fittings Used on Milk and Milk Products Equipment and Used on Sanitary Lines Conducting Milk and Milk Products

349 APN, Inc. (12/15/81)
400 W. Lincoln
Caledonia, Minnesota 55921

403 APV Equipment, Inc. (8/22/82)
395 Fillmore Ave.
Tonawanda, NY 14150

291 Accurate Metering Systems, Inc. (6/22/77)
1731-33 Carmen Dr.
Elk Grove Village, Illinois 60007

67R Alfa-Laval, Inc. (6/10/57)
Flow Equipment Div.
5718-52nd St.
Kenosha, Wisconsin 53141

322 Alfa-Laval, Ltd. (7/16/79)
(not available in USA)
113 Park Street South
Peterborough, Ontario
Canada K9J 3R8

380 Allegheny Bradford Corp. (3/21/83)
P.O. Box 264
Bradford, Pennsylvania 16701

79R Alloy Products Corp. (11/23/57)
1045 Perkins Ave., P.O. Box 529
Waukesha, Wisconsin 53187

422 BS&B Safety Systems, Inc. (6/12/84)
7455 E. 46th St.
Tulsa, OK 74133

245 Babson Bros. Company (2/12/73)
2100 So. York Rd.
Oak Brook, Illinois 60521

284 Bristol Engineering Co. (11/18/76)
210 Beaver St., P.O. Box 696
Yorkville, Illinois 60560

411 Capital Equipment Corp. (11/15/83)
2421 Darwin Road
Madison, WI 53704

82R Cherry-Burrell Corp. (12/11/57)
(A Unit of AMCA Int'l. Corp.)
2400-6th St. SW, P.O. Box 3000
Cedar Rapids, Iowa 52406

407 Continental Disc Corp. (10/14/83)
4103 Riverside NW
Kansas City, MO 64150

260 Crepaco, Inc. (5/22/74)
100 South CP Ave.
Lake Mills, Wisconsin 53551

376 Defontaine Inc. (1/25/83)
563 A. J. Allen Circle
Wales, WI 53183

271 The Foxboro Co. (3/8/76)
38 Neponset Ave.
Foxboro, Massachusetts 02035

350 H&K, Inc. -Rosista Div. (1/7/82)
2365 S. 170th Street
P.O. Box 54
New Berlin. WI 53151

369 IMEX, Inc. (11/3/82)
6733 So. Sepulveda Blvd.
Suite E
Los Angeles, California 90045

203R ITT Grinnell Valve Co., Inc. (11/27/68)
Dia-Flo Division
33 Centerville Rd.
Lancaster, Pennsylvania 17603

34R Ladish Co., Tri-Clover Div. (10/15/56)
9201 Wilmot Rd.
Kenosha, Wisconsin 53141

398 Ladish Co., Tri-Clover Div. (7/29/83)
9201 Wilmot Road
Kenosha, WI 53141

389 Lee Industries, Inc. (5/31/83)
P.O. Box 537
Port Matilda, Pennsylvania 16870

239 Lumaco, Inc. (6/30/72)
P.O. Box 688
Teaneck, New Jersey 07666

200R Paul Mueller Co. (3/5/68)
1600 W. Phelps St., Box 828
Springfield, Missouri 65801

374 Pasilac, Inc. (1/25/83)
660 Taft St., NE
Minneapolis, Minnesota 55413

416 Process Engineers, Inc. (1/11/84)
3329 Baumberg Ave.
Hayward, CA 94545

242 Puriti, S.A. de C.V. (9/12/72)
(not available in USA)
Alfredo Nobel 39
Industrial Puente de Vigas
Tlalnepantla, Mexico

149R Q Controls Subsid. of Cesco Magnetics (5/18/64)
93 Utility Court
Rohnert Park, California 94928

287 Sanitary Processing Equipment Corp. (1/14/77)
P.O. Box 178, Salino Station
Syracuse, New York 13201

334 Stainless Products, Inc. (12/18/80)
1649-72nd Ave., Box 169
Somers, Wisconsin 53171

391 Stork Food Machinery, Inc. (6/9/83)
7 Finderne Ave., P.O. Box 816
Somerville, New Jersey 08876

300 Superior Stainless, Inc. (11/22/77)
611 Sugar Creek Rd.
Delavan, Wisconsin 53115

357 Tanaco Products (4/16/82)
3860 Loomis Trail Rd.
Blaine, Washington 98230

73R L. C. Thomsen & Sons, Inc. (8/31/57)
1303-43rd St.
Kenosha, Wisconsin 53140

191R Tri-Canada, Inc. (11/23/66)
6500 Northwest Dr.
Mississauga, Ontario
Canada L4V 1K4

250 Universal Dairy Equipment (6/11/73)
408 First Avenue, So.
Albert Lea, Minnesota 56007

304 VNE Corporation (3/16/78)
1415 Johnson St., P.O. Box 187
Janesville, Wisconsin 53547

278 Valex Products Corp. (8/30/76)
20447 Nordhoff St.
Chatsworth, California 91311

86R Waukesha Specialty Co., Inc. (12/20/57)
Hwy 14
Darien, Wisconsin 53144

09-07 Instrument Fittings and Connections Used on Milk and Milk Products Equipment

321 Anderson Instrument Co., Inc. (6/14/79)
RD #1
Fultonville, New York 12072

315 Burns Engineering, Inc. (2/5/79)
10201 Bren Rd., East
Minnetonka, Minnesota 55343

206 The Foxboro Co. (8/11/69)
38 Neponset Ave.
Foxboro, Massachusetts 02035

418 Pasilac, Inc. (4/2/84)
660 Taft St., NE
Minneapolis, MN 55413

367 RdF Corporation (10/2/82)
23 Elm Ave.
Hudson, New Hampshire 03051

420 Stork Food Machinery, Inc. (4/17/84)
7 Finderne Ave., P.O. Box 816
Somerville, NJ 08876

32 Taylor Instrument Co. (10/4/56)
Div. of Combusion Eng.
95 Ames St.
Rochester, New York 14601

10-03 Milk and Milk Products Filters Using Disposable Filter Media, as Amended

371 Alloy Products Corp. (12/10/82)
1045 Perkins Ave., P.O. Box 529
Waukesha, Wisconsin 53187

35 Ladish Co., Tri-Clover Div. (10/15/56)
9201 Wilmot Rd.
Kenosha, Wisconsin 53141

296 L. C. Thomsen & Sons, Inc. (8/25/77)
1303 43rd St.
Kenosha, Wisconsin 53140

11-03 Plate-type Heat Exchangers for Milk and Milk Products

20 APV Equipment, Inc. (9/4/56)
395 Fillmore Ave.
Tonawonda, New York 14150

316 Agric Machinery Corp. (2/7/79)
2 Green Village Rd., P.O. Box 6
Madison, New Jersey 07940

17 Alfa-Laval, Inc. (8/30/56)
2115 Linwood Ave.
Ft. Lee, New Jersey 07024

120 Alfa-Laval, Ltd. (12/3/59)
(DeLaval Agric. Div.)
11100 No. Congress Ave.
Kansas City, Missouri 64153

326 American Vicarb Corp. (2/4/80)
77 Oriskany Dr.
Tonawanda, New York 14150

30 Cherry-Burrell Corp. (10/2/56)
(A Unit of AMCA Int'l. Inc.)
2400-6th St. SW, P.O. Box 3000
Cedar Rapids, Iowa 52406

14 Chester-Jensen Co., Inc. (8/15/56)
5th & Tilghman Sts., P.O. Box 908
Chester, Pennsylvania 19016

38 Crepaco, Inc. (10/19/56)
100 South CP Ave.
Lake Mills, Wisconsin 53551

362 Kroeze Dairy Equipment, Inc. (7/20/82)
14393 Euclid Ave.
Chino, California 91710

15 Kusel Equipment Co. (8/15/56)
820 West St., P.O. Box 87
Watertown, Wisconsin 53094

360 Laffranchi Wholesale Co. (7/12/82)
P.O. Box 698
Ferndale, California 95536

414 Paul Mueller Co. (12/13/83)
P.O. Box 828
Springfield, MO 65801

365 Pasilac Therm, Inc. (9/8/82)
660 Taft St., N.E.
Minneapolis, Minnesota 55413

279 The Schlueter Co. (8/30/76)
112 E. Centerway
Janesville, Wisconsin 53545

12-04 Tubular Heat Exchangers for Milk and Milk Products

307 Alfa-Laval, Inc. (5/2/78)
Flow Equipment Div.
5718-52nd St.
Kenosha, Wisconsin 53141

248 Allegheny Bradford Corp. (4/16/73)
P.O. Box 264
Bradford, Pennsylvania 16701

243 Babson Bros. Company (10/31/72)
2100 So. York Rd.
Oak Brook, Illinois 60521

103 Chester-Jensen Co., Inc. (6/6/58)
5th & Tilghman Sts., P.O. Box 908
Chester, Pennsylvania 19016

217 Girton Manufacturing Co. (1/31/71)
Millville, Pennsylvania 17846

238 Paul Mueller Co. (6/28/72)
P.O. Box 828
Springfield, Missouri 65801

96 C. E. Rogers Co. (3/31/64)
So. Hwy #65, P.O. Box 118
Mora, Minnesota 55051

392 Stork Food Machinery, Inc. (6/9/83)
7 Finderne Ave., P.O. Box 816
Somerville, New Jersey 08876

393 Stork Food Machinery, Inc. (6/9/83)
7 Finderne Ave., P.O. Box 816
Somerville, New Jersey 08876

394 Stork Food Machinery, Inc. (6/9/83)
7 Finderne Ave., P.O. Box 816
Somerville, New Jersery 08876

395 Stork Food Machinery, Inc. (6/9/83)
7 Finderne Ave., P.O. Box 816
Somerville, New Jersey 08876

13-06 Farm Milk Cooling and Holding Tanks

240 Babson Bros. Company (9/6/72)
2100 So. York Rd.
Oak Brook, Illinois 60521

119R DCI, Inc. (10/28/59)
P.O. Box 1227
St. Cloud, Minnesota 56302

4R Dairy Equipment Co. (6/15/56)
1919 So. Stoughton Rd.
Madison, Wisconsin 53716

49R DeLaval Agric. Div. (12/5/56)
Alfa-Laval, Inc.
11100 No. Congress Ave.
Kansas City, Missouri 64153

336 Merle D. Haberer (2/3/81)
P.O. Box 220
Bowdle, South Dakota 57428

179R Heavy Duty Products (Preston) Ltd. (3/8/66)
(not available in USA)
1261 Industrial Rd.
Cambridge (Preston)
Ontario Canada N3H 4W3

12R Paul Mueller Co. (7/31/56)
1600 W. Phelps, P.O. Box 828
Springfield, Missouri 65801

16R Zero Manufacturing Co. (8/27/56)
811 Duncan Ave.
Washington, Missouri 63090

16-04 Evaporators and Vacuum Pans for Milk and Milk Products

254 APV Anhydro, Inc. (1/7/74)
165 John L. Dietsch Square
Attleboro Falls, Massachusetts 02763

132 APV Equipment, Inc. (10/26/60)
395 Fillmore Ave.
Tonawanda, New York 14150

277 Alfa-Laval, Inc. (8/19/76)
Contherm Division
P.O. Box 352, 111 Parker St.
Newburyport, Massachusetts 01950

356 Damrow Co. (3/10/82)
(Div. of DEC Int'l. Inc.)
196 Western Ave., P.O. Box 750
Fond du Lac, Wisconsin 54935-0750

273 Niro Atomizer Food & Dairy, Inc. (5/20/76)
1600 County Rd F
Hudson, Wisconsin 54016

107R C. E. Rogers Co. (7/31/58)
So. Hwy #65, P.O. Box 118
Mora, Minnesota 55051

299 Stork Food Machinery, Inc. (11/17/77)
7 Finderne Ave., P.O. Box 816
Somerville, New Jersey 08876

387 Unitech Div. of the Graver Co. (5/13/83)
2720 Hwy. 22
Union, New Jersey 07083

186R Marriott Walker Corp. (9/6/66)
925 E. Maple Rd.
Birmingham, Michigan 48011

311 Wiegand Evaporators, Inc. (8/28/78)
8940 Rt. 108
Columbia, Maryland 21045

17-06 Fillers and Sealers of Single Service Containers for Milk and Milk Products

366 Autoprod, Inc. (9/15/82)
12 So. Denton Ave.
New Hyde Park, New York 11040

346 B-Bar-B, Inc. (10/21/81)
E. 10th & McBeth, P.O. Box 909
New Albany, New York 47150

351 Brik Pak, Inc. (1/7/82)
P.O. Box 802605
Dallas, Texas 75380

192 Cherry-Burrell Corp. (1/3/67)
(A Unit of AMCA Int'l., Inc.)
2400-6th St. SW, P.O. Box 3000
Cedar Rapids, Iowa 52406

382 Combibloc, Inc. (4/15/83)
100 E. Campus View Blvd., Suite 300
Columbus, OH 43085

324 Conoffast (11/29/79)
711 Jorie Blvd.
Oak Brook, Illinois 60521

137 Ex-Cell-O Corp. (10/17/62)
850 Ladd Rd., Bldg. "A"
Walled Lake, Michigan 48088

352 GMS Engineering (1/12/82)
1936 Sherwood St.
Clearwater, Florida 33515

220 Liquipak International, Inc. (4/24/71)
2285 University Ave.
St. Paul, Minnesota 55114

330 Milliken Packaging (8/26/80)
White Stone, South Carolina 29353

281 Purity Packaging Corp. (11/8/76)
800 Kaderly Dr.
Columbus, Ohio 43228

211 Twinpak, Inc. (Canada) (2/4/70)
2225 Hymus
Dorval, Quebec, Canada H9P 1J8

19-03 Batch and Continuous Freezers for Ice Cream, Ices, and Similarly Frozen Dairy Foods, as Amdended

146 Cherry-Burrell Corp. (12/10/63)
(A Unit of AMCA Int'l., Inc.)
2400-6th St. SW, P.O. Box 3000
Cedar Rapids, Iowa 52406

401 Coldelite Corp. of America (8/22/82)
Robinson Rd. & Rt. 17 So.
Lodi, NJ 07644-3897

141 Crepaco, Inc. (4/15/63)
100 South CP Ave.
Lake Mills, Wisconsin 53551

286 O. G. Hoyer, Inc. (12/8/76)
201 Broad St.
Lake Geneva, Wisconsin 53147

412 Sani Mark, Inc. (11/28/83)
5767 Dividend Road
Indianapolis, IN 46241

355 Emery Thompson Machine & Supply Co. (3/9/82)
1349 Inwood Ave.
Bronx, New York 10452

22-04 Silo-type Storage Tanks for Milk and Milk Products

262 Alfa-Laval, Inc. (11/11/74)
11100 W. Congress Ave.
Kansas City, Missouri 64153

164 Cherry-Burrell Corp. (6/16/65)
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Lake Mills, Wisconsin 53551

160 DCI, Inc. (4/5/65)
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St. Cloud, Minnesota 56301

181 Damrow Co. (5/18/66)
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Fond du Lac, Wisconsin 54935-0750

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1600 W. Phelps, P.O. Box 828
Springfield, Missouri 65801

312 Sanitary Processing Equipment Corp. (9/15/78)
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Syracuse, New York 13201

165 Walker Stainless Equipment Co., Inc. (4/26/65)
Elroy, Wisconsin 53929

23-01 Equipment for Packaging Frozen Desserts, Cottage Cheese, and Similar Milk Products, as Amended

174 Anderson Bros. Manufacturing Co. (9/28/65)
1303 Samuelson Rd.
Rockford, Illinois 61101

209 Doboy Packaging Machinery Incorp. (7/23/69)
869 S Knowles Ave.
New Richmond, Wisconsin 54017

302 Eskimo Pie Corp. (1/26/78)
530 E. Main St.
Richmond, Virginia 23219

343 O. G. Hoyer, Inc. (7/6/81)
201 Broad St.
Lake Geneva, Wisconsin 53147

222 Maryland Cup Corp. (11/15/71)
Owings Mills, Maryland 21117

24-01 Non-coil Type Batch Pasteurizers

161 Cherry-Burrell Corp. (4/5/65)
(A Unit of AMCA Int'l., Inc.)
575 E. Mill St.
Little Falls, New York 13365

402 Coldelite Corp. of America (8/22/83)
Robinson Rd. & Rt. 17 So.
Lodi, NJ 07644-3897

158 Crepaco, Inc. (3/24/65)
100 South CP Ave.
Lake Mills, Wisconsin 53551

187 DCI, Inc. (9/26/66)
P.O. Box 1227, 600 No. 54th Ave.
St. Cloud, Minnesota 56301

166 Paul Mueller Co. (4/26/65)
P.O. Box 828
Springfield, Missouri 65801

25-01 Non-coil Type Batch Processors for Milk and Milk Products

162 Cherry-Burrell Corp. (4/5/65)
(A Unit of AMCA Int'l., Inc.)
575 E. Mill St.
Little Falls, New York 13365

159 Crepaco, Inc. (3/24/65)
100 South CP Ave.
Lake Mills, Wisconsin 53551

188 DCI, Inc. (9/26/66)
P.O. Box 1227, 600 No. 54th Ave.
St. Cloud, Minnesota 56301

167 Paul Mueller Co. (4/26/65)
P.O. Box 828
Springfield, Missouri 65801

202 Walker Stainless Equipment Co. (9/24/68)
New Lisbon, Wisconsin 53950

26-02 Sifters for Dry Milk and Dry Milk Products

173 Blaw-Knox Food & Chemical Equip. Co. (9/20/65)
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Mt. Vernon, New York 10550

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Cincinnati, Ohio 45223

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6033 E. Bandini Blv.
P.O. Box 4151
Los Angeles, California 90051

176 Sprout-Waldron, Koppers Co., Inc. (1/4/66)
Muncy, Pennsylvania 17756

27-01 Equipment for Packaging Dry Milk and Dry Milk Products

347 Accurate Metering Systems (10/28/81)
1731-33 Carmen Dr.
Elk Grove Village, IL 60007

353 All-Fill, Inc. (3/2/82)
40 Great Valley Pkwy.
Malvern, Pennsylvania 19355

409 Mateer-Burt Co. (10/31/83)
436 Devon Park Dr.
Wayne, PA 19087

313 St. Regis Paper Co. (10/10/78)
Pkg. Mach. Group
1881 W. North Temple
Salt Lake City, Utah 84116

28-00 Flow Meters for Milk and Liquid Milk Products

272 Accurate Metering Systems (4/2/76)
1731-33 Carmen Dr.
Elk Grove Village, Illinois 60007

253 Badger Meter, Inc. (1/2/74)
4545 W. Brown Deer Rd.
P.O. Box 23099
Milwaukee, Wisconsin 53223

223 C-E Invalco (11/15/71)
Combustion Engineering, Inc.
P.O. Box 556
Tulsa, Oklahoma 74101

265 Electronic Flo-Meters, Inc. (3/10/75)
P.O. Box 38269
Dallas, Texas 75238

359 Emerson Elec. Co. (6/11/82)
Brooks Instrument Div.
P.O. Box 450, North 301
Statesboro, Georgia 30458

226 Fischer & Porter Co. (12/9/71)
County Line Rd.
Warminster, Pennsylvania 18974

224 The Foxboro Co. (11/16/71)
38 Neponset Ave.
Foxboro, Massachusetts 02035

399 E. Johnson Engineering & Sales (8/3/83)
11 N. Grant St.
Hinsdale, IL 60521

320 Max Machinery, Inc. (3/28/79)
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Healdburg, California 95448

378 Micro Motion, Inc. (2/16/83)
7070 Winchester Circle
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31-01 Scraped Surface Heat Exchangers, as Amended

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Newburyport, Massachusetts 01950

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Louisville, KY 40232

323 Cherry-Burrell Corp. (7/26/79)
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2400-6th St., SW, P.O. Box 3000
Cedar Rapids, Iowa 52406

290 Crepaco, Inc. (6/15/77)
100 South CP Ave.
Lake Mills, Wisconsin 53551

361 Damrow Co. (7/12/82)
(A Div. of DEC Int'l., Inc.)
196 Western Ave., P.O. Box 750
Fond du Lac, Wisconsin 54935-0750

32-00 Uninsulated Tanks for Milk and Milk Products

264 Cherry-Burrell Corp. (1/27/75)
(A Unit of AMCA Int'l., Inc.)
575 E. Mill St.
Little Falls, New York 13365

397 Crepaco, Inc. (6/21/83)
100 South CP Ave.
Lake Mills, Wisconsin 53551

268 DCI, Inc. (11/21/75)
600 No. 54th Ave., P.O. Box 1227
St. Cloud, Minnesota 56301

354 C. E. Rogers Co. (3/3/82)
So. Hwy #65, P.O. Box 118
Mora, Minnesota 55051

339 Walker Stainless Equipment Co., Inc. (6/2/81)
601 State St.
New Lisbon, Wisconsin 53950

33-00 Polished Metal Tubing for Dairy Products

310 Allegheny Bradford Corp. (7/19/78)
P.O. Box 264
Bradford, Pennsylvania 16701

413 Azco, Inc. (12/8/83)
P.O. Box 567
Appleton, WI 54912

289 Ladish Co., Tri-Clover Div. (1/21/77)
9201 Wilmot Rd.
Kenosha, Wisconsin 53141

308 Rath Manufacturing Co., Inc. (6/20/78)
2505 Foster Ave.
Janesville, Wisconsin 53545

368 Gordon J. Rodger & Sons Ltd. (10/7/82)
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Blenheim, Ontario Canada N0P 1A0

335 Stainless Products, Inc. (12/18/80)
1649-72nd Ave., Box 169
Somers, Wisconsin 53171

345 Trent Tube Div., Crucible, Inc. (9/16/81)
2188 Church St.
East Troy, Wisconsin 53120

331 United Industries, Inc. (10/23/80)
1546 Henry Ave.
Beloit, Wisconsin 53511

35-00 Continuous Blenders

417 Cherry-Burrell (2/7/84)
Anco/Votator Division
P.O. Box 35600
Louisville, KY 40232

415 Luwa Corporation (1/5/84)
4404 Chesapeake Dr.
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292 Waukesha Div., Abex Corp. (8/25/77)
1300 Lincoln Ave.
Waukesha, Wisconsin 53186

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318 Anderson Instrument Co., Inc. (4/9/79)
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Combustion Engineering, Inc.
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405 Drexelbrook Engineering Co. (9/27/83)
205 Keith Valley Rd.
Horsham, PA 19044

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Norwood, MA 02062

396 King Engineering Corp. (6/13/83)
P.O. Box 1228
Ann Arbor, Michigan 48106

419 Pasilac, Inc. (4/2/84)
660 Taft St., NE
Minneapolis, MN 55413

328 Rosemount, Inc. (5/22/80)
12001 W. 78th St.
Eden Prairie, Minnesota 55344

285 Tank Mate Div/Monitor Mfg. Co. (12/7/76)
P.O. Box AL
Elburn, IL 60119

410 Viatran Corporation (11/1/83)
300 Industrial Drive
Grand Island, NY 14072

38-00 Cottage Cheese Vats (In Press)

385 Stoelting, Inc. (5/5/83)
P.O. Box 127
Kiel, Wisconsin 53042-0127

40-00 Bag Collectors for Dry Milk and Dry Milk Products

406 Chicago Conveyor Corporation (10/5/83)
330 LaLonde Avenue
Addison, IL 60101

381 Marriott Walker Corp. (4/12/83)
925 E. Maple Rd.
Birmingham, Michigan 48011

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JFP Abstracts

Abstracts of papers in the September Journal of Food Protection

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Thermal Degradation of FD & C Red No. 3 and Release of Free Iodide, D. M. Barbano and M. E. Dellavalle, Department of Food Science, Cornell University, Ithaca, New York 14853

J. Food Prot. 47:668-669

Thermal degradation of certified FD & C Red No. 3 was evaluated at 20, 90, 150, 200, 220, 240, 260, 300, and 350°C using a differential scanning calorimeter. Release of free iodide was measured using an ion selective electrode. Under conditions used in this study, it was found that FD & C Red No. 3 begins to release significant amounts of iodide at temperatures between 200 and 210°C. In commercial food products such as breakfast cereals, where high processing temperatures are common, there may be significant thermal degradation of FD & C Red No. 3 that results in high levels of free iodide.

Method for Selection of Lactic Acid Bacteria and Determination of Minimum Temperature for Meat Fermentation, M. Raccach, Division of Agriculture, Food Quality Program, Arizona State University, Tempe, Arizona 85287

J. Food Prot. 47:670-671

Arrhenius plots for the fermentation of dextrose in meat by *Pediococcus acidilactici* and *Pediococcus pentosaceus* showed discontinuities at 32 and 24°C, respectively. The Arrhenius energy of activation (Ea) of *P. pentosaceus* was 25% lower than that of *P. acidilactici* at temperatures above the discontinuity. The Ea of *P. acidilactici* and of *P. pentosaceus* increased about 2- and 3-fold, respectively, at temperatures below the discontinuity. The Ea can be used for selection of efficient starter culture strains. The temperature of discontinuity may be used to determine the lowest efficient temperature for lactic acid fermentation.

Growth of Indicator, Pathogenic and Psychrotrophic Bacteria in Mechanically Separated Beef, Lean Ground Beef and Beef Bone Marrow, Bibek Ray, Craig Johnson and R. A. Field, Animal Science Division, Box 3354, University of Wyoming, Laramie, Wyoming 82071

J. Food Prot. 47:672-677

Growth of *Escherichia coli, Salmonella anatum, Staphylococcus aureus, Clostridium perfringens* and naturally occurring psychrotrophs in mechanically separated beef (MSB), lean ground beef (LGB) and beef bone marrow (BBM) was studied. Six good grade steers were slaughtered and samples of MSB, LGB and BBM were prepared under proper sanitary care. Six hundred grams of each sample were collected; 100 g were used for chemical analysis. The remaining 500 g were divided into 10-g portions, each mixed with 10 ml of water and either frozen to -20°C or used immediately for bacteriological analysis. For growth studies, samples were inoculated with *E. coli* or one of the pathogens, incubated at 37°C up to 24 h and enumerated for colony forming units (CFU) on specific selective agar plates. During the first 8 h of incubation, *E. coli* and *S. anatum* multiplied rapidly in MSB and LGB but rather slowly in BBM. By 24 h, both species had multiplied to the same population level. Initial growth of *S. aureus* was rapid in MSB and LGB, but by 24 h its number was higher in LGB than in MSB or BBM. *C. perfringens* grew faster in LGB and slower in BBM during the 24-h period. Growth of psychrotrophs was determined by incubating the materials at 10, 7 and 3°C up to 10 d. The psychrotrophs grew fastest in MSB and slowest in LGB at all three temperatures, especially at 3°C. Rapid growth of various bacteria in MSB should be considered in its production, storage and subsequent use.

Iodine Content of Milk and Other Foods, M. E. Dellavalle and D. M. Barbano, Department of Food Science, Cornell University, Ithaca, New York 14853

J. Food Prot. 47:678-684

Excess dietary iodine intake has been identified as an issue of public health concern. The recommended dietary allowance for iodine is 100-150 μg for adults and 70-120 μg per day for children. A 1978 Food & Drug Administration survey found that milk and dairy products contributed more than 50% of the total food iodine intake for most age groups. A wide variety of dairy and food products were analyzed for iodine content. Red breakfast cereals and red candy (that contain FD&C Red No. 3), dairy products, eggs, milk, marine fish, and iodized salt contained the most significant quantities of iodine. Iodide content of individual raw milk samples from approximately 2500 farms in New York State was measured. Approximately 62% of all farms had milk iodide levels less than 200 μg/L, 28% between 200 and 499 μg/L, 7% between 500 and 1000 μg/L and 3% had greater than 1000 μg/L. The iodine content of all types of retail milk averaged 394.1 μg/L, cheese and cheese products averaged 15.2 μg/100 g. Most of the iodine partitions into the whey during cheese processing. For dairy powders (including whey), the average iodine content was 471.8 μg/100 g. Use of these powders as ingredients in other dairy and non-dairy products can contribute to high iodine content of other food products. In particular, the iodine content of ice cream was extremely variable, ranging from 18 to 359 μg/100 g. Generally, ice creams and ice milks that contained high proportions of whey and non-fat milk powders had higher levels of iodine in the finished product. Addition of FD&C Red No. 3 to foods substantially increases their total iodine content. However, the measured free iodide content of four brands of red breakfast cereal was higher than would be expected. Food and Drug Administration specifications for certified lots of FD&C Red No. 3 allows up to 0.4% sodium iodide as a contaminant from manufacture. The four brands of red breakfast cereal averaged 6% of their total iodine as free iodide (366 μg/30 g serving). This may indicate that free iodide may be released from FD&C Red No. 3 during processing.

Viability of *Byssochlamys nivea* in Apple Sauce Containing Sorbate, Benzoate and Sulfur Dioxide and Packaged Under Various Oxygen Levels, J. O. Roland, L. R. Beuchat and E. K. Heaton, Department of Food Science, University of Georgia, Agricultural Experiment Station, Experiment, Georgia 30212

J. Food Prot. 47:685-687

The effects of potassium sorbate (50 and 100 ppm), sodium benzoate (200 and 400 ppm) and SO_2 (25 and 50 ppm) on growth and patulin production by *Byssochlamys nivea* in apple sauce packaged under various levels of oxygen were determined. A low level (1.4-2.3%) of oxygen in the headspace of sealed pouches protected *B. nivea* against loss of viability over a 13-month storage period at 21°C. No increase in population was observed in inoculated apple sauce with headspace oxygen contents of up to 9.5-9.7%. Sulfur dioxide was the most lethal preservative tested, 50 ppm causing complete inactivation within 4-months. Patulin was not detected in any of the test samples.

Fungi Associated with Pure Maple Syrup Packed at the Minimum Recommended Reheating Temperature, Mary Lynn Whalen and Maria Franca Morselli, Maple Research Laboratory, Vermont Agricultural Experiment Station, Department of Botany, University of Vermont, Burlington, Vermont 05405

J. Food Prot. 47:688-689

In a study on container storage and syrup stability, when pure maple syrup was heated at the traditional minimum packing temperature of 82°C, 6.9% of syrups in all types of containers were surface-contaminated with a fungal mat; *Penicillium* and *Aspergillus* species predominated. Fungal growth was not found in syrups stored at 4°C for 12 months, only in syrups stored for the same length of time at 24 and 30°C. In a second container study, heating the maple syrup before packing at 93°C resulted in no detectable fungal growth. This higher-than-recommended reheating temperature successfully minimized the effect of cold ambient temperatures during syrup packing, so that the reheated syrup was hot enough to sterilize the container and the air space between syrup and cap.

Lipolytic Activity During Storage of Human Milk: Accumulation of Free Fatty Acids, C. W. Dill, C. T. Chen, E. S. Alford, R. L. Edwards, R. L. Richter and C. Garza, Department of Animal Science, Texas A&M University, College Station, Texas 77843 and Department of Pediatrics, Baylor College of Medicine, Houston, Texas 77030

J. Food Prot. 47:690-693

Lipolysis was quantitated during storage of fluid and freeze-dried human whole and skim milks. Fatty acid accumulation was faster in whole fluid milk stored for 1 week at 4°C than in frozen (-20°C) samples stored for 180 d. The rapid accumulation of fatty acids during 24 h of storage at 4°C was enhanced in previously frozen milk samples. While freeze-dried whole milk showed no lipolysis when stored at -20°C, accumulation of free fatty acids was rapid in samples stored at room temperature. Fluid and freeze-dried skim milk samples exhibited no appreciable lipolysis.

Somatic Cell Reference Samples for Calibration of Milk Somatic Cell Counting Methods, T. J. Lintner, C. W. Heald and R. J. Eberhart, The Pennsylvania State University, Department of Veterinary Science and Dairy Science Extension, University Park, Pennsylvania 16802

J. Food Prot. 47:694-696

Somatic cell count samples (SCCS) for use in calibration of milk somatic cell counting methods were prepared from raw bulk milk preserved with potassium dichromate. Somatic cells were separated by centrifugation, then appropriate cell dilutions were prepared in the dichromate-preserved skim milk. Somatic cell counts from SCCS stored at 4°C were stable over a 23-wk period. No bacterial contamination was detected in these samples. In a collaborative study among eight laboratories, SCCS were not affected by usual conditions by shipping. The SCCS can be used as reference standards for the direct microscopic somatic cell count and the Fossomatic and Coulter Counter somatic cell counting methods.

Effect of Aeration on Extracellular Enzyme Synthesis by Psychrotrophs Growing in Milk During Refrigerated Storage, Mansel W. Griffiths and John D. Phillips, The Hannah Research Institute, Ayr KA6 5HL, Scotland

J. Food Prot. 47:697-702

Aerating milk markedly reduced proteolysis but increased lipolysis during storage at 6°C. The increase in lipolysis was due to native milk lipoprotein lipase, and aeration conditions could be modified to overcome this deleterious effect. The decrease in proteolysis was due primarily to a decrease in the amount of protease synthesized rather than a change in the bacterial flora of the milk. It was shown that protease and lipase production by psychrotrophs growing in milk was subject to catabolite repression by glucose. Differences in levels of certain metabolites produced by bacteria growing in aerated and non-aerated milks a factor contributing to the decrease in protease activity.

Microbiology of Commercial Depuration of the Sydney Rock Oyster, *Crassostrea commercialis*, Michael J. Eyles and George R. Davey, CSIRO Division of Food Research, P.O. Box 52, North Ryde NSW 2113, Australia and Division of Analytical Laboratories, Department of Health NSW, P.O. Box 162, Lidcombe NSW 2141, Australia

J. Food Prot. 47:703-706

Paired batches of unpurified and commercially purified oysters from a polluted estuary were examined for a range of indicator and pathogenic microorganisms on 16 occasions over a period of 1 year. Aerobic plate counts of purified oysters (geometric mean of all samples 4.8×10^2/g) were generally lower than those of unpurified oysters (geometric mean of all samples 1.2×10^3/g). Coliforms and *Escherichia coli* were detected considerably less frequently, and usually at lower levels in purified than in unpurified oysters. Three batches of purified oysters contained unacceptably high concentrations of *E. coli*. The purification process had little impact on the incidence or concentration of *Vibrio parahaemolyticus*, which was present at low levels (up to 48/g) in 12 batches of both unpurified and purified oysters. Non-01 serotypes of *V. cholerae* were also present in purified oysters. Viruses were not detected. In a subsequent survey, 54 oyster samples from 25 different purification plants and 5 estuaries were examined. Twenty one samples contained *V. parahaemolyticus* at levels up to 48/g and one contained *V. cholerae* (non-01). Ten samples contained *E. coli*. The results indicate that small numbers of potentially pathogenic vibrios are frequently a part of the microflora of purified oysters.

Collaborative Study of the Impedance Method for Examining Raw Milk Samples, R. Firstenberg-Eden, Bactomatic, P.O. Box 3103, Princeton, New Jersey 08540

J. Food Prot. 47:707-712

The impedance method is a rapid automated method for determining bacteriological contamination levels. A collaborative study was done to establish the reproducibility of the impedance method in predicting counts of raw milk. Frozen and unfrozen raw milk samples, with counts in the range of 9×10^4 to 4×10^7 CFU/ml, were sent to six laboratories to be examined by the standard plate count method (SPC) and by the impedance method which produced Bactometer-predicted counts (BPC). The impedance results showed less variability than SPC among laboratories in all three trials. The variance between split samples was also smaller for the impedance method than for SPC. However, the variance between duplicate plates of the same sample was significantly smaller for SPC than for BPC. In one trial, the means of BPC and SPC were not significantly different, whereas in another trial there was a significant difference of ca. $\log_{10}$ 0.27 between the means of the two methods. However, in this trial the extreme differences between laboratories counting the same sample were $\log_{10}$ 0.42.

Growth of *Pseudomonas* or *Flavobacterium* in Milk Reduced Yield of Cheddar Cheese, Brook R. Ellis and Elmer H. Marth, Department of Food Science and The Walter V. Price Cheese Research Institute, University of Wisconsin-Madison, Madison, Wisconsin 53706

J. Food Prot. 47:713-716

Cheddar cheese was manufactured from milk which was artificially contaminated with proteolytic species of *Pseudomonas* or *Flavobacterium* and stored at 7°C. Cheese was analyzed for moisture content and yield was determined on a dry matter basis. Bacterial counts were made during 7 d of milk storage. *Pseudomonas* isolates grew to larger populations and faster than did *Flavobacterium* isolates. Yield of cheese decreased as time of storage was extended beyond 3 d and psychrotrophic populations increased. Greatest losses were observed after 5-7 d of storage with psychrotrophic bacterial counts of 10^6-10^8/ml. Overall average decreases in yield of cheese caused by *Pseudomonas* spp. or by *Flavorbacterium* spp. were 0.53% and 0.39% per day, respectively, when divided equally over a 7-day period. However, losses generally were not evident until milk was held for 5 d. Numbers of and kind of psychrotrophic bacteria, and multiplication and metabolic activity of these bacteria, when present in milk, are among the factors important in causing a reduction of cheese yield.

Antitumor Properties of Lactobacilli and Dairy Products Fermented by Lactobacilli, B. A. Friend and K. M. Shahani, Department of Food Science and Technology, University of Nebraska, Lincoln, Nebraska 68583

J. Food Prot. 47:713-723

This paper reviews the antitumor properties of lactobacilli and dairy products fermented by the lactobacilli. Generally, the presence or absence of specific dietary constituents has an indirect influence on carcinogenesis. Epidemiological evidence and dietary studies have shown that the consumption of dairy products fermented by lactobacilli may reduce the risk of colon cancer in both animals and humans. Specific strains of the lactobacilli also possess activity against a number of transplanted and chemically-induced cancers in animals. Additional studies are required to ascertain the role of dietary lactobacilli in human cancer.

Lactoperoxidase Antibacterial System: Natural Occurrence, Biological Functions and Practical Applications, Bruno Reiter and Göran Härnulv, National Institute for Research in Dairying, Shinfield, Reading, RG2 9AT, England and Alfa-Laval International AB, P.O. Box 39, S-147 00 Tumba, Sweden

J. Food Prot. 47:724-732

In the present review dealing with the antibacterial lactoperoxidase (LP) system, it is shown that the two reactants thiocyanate (SCN^-) and hydrogen peroxide (H_2O_2) as well as the catalytic enzyme lactoperoxidase (LP) are widely distributed in nature and that evidence for the activity of the LP system in animals, including man, is accumulating. The in vitro effects on bacterial and animal cells are discussed and the unique action of the LP system on the bacterial cytoplasmic membrane is pointed out. Some practical applications are also presented, with particular emphses on the possibility of utilizing the LP system to preserve the quality of raw, cooled as well as uncooled milk. It is concluded that the addition of minute quantities of SCN^- and H_2O_2 (ca. 12 and 8 ppm, respectively) to secure an optimum activity of the LP system should be harmless to the consumer of milk and milk products treated in this way.

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September 10-14, INTRODUCTION TO FOOD MICROBIOLOGY: A SHORT COURSE, to be held at the University of California, Davis. For more information contact: John C. Bruhn, Dept. of Food Science & Technology, University of California, Davis, Davis, CA 95616. 916-752-2192. Reg. fee is $395, due by September 5th.

September 11, WASHINGTON MILK AND FOOD SANITARIANS ASSOCIATION ANNUAL MEETING to be held at the Holiday Inn, 128th, Everett, Washington. For more information contact: Lloyd Luedecke, Dept. of Food Science & Tech., Washington State Univ., NW 312 True Street, Pullman, WA 99163. 509-335-4016.

September 11-13, AMERICAN CULTURED DAIRY PRODUCTS INSTITUTE THIRD MINI-KLINIC, to be held in Toronto, Ontario, Canada. For more information contact: Dr. C. Bronson Lane, ACDPI Vice President, P.O. Box 7813, Orlando, FL 32854. 305-628-1266.

September 12-13, The FIFTH ANNUAL JOINT EDUCATIONAL CONFERENCE of the Wisconsin Association of Milk and Food Sanitarians, the Wisconsin Environmental Health Association, The Wisconsin Dairy Technology Society and the Wisconsin Association of Dairy Plant Field Representatives will be held at the Elisabeth Inn at Plover (Stevens Point), Wisconsin. *Please note that this is a change of location.* For more information contact: Ron Buege, West Allis Health Department, 7120 West National Ave., West Allis, WI 53214. 414-476-3770.

September 15-21, 68th ANNUAL SESSIONS OF THE INTERNATIONAL DAIRY FEDERATION, Prague, Czechoslovakia. For more information contact: Harold Wainess, Secretary U. S. National Committee of the IDF (USNAC), 464 Central Avenue, Northfield, IL 60093. 312-446-2402.

September 18-20, NYS ASSOCIATION OF MILK AND FOOD SANITARIANS ANNUAL MEETING, to be held at the Albany Hilton, Albany, NY. For more information contact: John R. Bartell, President, Alfred State College, Alfred, NY 14802. 607-871-6145 (office) or 607-324-7556 (home).

September 20-21, MINNESOTA SANITARIANS ASSOCIATION, INC. ANNUAL MEETING to be held at the Earl Brown Center for Continuing Education on the St. Paul Campus of the University of Minnesota. For more information contact: C. B. Schneider, President, Minnesota Sanitarians Association, Inc. 612-623-5335.

September 30-October 4, 69TH ANNUAL MEETING OF THE AMERICAN ASSOCIATION OF CEREAL CHEMISTS to be held at the Hyatt Regency and Amfac Hotels in Minneapolis, MN. For more information contact: Raymond J. Tarleton, AACC Headquarters, 3340 Pilot Knob Road, St. Paul, MN 55121. 612-454-7250.

October 3, OHIO ASSOCIATION OF MILK, FOOD & ENVIRONMENTAL SANITARIANS ANNUAL MEETING to be held at Duff's Restaurant, Columbus, OH. For more information contact: CDR Ronald H. Smith, USPHS, % State Training Branch, FDA, Room 8002, FOB, 550 Main Street, Cincinnati, OH 45202. 513-684-3771.

October 3-5, KANSAS ASSOCIATION OF SANITARIANS ANNUAL MEETING to be held at the Red Coach Inn, McPherson, KS. For more information contact: Dale Wing, 1014 Cody, Hays, KS 67601. 913-625-5663.

October 9-10, DAIRY INDUSTRY CONFERENCE, Hyatt/Long Beach, Long Beach, CA. For more information contact: John C. Bruhn or Shirley Rexroat, Dept. of Food Science & Technology, University of California, Davis, CA 95616. 916-752-2191.

October 14-17, LONDON INTERNATIONAL FROZEN FOOD TRADE FAIR. For more inforamtion contact: Sandra Paul, 212-752-8400.

October 15-17, ISSUES IN SENSORY EVALUATION - STABILITY AND QUALITY CONTROL - Palo Alto, California. Attendence is limited and there is a fee. For more information and registration contact: Tragon Corporation, 750 Welch Road, Suite 210, Palo Alto, CA 94304.

October 17, IOWA ASSOCIATION OF MILK, FOOD AND ENVIRONMENTAL SANITARIANS, INC. ANNUAL MEETING, to be held at the Holiday Inn, Exit 225 Interstate 80, Little Amana, IA. For more information contact: Derward Hansen, R.R. #3, Exira, IA 50076. 712-268-2798.

October 18-19, RESOLVING CONSUMER COMPLAINTS SUCCESSFULLY, a course, to be held at the Minneapolis Plaza Hotel, Minneapolis, MN. For more information contact: The Food Processors Institute, 1401 New York Avenue NW, Suite 400, Washington, DC 20005.

October 19-25, FOOD SANITATION INSTITUTE 27TH ANNUAL NATIONAL EDUCATIONAL CONFERENCE & EXPOSITION, Holiday Inn Surfside, Clearwater Beach, FL. For more information contact: Jean M. Day, Executive Director, Food Sanitation Institute, 1019 Highland Ave., Largo, FL 33540. 813-586-5710.

October 23, ILLINOIS MILK, FOOD & ENVIRONMENTAL SANITARIANS ANNUAL MEETING, to be held at the Blue Moon Restaurant, Elgin, IL. For more information contact: Clem Honer, 1 South 760 Kenilworth Avenue, Glen Ellyn, IL 60137. 312-693-3200 (business). 312-858-9314 (home).

October 23-26, VETERINARY TOXICOLOGY WORKSHOP: ANIMAL TOXICOLOGY RELATED TO ENERGY INDUSTRIES, to be held at the Knoxville Hilton Hotel, Knoxville, TN. For more information contact: Dr. Charles F. Reed, College of Veterinary Medicine, P.O. Box 1071, Knoxville, TN 37901-1071. 615-974-7264.

October 25-26, 1984 WHEY PRODUCTS CONFERENCE, to be held at the Chicago O'Hare Marriott Hotel, Chicago, IL. For more information contact: Dr. Warren S. Clark, Jr., Executive Director, Whey Products Institute, 130 N. Franklin Street, Chicago, IL 60606. 312-782-5455.

October 28-30, NATIONAL-AMERICAN WHOLESALE GROCERS' ASSOCIATION FIRST ALL-COMPUTER CONFERENCE AND EXPOSITION, to be held at the Loews Anatole Hotel in Dallas, TX. For more information contact: Diane Aiken, Publications Manager, NAWGA, 201 Park Washington Court, Falls Church, VA 22046. 703-532-9400.

November 22-24, 14TH ANNUAL SYMPOSIUM ON THE ANALYTICAL CHEMISTRY OF POLLUTANTS, 3rd International Congress on Analytical Techniques on Environmental Chemistry-Expoquimia, Barcelona, Spain. For more information contact: Av. Reina Ma. Christina Palacio No. 1, Barcelona-4 Spain.

November 26-29, UCD/FDA BETTER PROCESS CONTROL SCHOOL, to be held at the University of California. For more information contact: Robert C. Pearl, Dept. of Food Science & Technology, University of California, Davis, CA 95616. 916-752-0980.

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February 13-14, DAIRY AND FOOD INDUSTRY CONFERENCE, The Ohio State University. For more information contact: John Lindamood, Department of Food Science and Nutrition, 2121 Fyffe Road, The Ohio State University, Columbus, OH 43210-1009.

February 15-17, NATIONAL MASTITIS COUNCIL ANNUAL MEETING, to be held at the Frontier Hotel, Las Vegas, NV. For more information and registration materials contact: John Adams, National Mastitis Council, 1840 Wilson Blvd., Arlington, VA 22201. 703-243-8268.

February 25-27, 11TH ANNUAL ABC RESEARCH CORPORATION TECHNICAL SEMINAR. For more information contact: Sara Jo Atwell, Administrative Assistant, ABC Research Corporation, P.O. Box 1557, Gainesville, FL 32607. 904-372-0436.

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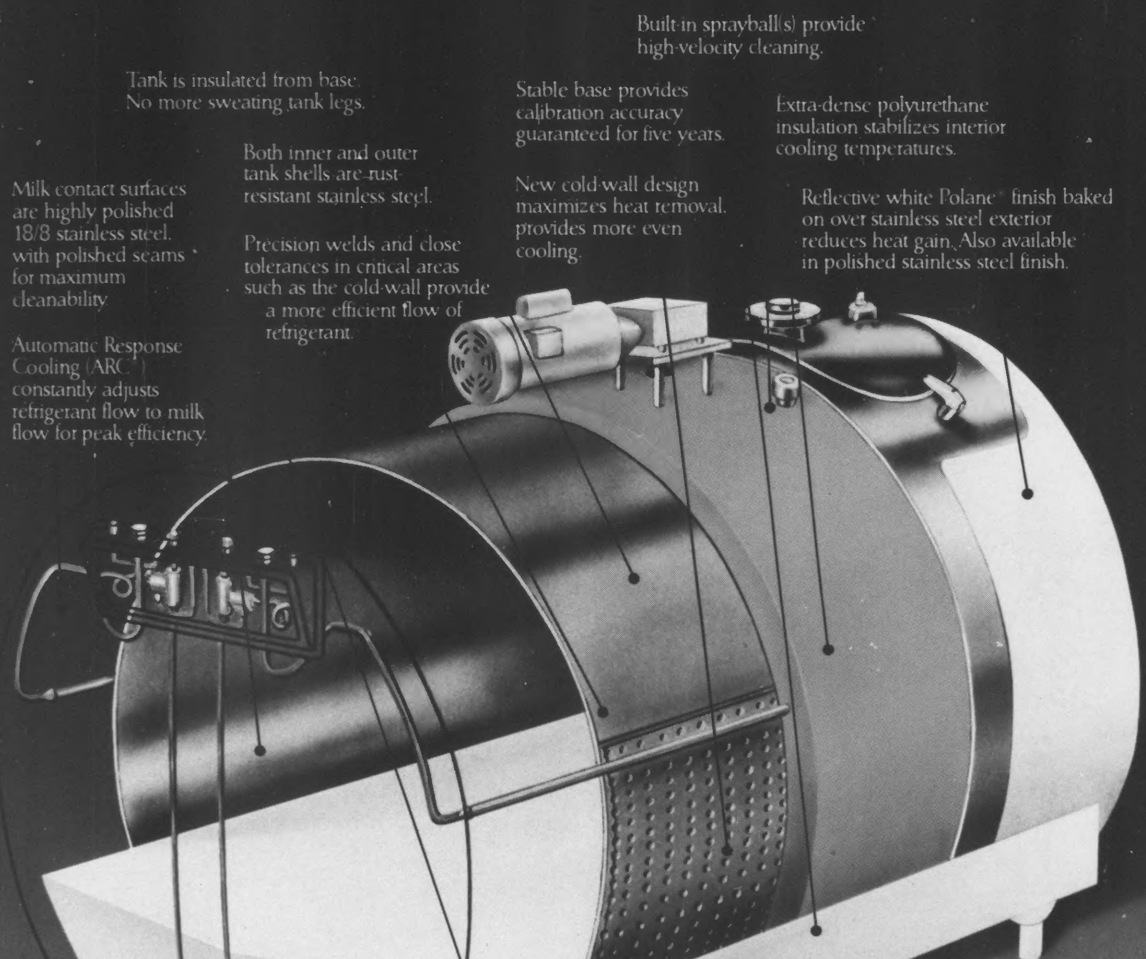

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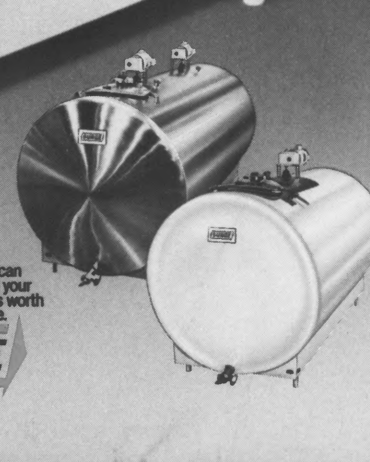

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