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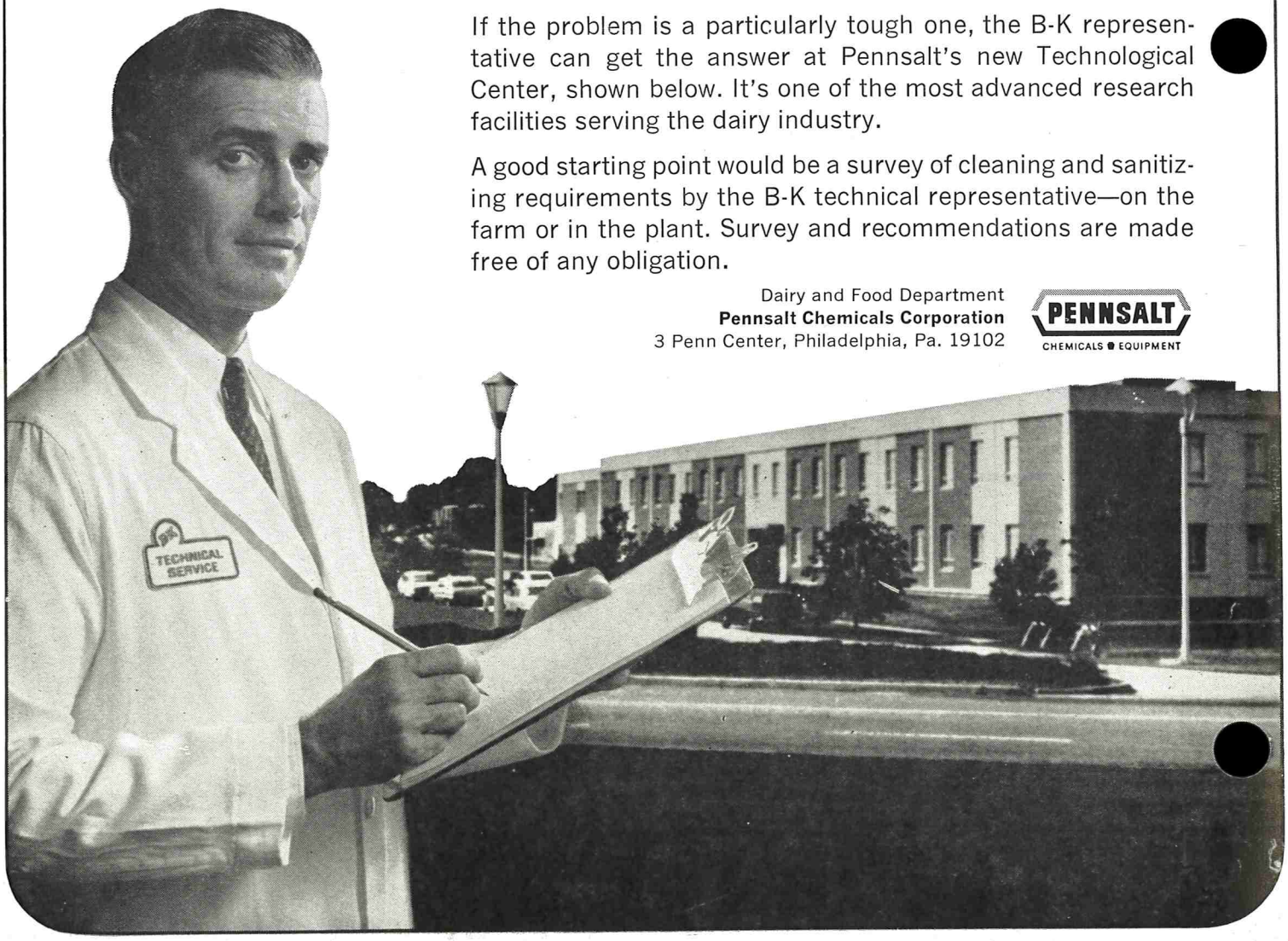

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Why milk processors spell clean with a "K"

WATER-BORNE AND FOOD-BORNE VIRUSES[1]

M. E. Becker

Bureau of Laboratories,
State Department of Public Health
Lansing, Michigan

Our knowledge of viral transmission by food and water is limited by our present techniques. Infectious hepatitis virus, for example, cannot yet be cultured in the laboratory, yet its spread through food and water has been demonstrated epidemiologically and presents a real public health problem. Most of our knowledge pertains to the enteroviruses merely because the methodology for these agents is more advanced. These viruses are quite resistant to chemicals and heat and are not destroyed by the usual sewage treatment.

With rapidly increasing population and continued re-use of water supplies in the United States, it is becoming more and more imperative that we strive to solve the problem of viruses in food and water.

The transmission of disease agents in food and water has been amply documented by generations of investigators. The bacteriologist, aided by artificial media, enrichment techniques, and years of trial and error, has achieved considerable success in detecting pathogenic bacteria in raw and finished foods and even in water. Nevertheless, there are times when the bacteriologist draws a blank in his efforts, even when circumstantial evidence points to food or water as a source of infection. The frequent cause of his failure is the "needle in the haystack," the presence of a minute quantity of infectious agent in a mass of material or liquid.

Problem of Detecting Viruses

It is not surprising that the virologist, who labors under greater technical handicaps than the bacteriologist, finds himself in difficulty when confronted with the problem of detecting viruses in food and water. It is perhaps an understatement to say that our present state of knowledge concerning food and water as vehicles for transmission of viruses is limited: the truth is that our information is very limited, chiefly because of the inadequacy of present virus techniques.

The problem appears to be one of infectious virus particle numbers. As a general rule, viral agents are present in such small quantity in food and water that it is impossible to detect them with present-day techniques, even with the aid of concentration by high speed centrifugation and the use of resin columns *(7, 10, 29)*. In sewage, the most readily isolated viral agents are the enteroviruses, which have been demonstrated repeatedly in untreated and even treated effluent. However, even in sewage the ratio of enteric viruses to coliform bacteria may approach 1 to 100,000 or greater *(7)*. Some viruses, though present in food and water, cannot be isolated in the usual laboratory host systems such as tissue culture and animals. The isolation of infectious hepatitis virus, for example, requires human volunteers, although some recent reports indicate progress in the propagation of this agent in eggs and tissue culture *(15, 19, 20, 22, 28)*. Certain types of gastroenteritis, we feel, are also caused by a virus, but here again we cannot determine the mode of transmission until a suitable isolation technique is developed.

Viruses Implicated in Epidemics

There are over 100 different viruses which thrive in the intestinal tract of man. These, therefore, can be potentially transmitted *via* the anal-oral route or through sewage-contaminated food and water. Such viruses cause many types of illness, from paralysis and meningitis to respiratory infection and exanthems. Among them are the polioviruses, coxsackieviruses, echoviruses, reoviruses, adenoviruses, and infectious hepatitis virus. In general, these agents are quite resistant to heat, drying, and chemicals, and therefore may be expected to survive in both water and food. Some of them, such as polio virus, are excreted in tremendous numbers in the feces, sometimes reaching over a million infectious particles per gram. Moreover, these viruses are often shed for weeks following infection.

From the foregoing statements it would appear that a contradictory situation exists. On the one hand, viruses in food and water are said to be present in such small numbers that they are detected with difficulty by the virologist. On the other hand, certain of the viruses are known to be excreted in great numbers in human feces. The answer to this apparent contradiction, in the opinion of the author, lies in the dilution that occurs in water, milk, and even solid foods, and in the virologist's use of relatively minute amounts of inoculum for tissue culture systems.

[1]Presented at the Conference on Environmental Sanitation, Gull Lake Biological Station, Gull Lake, Michigan, March 15-16, 1966.

The following viruses have been implicated in water- or food-borne epidemics:

Polioviruses. There is strong evidence that contaminated water may be the source of poliovirus infections. In 1957, an explosive outbreak of waterborne polio was reported in Huskerville, Nebraska *(3)*. A probable milk-borne epidemic was reported in New York State in 1951 *(21)*. Incidentally, it has been demonstrated that flies and their excreta may harbor live poliovirus for 11 days at room temperature and several months at lower temperatures *(11)*, however, their significance in transmission of infection is not clear.

Adenoviruses. These viruses proliferate in the intestinal tract of man and may be present in sewage. Their chief importance clinically is their ability to produce acute respiratory disease. Bathing water contaminated by persons shedding the virus has caused outbreaks of pharyngoconjunctival fever and inclusion conjunctivities *(4, 8, 26)*. Of general interest is the finding that adenoviruses have been associated with an appendicitis-like disease *(30)*.

Infectious Hepatitis Virus in Food. It is well known that some of the enteroviruses may accumulate and become concentrated within the digestive system of oysters *(25, 29)*. It is probable that the infectious hepatitis virus is similarly concentrated, for there have been many outbreaks of hepatitis in which shellfish grown in contaminated waters were the proven source of infection.

Two recent infectious hepatitis outbreaks in which food was the vehicle of transmission occurred in New Jersey in 1965 *(12)*. In the first outbreak, cold cuts were contaminated by a delicatessen food handler. About 2-1/2 weeks before the outbreak started, a sewer backup had occurred at the delicatessen store. One of the food handlers, in mopping up the sewage-flooded floors, presumably contaminated his hands and then the cold cuts. Over 80 people purchasing these cold cuts ingested enough virus to become infected. In the other outbreak of 19 cases, the vehicle of transmission was attributed to frozen strawberries dispensed from a frozen custard establishment.

Infectious Hepatitis Virus in Water. There have also been many hepatitis outbreaks in which contaminated water supplies were proven sources of infection. One of the most interesting occurred in Posen, Michigan, in 1959 *(32)*. Ninety of the 340 residents of this small village and its environs had hepatitis within the period of a few months. The village is located in a limestone region where the bedrock is exposed, with almost no overlying soil to permit filtration of surface waters. Septic tanks must be placed in holes dynamited from solid rock. The effluent from these tanks reaches many of the private wells without adequate filtration. The interconnecting channels between wells and between the surface and underlying layers of rock provide ideal conditions for the spread of infection.

One of the largest outbreaks of infectious hepatitis ever recorded occurred in New Delhi, India, in 1955-56, when over 50,000 cases of the disease resulted from ingestion of contaminated drinking water—which according to city authorities, had been "fully" treated with chlorine *(31)*. That the hepatitis virus will survive recommended chlorination procedures is further substantiated by the findings of an investigation of an outbreak in New York State in 1961 *(27)*.

Psittacosis (Ornithosis, Parrot Fever). Psittacosis is usually thought to be an air-borne infection, but transmission through handling diseased carcasses may occur. Outbreaks of psittacosis have accurred chiefly among poultry plant workers. Most of the psittacosis cases in Michigan, however, have occurred in dime-store salesladies who sell infected psittacine birds.

Q. Fever. This virus-like agent causes a severe pneumonia in man, very similar to psittacosis, and may be transmitted through milk from infected cows, sheep, or goats. Rather explosive outbreaks have also occurred in meat packing plant personnel *(5)*. In southern Michigan the disease is endemic in cattle herds, but the extent of human infection is unknown. Laboratory-proven cases in humans are rare.

Other Viruses. It is interesting to speculate as to possible human infection by other animal viruses, and perhaps even plant viruses. The shipping fever virus of cattle, for example, is closely related, if not identical to one of the parainfluenza viruses infecting man *(1)*. Is this bovine virus associated with human disease through handling of infected meat? Many of the enteroviruses of cattle and hogs are related to the enteric viruses of man. Do these cause human infection? We know that some viruses are capable of producing different diseases in different hosts. For example, certain of the adenoviruses which produce respiratory illness in man cause tumors when injected into another host, the hamster. Some plant viruses proliferate within their arthroped hosts. Is it possible that plant viruses may, under certain conditions, also cause disease in man?

DESTRUCTION OF VIRUSES IN FOOD AND WATER

Although the resistance of viruses to heat and drying does not approach that of spore-forming bacteria, still some viruses such as hepatitis and poliovirus may withstand temperature treatment approaching that of pasteurization *(15, 23)*. The enteroviruses

are especially resistant to chlorine, a fact of importance in sewage treatment *(6, 9, 14, 16, 18)*. Primary sewage treatment has little effect on these viruses; secondary treatment, however, by trickling filters and activated sludge, reduces counts significantly *(7, 13)*. Effluent from the ordinary treatment plant, treated with 0.5 ppm chlorine is not free of viruses *(17)*. Sewage can, however, be treated so that the effluent is not only free of demonstrable cytopathic human viruses, but safe for swimming and boating. Since 1962, a sewage reclamation project at Santee, California, has proved that re-use of such waters is entirely feasible in arid regions *(2, 24, 29)*. The treatment facilities at Santee include five ponds and a huge sand-filtration bed. The fifth pond receiving fully treated water is now being used for both swimming and boating.

LACK OF DIAGNOSTIC SERVICES

If human cases of suspect viral infection occur, the virus laboratory can aid in diagnosis of the individual case. Recovery of a virus from man is relatively simple because man, in effect, concentrates the virus, as does the shellfish. It is impractical however, for the laboratory to test food or water supplies implicated in viral transmission. The methods for virus detection in foods and water are still too primitive to be undertaken by routine diagnostic laboratories.

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A STATEWIDE SURVEY OF FREEZING POINTS OF AUTHENTIC MILK SAMPLES[1, 2]

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and

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(Received for publication April 15, 1966)

SUMMARY

Eigty-three authentic samples were taken from the mixed herd milk of dairies located in eight areas of the State of Mississippi during an eight-month period. The range of freezing points observed was wider than expected based on the recognized upper limit of −0.530 C. Eleven percent of the samples would have been termed adulterated based on this accepted standard. The mean freezing point was −0.536 C and the standard deviation −0.006 C. The data showed a moderately acceptable normal curve fit. But the true distribution appeared somewhat skewed, indicating that factors other than normal differences between animals tend to force the freezing point up. Variation between laboratories was small. The mean test deviation was slightly more than 0.001 C.

In 1958 the Mississippi State Board of Health established a standard of −0.530 C as the maximum freezing point for producer milk. White *(6)* stated that the freezing point distribution curve for milk shows that something less than one in a thousand herd samples could normally fall above this figure. However, the possibility that this standard is too low for the applicable area has been often suggested by producers and processors. Official laboratory analyses on 4,777 producer samples during 1963 and 1964 showed that 10.3% froze at temperatures higher than −0.530 C.

Custer (*1*, unpublished data) ran freezing point determinations on unauthenticated samples from 631 Mississippi herds. The freezing point range was −0.550 to −0.471 C with an average of −0.536 C. Variance within the one regulatory and two private laboratories was ± 0.003 C.

Several workers have concluded that freezing point values vary geographically *(2, 3, 4, 5)*. Robertson *(5)* suggested that "regional or area freezing point values be established based on local data and research."

These considerations led to the experiments reported herein.

EXPERIMENTAL PROCEDURES

Sample Collection.

The State of Mississippi was divided into eight areas based on concentration of dairy herds, topography and meteorological conditions. Two milk sanitarians were selected from each area and trained to take authentic samples and to make essential observations. One sample was taken from each area every two weeks.

Aseptically collected samples were iced in fiberglass shipping containers and shipped via bus express to the Mississippi State Board of Health Central Milk Laboratory where the samples were split. One sample was held for testing and the other shipped in the same manner to the University of Missouri Milk Analysis Laboratory. Samples were normally tested within 52 hr of collection.

The following were criteria of sampling: (*a*) random sampling based on the number of dairies within the area; (*b*) bulk tanks empty at the beginning of the evening milking; and (*c*) milking operations observation and control to prevent adulteration. The latter included inspection of the milking equipment to assure the complete drainage of water before milking. Where teat cup rinsing was practiced, the operator was cautioned to insure that all valves were closed during the rinsing operation.

Sampling began in September, 1964 and ended in May, 1965.

Freezing Point Determinations.

Determinations were made in both the Mississippi State Board of Health and the University of Missouri Milk Analysis laboratories using Fiske Milk Cryoscopes (Model J). Each instrument was calibrated with 7 and 10% sucrose equivalent solutions. Daily calibration checks were made using a standard solution with a true freezing point of −0.530. C. Comparative tests of the two instruments using this standard demonstrated variation which never exceeded ± 0.002 C. Technician variation between samples run on the same instrument ranged up to ± 0.003 C.

RESULTS AND DISCUSSION

Eighty-three authentic samples were tested in each of the two laboratories. The arithmetic mean freezing point and the standard deviation were the same for both laboratories, the former being −0.536 C and the latter 0.006 C. The average difference on paired samples between the two laboratories was

[1]Submitted by the senior author in partial fulfillment of the degree of Master Sanitary Science.

[2]Contribution from the Missouri Agricultural Experiment Station. Journal Series Number 3095.

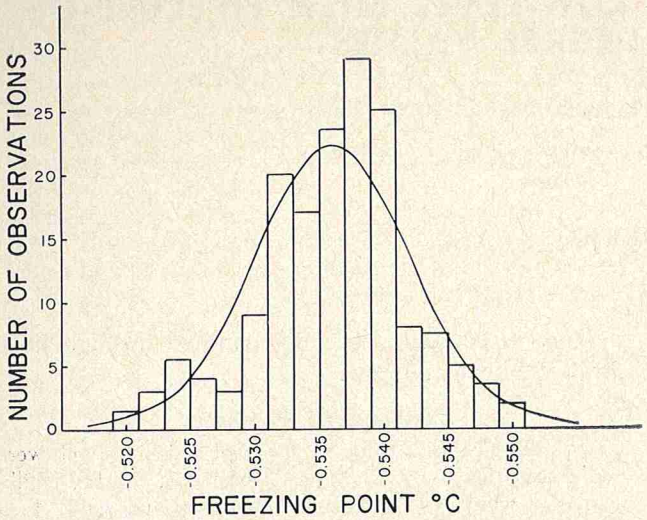

Figure 1. Normal curve and bar graph constructed from observations made on 83 authentic herd samples.

slightly greater than 0.001 C. Freezing points of only four samples varied more than 0.003 C when results were compared between laboratories.

When all tests were considered, one-third of the samples (65) froze within the temperature range of –0.535 to –0.539. On either side of this range the observations were about evenly divided. Thirty-nine froze in the range of –0.530 to –0.534 and 32 in the range of –0.540 to –0.544. Eighteen percent of the observations fell outside the broad range of –0.530 to –0.544. Eighteen fell above and 12 below.

A normal curve distribution constructed from these data places 16.6% above the –0.530 C freezing point and the same percentage below –0.542 C. Since only 11% fell above –0.530 and only 12% below –0.542, it appears the data may not be normally distributed. Figure 1 shows the normal curve representing the mean and standard deviation for the data. Also shown is a bar graph depicting the actual distribution of the observations. These data were subjected to Chi Square analysis which showed that this distribution would be expected about 55% of the time. Such a probability would allow for our suggestion that the freezing points were not normally distributed. The bar graph suggests that the mean freezing point of strictly normal milk would have been somewhat lower than –0.53 C. The fact that 63 observations fall within one standard deviation below and only 50 within one standard deviation above the mean freezing point, suggests a skewed distribution. Factors other than normal differences between animals may have shifted the distribution and increased the variation. To have produced the observed distribution, however, the factors must have influenced a large portion of the samples.

Feeding practices and animal conditions were possible influencing factors. About 20% of the 31 samples from herds which were "poorly fed" and/or in "fair to poor condition" produced high freezing points. Less than 6% of the 52 herds classed "good" under these categories produced milk high in freezing point. The mean freezing points were–0.537 C and –0.535 C for the herds classed "good" or "fair to poor", respectively, as to condition and feeding practices. While the difference between the means was only large enough to approach significance at the 10% probability level, it is our opinion that they were at least related to influential factors. It has been our observation that poorly managed herds often show a high incidence of mastitis. However, relation of mastitis to freezing points was not studied.

Certainly, these data indicate a much broaded distribution of freezing points than suggested by White *(6)*. Furthermore, they indicate an unexpected number of high freezing points.

No significant differences in mean freezing points between areas could be demonstrated. The highest mean was –0.535 C and the lowest –0.539 C. At least one sample of milk from each of six of the eight areas froze above –0.530 C.

High freezing points occurred in samples from three of 39 herds milked with pipeline equipment and six of 44 herds milked with conventional equipment. These results verify the sanitarian's observations that pipelines were well-drained prior to milking.

Freezing points did not vary from month to month as evidenced by the uniformity of distribution within months. Freezing points of –0.524 C or higher were observed during each month of the experiment.

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EFFECT OF A HIGH-LEVEL AND A LOW-LEVEL MILK PIPELINE ON MILK FAT ACID DEGREE VALUES[1]

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(Received for publication March 17, 1966)

Summary

Dairy farm milk pipelines located 2 ft below normal udder level and 4 ft above, respectively, were used to determine the effect of milk pipeline height on induced lipolysis. Three trials involving 86 cows and 54 observations were made. The combined data from the three groups, when averaged, indicated mean spontaneous Acid Degree Value increases above mean initial values of 0.68 for the low line and 1.16 for the high line. These results were highly significant ($P < 0.01$) with milk handled through the high line showing a mean ADV increase of 0.48 more than the low line.

Agitation of warm raw milk in the presence of air wth foam formation has been well established as a causative mechanism for increases in Acid Degree Value (ADV) of milk fat. The amount of increase has also been reported *(2, 12)* to be proportional to the amount and severity of agitation and stability of milk fat.

Milk pipeline risers have been reported by several workers *(1, 3, 4, 7, 8)* to materially contribute to increases in ADVs or fat acidity and subsequent development of rancid flavors. Other investigators *(6, 11)* have found that ADVs were significantly higher in milk handled in pipeline systems than in bucket milking systems. Data reported by Speer, et al. *(9)* indicated that the use of a 54-inch riser in pipelines caused a greater increase in ADVs of milk than use of pipelines without a riser. Irving *(5)* analyzed milk samples taken at different locations along a pipeline and reported that acid degree increased with distance of flow and height of risers. Acid degree in the samples ranged from 2.95 to 4.95. Whittlestone, et al. *(13)* reported that use of a milk pipeline located below the cow, which eliminated the milk hose riser, virtually removed the causes for induced lipolysis. However, no data were reported on the degree of effect. Other reports of isolated incidents of rancid flavor have appeared in the popular press and have indicated beneficial effects by handling milk in lines installed below the cow.

This investigation was undertaken to determine, under farm conditions, the influence on ADVs of milk handled through milk pipelines installed below the cow as compared to milk handled through lines installed above the cow.

Experimental Procedure

Two milk pipeline systems, a low-level and high-level, were used during this study. These were located in the LSU milking parlor which was designed with 8 elevated stalls, 4 on each side.

The low-level 1½-inch glass milk pipeline was comprised of normally available commercial equipment[2]. It was installed on one side of the parlor approximately 2 ft below the level of a normal cow udder with a milk inlet for each of 3 stalls. The milk hose measured 72 inches from each breaker cup to milk inlet.

The permanently installed high-level 1½-inch glass milk pipeline was located above the cows approximately 4 ft above the level of a normal cow udder. This line was installed such that it circled the parlor and provided a separate milk return line for the 4 stalls located on either side of the parlor with the same direction of flow and degree of slope on each side. Milk inlets were installed above each stall. The milk hose measured 116 inches from the breaker cup to high-line milk inlet. The sampling tees were designed to provide slow continuous sampling throughout the milking operation.

When 3 cows were milked on one side into the high-line and 3 on the opposite side into the low-line, all conditions such as degree of slope, direction of flow, length of milk pipeline, milk inlet position, vacuum supply, and sampling tee location (4 ft down slope from the last milk inlet) were similar in each of the systems. The only differences were length of milk hose and height of pipeline. When weigh pails were used in the system they were located approximatly at udder level. The milk hoses used to convey milk from breaker cups to weigh pails were the same length in all cases while the hoses used to convey milk from the weigh pails to each of the milk pipelines were the same as previously described.

During a period of 8 months, the following groups of cows were milked on both the high and low lines.

A GROUP. This group included 70 Jersey, Holstein and Brown Swiss first lactation cows of the LSU Milking Herd. Milk samples were taken simultaneously and continuously during the entire evening milking from each of the milk lines on 10 days selected at random during a period of 5 weeks. During the test milking, no effort was made to segregate the cows for milking on either the high or low line. Undoubtedly, some cows tended to seek the same side of the parlor for milking. Weigh pails were used in the system during this trial period.

B GROUP. Four Holstein cows on a low protein experimental ration and 4 similar Holstein cows on a normal herd ration were used in this trial. The cows on the experimental ration were milked alternately on the high and low line

[1]Supported in part by a grant from the American Dairy Association.

[2]Babson Bros., Surge Equipment.

systems during the last 2 weeks of the 5-week feeding trial. A pipeline milk sample representing a composite of the milk from the 4 cows was taken daily from their whole evening milking during this period. Those on the control ration were milked and similarly sampled 4 times on the low line and high line, respectively, on 8 days selected at random during the same 2-week period. Milk weigh pails were used in the systems during this group trial.

The experimental ration was composed of 48% snapped corn, 39% beet pulp, 10% molasses, 2% bonemeal and 1% salt. This ration was fed at adjusted levels to provide 100% of the energy and 50% of the protein necessary for maintenance and milk production based on Morrison's standards. In addition, 10 lb of very poor quality "native" hay (4.6% protein) was fed each cow per day. The herd ration was composed of an 18% protein pelleted concentrate fed at a 1:3 ratio. Roughage which was group fed included approximately 6 lb alfalfa hay, 20 lb corn silage, 35 lb green chop per day per cow plus very limited Bermuda grass pasture.

C GROUP. Four Holstein cows on a low energy experimental ration and 4 similar Holstein cows on a normal herd ration were used in this trial. The cows on the experimental and control ration were milked alternately on high and low lines on 6 days selected at random during the last 2 weeks of the 5-week feed-trial. Samples were taken during the test milkings as described in B Group. No milk weigh pails were used in the systems during this group trial as the milk moved directly from the breaker cup to the milk line.

The experimental ration was composed of 47% beet pulp, 40% cottenseed meal, 10% molasses, 2% bonemeal and 1% salt. This ration was fed at adjusted levels to provide 50% of the energy and 100% of the protein necessary for maintenance and milk production based on Morrison's standards. In addition, 10 lb of very poor quality "native" hay (4.6% protein) was fed each cow per day. The herd ration was the same as in B Group trials.

Milk collected through the sampling tee from each of the milk lines in the three group trials was immediately transported to the laboratory where one portion was immediately pasteurized, cooled and analyzed for initial ADV. The remaining portion was immediately cooled and held at 4°C for 48 hr for determination of spontaneous ADV.

Levels of initial and spontaneous ADVs were determined by the method of Thomas, et al.*(10)*.

Table 1. Group A. Trials. Summary of Initial, Spontaneous and Difference in ADV as Affected by Pipeline Height Only[a]

Paired observations		Initial	48 hrs. spontaneous	Difference
		Low milk line		
	Range	0.61-0.87	1.11-1.58	0.33-0.81
10	Mean	0.71	1.29	0.59
	Std. Dev.	0.09	0.16	0.16
		High milk line		
	Range	0.55-0.99	1.23-2.58	0.36-1.61
10	Mean	0.77	1.63	0.86
	Std. Dev.	0.16	0.40	0.41

[a]Weigh pails in system.

Table 2. Group B. Trials. Summary of Initial, Spontaneous and Difference in ADV as Affected by Low Protein Ration and Pipeline Height[a]

Paired observations		Initial	48 hrs. spontaneous	Difference
		Low milk line		
	Expt'l. cows			
	Range	0.33-0.96	1.00-2.57	0.43-1.98
7	Mean	0.57	1.71	1.14
	Std. Dev.	0.22	0.62	0.66
	Contr. cows			
	Range	0.55-0.95	0.73-2.03	0.18-1.08
4	Mean	0.68	1.38	0.70
	Std. Dev.	0.18	0.53	0.38
		High milk line		
	Expt'l. cows			
	Range	0.25-1.12	1.82-4.13	0.96-3.24
7	Mean	0.65	2.96	2.32
	Std. Dev.	0.32	0.97	0.89
	Contr. cows			
	Range	0.51-0.71	1.65-3.42	1.11-2.71
4	Mean	0.72	2.38	1.66
	Std. Dev.	0.18	0.77	0.75

[a]Weigh pails in system.

Results and Discussion

The ranges, means, and standard deviation of ADVs of Group A trial have been reported in Table 1. As can be noted the means of both initial and spontaneous ADVs were lower for the low milk line than for the high line above the cows. The mean difference or increase of spontaneous over initial ADVs was also less for the low line, which suggested that the milk handled through the low line received less agitation activation than in the line located above the cows. The relatively high standard deviations noted in the spontaneous ADVs and in the differences in ADV for the high line indicated uncontrollable variables which did not significantly appear in the low line.

Similar information for Group B trials has been summarized in Table 2. Since only 4 cows were involved in each of the experimental and control groups, greater variations in results were noted in that the standard deviations in all instances were greater than those reported in Table 1. Milk handled through the low line whether from experimental or control animals indicated lower mean spontaneous ADVs and a smaller mean increase in spontaneous over initial ADVs than milk from the same animals handled through the high line. The experimental animals, which perhaps were under some stress from the abnormally low protein ration, produced milk with higher mean spontaneous ADVs and greater mean differences between initial and spontaneous ADVs than was found in milk from the control animals in each of the two systems.

Results from Group C trials have been reported in Table 3. These trials differed from Group B

TABLE 3. GROUP C. TRIALS. SUMMARY OF INITIAL, SPONTANEOUS AND DIFFERENCE IN ADV AS AFFECTED BY LOW ENERGY RATIONS AND PIPELINE HEIGHT[a]

Paired observations		Low milk line Initial	48 hrs. spontaneous	Difference
	Expt'l. cows			
	Range	0.42-0.50	0.81-0.96	0.32-0.46
3	Mean	0.48	0.87	0.39
	Std. Dev.	0.06	0.08	0.07
	Contr. cows			
	Range	0.37-0.65	0.66-1.16	0.01-0.62
3	Mean	0.52	0.94	0.41
	Std. Dev.	0.14	0.25	0.35
		High milk line		
	Expt'l. cows			
	Range	0.57-0.72	0.97-1.38	0.25-0.81
3	Mean	0.66	1.23	0.58
	Std. Dev.	0.08	0.23	0.30
	Contr. cows			
	Range	0.46-0.61	0.92-1.64	0.68-1.03
3	Mean	0.53	1.23	0.70
	Std. Dev.	0.76	0.37	0.32

[a]Weigh pails in system.

trials in that the experimental cows were on a low energy ration in place of a low protein ration and that no milk weigh pails were used in the milking system. As in the two previous trials, spontaneous mean ADVs in milk were less for both groups of animals milked on the low line as compared to the high line. In these trials no weigh pails were used. Since different animals were used in B and C trials, no particular influence has been attributed to the absence or presence of weigh pails. The variable results noted between the experimental and control cows in similar systems indicated little difference in the fat stability of the milk produced by each group.

From casual observations during milking operations, milk flow appeared to be less turbulent in the milk hose and low-line than in the high-line system.

While there may have been some effects of rations on the results, the major effect was that of pipeline height. In each of the trials there was greater activation of fat lipolysis in milk handled through the high line located 4 ft. above the cow as compared to that handled through the low line located 2 ft below the cow. This is in agreement with the earlier report of Whittlestone, et al. *(13)*. Since Irving *(5)* had reported that acid degree increases with riser height it was also expected that use of the 116 in milk hose to the high line would result in greater agitation and activation than the 72 in milk hose to the low line.

For statistical analysis, data from the three trials were pooled. This included a total of 86 cows and 54 observations. The mean difference between initial and spontaneous ADVs for the low line was 0.68 and for the high line, 1.16, which upon analysis was found to be highly significant ($P < 0.01$).

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THE EFFECT OF SELECTED PLATING PROCEDURES ON THE BACTERIAL COUNT OF INSTANT NONFAT DRY MILK[1]

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Summary

It was estimated that the addition of 10.5 g of instant nonfat dry milk to 99 ml of water more nearly approximated a 1:10 dilution than did the currently recommended addition of 11 g of powder. It was estimated that the addition of a gram of powder to 99 ml of water increased the volume 0.5798 ml. Incubation of plates for 3 days produced counts 71% higher than those obtained using 2 days incubation. The use of dilution blanks tempered at 45 C resulted in a 27% increase over the count obtained using dilution blanks at room temperature. The interaction between incubation time and water blank temperature indicated that the warmed dilution blanks exerted a stimulatory effect upon the microorganisms in the powder. Counts obtained using overlayed plates could be more accurately replicated but non-overlayed plates yielded counts 15% greater. The use of Standard Methods Agar produced counts 10% higher than those obtained using Milk Protein Hydrolysate Agar. Shaking dilution bottles 50 times produced counts no larger than those obtained by shaking the bottles 25 times. A pooled estimate of the variance between duplicate plates was found to be 0.0087.

If it were assumed that it is desirable to use a plating procedure which yields the highest estimate of the bacterial content of instant nonfat dry milk, the factors which affect this estimate should be studied. No reports were found concerning the effect of plating procedure on the bacterial count of instantized powders.

Prickett and Miller *(10)* reported that the procedure of weighing 1 g of powder into 9 ml of water results in an error in the bacterial estimate of approximately 2.9%. It was estimated that the addition of 1 g of powder to 9.3 ml of water resulted in a 1:10 dilution. Sorensen *(13)* added 10 g of powder to 93 ml of sterile water. Hiscox *(6)* prepared a 1:10 dilution by adding 10 g of powder to 90 ml of Ringer's solution. The presently recommended procedure for preparing a 1:10 dilution is to add 11 g of powder to 99 ml of water *(1)*.

The method of reconstituting milk powder for the plate count has been studied by several workers *(2, 4, 5, 6, 14)* Cone and Ashworth *(2)* found no differences in counts obtained using water blanks heated to 45, 50 and 55 C, however, counts were higher using these temperatures than those obtained using water blanks at room temperature. The addition of alkaline materials to the warmed water blanks did not further increase the counts. Holding samples reconstituted in 50 C dilution water for 5, 10 and 15 minutes after shaking produced counts no higher than those obtained with no holding time. White *(14)* studied the effect of holding diluted powders at 50 C as compared to room temperature prior to plating. Water blanks tempered at 50 C were used to make all dilutions. No significant differences were found. Both Higginbottom *(5)* and Hiscox *(6)* reported that the use of 50 C dilution water resulted in increased counts. Higginbottom *(5)* showed that the use of 50 C water resulted in a greater improvement in solubility of roller dried milk, but that the increase in count was less than the increase found with spray dried milk.

Experimental Methods

To estimate the increase in volume in a dilution bottle resulting from the addition of a gram of instant nonfat dry milk, a series of seven, 250-ml graduated cylinders was prepared. Each cylinder contained 99 ml of dilution water. Varying amounts of the instant powder obtained in consumer packages from the Gainesville market were added to each series of cylinders. The amount of instant powder added to each cylinder in a series was either 0, 1, 2, 4, 8, 11, 24 or 42 g. Each series for a given brand of powder was replicated once and each brand was replicated once for a total of four series for each brand. The least squares method was used to estimate the increase in volume resulting from the addition of a gram of powder (the slope of the plot of increase in volume versus grams of powder added). Four brands of powder were tested.

An experiment was designed using 4 brands of instant powder to determine the effect on bacterial count of tempering dilution blanks to 45 C prior to making the dilutions versus dilution blanks at room temperature. All plates were incubated at 32 C. Comparisons made in these trials included 2-day incubation versus 3-day incubation, and overlayed plates versus non-overlayed plates. This experimental design allowed testing of interaction among all comparisons.

Several experiments were performed to compare plate counts obtained using Standard Methods Agar with those obtained using Milk Protein Hydrolysate Agar. Shaking 50 times as described by Hiscox *(6)* was compared with the standard shaking procedure *(1)*.

All weighing and pipetting procedures were randomized to avoid sequential errors. All plating procedures used were those described in *Standard Methods (1)* except where the effect of varying a selected procedure was being studied. Analysis of variance techniques as described by Snedecor *(12)* were used in estimating the importance of an effect.

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TABLE 1. ESTIMATES OF THE INCREASE IN VOLUME OF A 99ML DILUTION BLANK RESULTING FROM THE ADDITION OF A GRAM OF INSTANT NONFAT DRY MILK

Brand of powder	ml/g
A	0.5905[a]
	0.6164[a]
B	0.5591
	0.5745
C	0.5511
	0.5542
D	0.6006
	0.5889
All data	0.5798

[a]Replicate estimates.

TABLE 2. ANALYSIS OF VARIANCE OF DATA OBTAINED FROM AN EXPERIMENT DESIGNED TO TEST THE EFFECT OF VARYING TIME, WATER BLANK TEMPERATURE AND OVERLAYING OF POURED PLATES

Source	d. f.	Mean Square
Brands (B)	3	—
Days (D)[b]	1	0.8635**[a]
D X B	3	0.3939**
Temperature[c] (T)	1	0.1714**
T X B	3	0.1021**
T X D	1	0.0524
T X D X B	3	0.0129
Overlay (O)	1	0.0818*
O X B	3	0.0241
O X D	1	0.0144
O X T	1	0
O X D X B	3	0.0292
O X T X B	3	0.0288
O X T X D	1	0.0270
O X T X D X B	3	0.0080
Error	32	0.0135

[a]Significant differences * ($P < .05$) ** ($P < .01$).

[b]Incubation time; 2 days versus 3 days.

[c]Dilution blank temperature; 45 C versus room temperature.

All plate counts were converted to common logarithms prior to analysis of the data and all average counts are geometric averages.

RESULTS AND DISCUSSION

The volume of a gram of dissolved powder for each of the four brands tested is presented in Table 1. There was a linear relationship between the increase in volume of the dilution water and the amount of powder added over the range tested (from 0 to 42 g of powder). The change in volume of the dilution water could be predicted by multiplying the grams of powder added by the volume per gram of dissolved powder. Using a 99 ml water blank, the true dilution factor of a sample of milk powder could be calculated by using the following formula:

$$\frac{\text{grams of powder}}{99 \text{ plus (volume per gram dissolved powder times grams of powder)}}$$

In order to use routinely a formula such as this, it would be necessary to obtain an estimate of the volume per gram of dissolved powder and to assume that this estimate would be representative of all powders tested. Analysis of the data in Table 1 indicated that the volume increase varied significantly with the brand of powder ($P < .01$). To test the importance of this variation, all estimates in Table 1 were used with the preceding formula to determine the grams of powder to be added to 99 ml of dilution water to prepare a 1:10 dilution. If the results were rounded to the nearest 0.1 g, the use of all estimates in Table 1 (except 0.6164) indicated that the addition of 10.5 g of powder to 99 ml of water resulted in a 1:10 dilution. Using the average volume per gram of dissolved powder (0.5798, S. E. 0.0048) it was estimated that the use of 10.5 g of powder instead of the currently recommended 11 g to prepare a 1:10 dilution would result in a decrease in the estimates of the bacterial count of approximately 4.2%.

Analysis of the data obtained from the experiment testing the four main effects of brand of powder, days incubation, temperature of the water blanks and the use or omission of the overlay is presented in Table 2. All main effects were considered as fixed effects and all were significantly different. The use of water blanks tempered at 45 C resulted in a 27% increase in the geometric mean count over that obtained when using water blanks at room temperature. It was estimated that the incubation of the plates for 3 days instead of 2 days resulted in an increase of 71% in the geometric mean of the resulting plate counts. Pedraja and Mengelis *(9)* estimated that 3 days incubation of plates containing dried milk samples resulted in an increase of 43% in bacterial count over those incubated for 2 days. Johns *(7)*, Pedraja and Mengelis *(9)* and Smith et al. *(11)* have discussed the use of either 2-day or 3-day incubation periods for dried milk. The present work indicates that counts obtained using 3 days incubation are significantly higher ($P < .01$) than those obtained using 2 days incubation. Based on these results it is estimated that a bacterial standard of 20,000 per g for a 2-day incubation period is equivalent to a standard of 35,000 for 3-day incubation. An estimate of the variance between duplicate plates following 2 days incubation was 0.0202 as compared to 0.0067 for plates incubated 3 days. It appears that 3 days instead of 2 days incubation improves both the accuracy and precision of the resulting estimate of the

bacterial count of instant nonfat dry milk.

The average count for plates without overlays was 15% greater than that obtained using overlays. Although the use of an overlay appeared to reduce the number of colonies that developed on a plate, it also appeared to reduce the size and number of spreaders that developed which allowed the plates to be counted with greater ease. The increased precision in counting plates was reflected in the estimate of the experimental error within duplicate plates which was 0.0077 for plates with overlays compared to 0.0192 for plates without overlays. The use of an overlay is indicated if maximum reproducibility in counts is desired, however, it should be omitted if the estimation of the maximum total number of organisms is the purpose of the plating procedure.

The only significant interactions were the two factor interactions between days incubation X brands of powder, and temperature of dilution blank X brand of powder. These interactions were probably a reflection of the different floras found in the different brands of powder. The interaction between the temperature of the water blank used and the length of the incubation period approached significance ($.05 < P < .10$). This interaction might indicate a stimulatory effect when hot water blanks and 2 days incubation are used but the effect is partially overcome by the use of longer incubation periods. The geometric mean obtained using hot water blanks was 45% greater than that obtained using room temperature water blanks when plates were incubated for 2 days, but was only 11% greater when plates were incubated for 3 days (Table 3). This indication of a stimulatory effect of the warmed water blanks supports the suggestion of Hiscox *(6)* that the dormancy of the cells in powder is broken by the application of heat which stimulates new growth.

TABLE 3. INTERACTION BETWEEN WATER BLANK TEMPERATURE AND TIME.

Water blank temperature	45 C	Room temp.
Days incubation		
3	1900	1700
2	1300[a]	900

[a]Entries represent geometric means (rounded to 2 significant numbers) obtained from a 2-way classification table of the data analyzed in Table 2,

Three experiments were performed which included a comparison of Standard Methods Agar (SMA) with Milk Protein Hydrolysate Agar (MPHA). In all experiments the geometric mean of the counts obtained using SMA were higher than those obtained using MPHA with estimates of the increase in count ranging from 7% to 11%. These differences were not great enough to be significant in two experiments with 48 and 96 total observations but the difference (10%) was significant in one experiment comprising 192 observations. In two experiments estimating the effect of shaking the dilution blanks 50 times versus 25 times, no significant differences were found.

In the statistical analyses of all plate count data the error term used was the variance between duplicate plates. If the mean square for error greatly exceeded 0.01, the experiment was performed again. Cone and Ashworth *(2)* were able to get error terms ranging from 0.0035 to 0.0086 for duplicate plates of reconstituted milk powder. Donnelly et al. *(3)* estimated that the variance between duplicate plates should be 0.0050 when a logarithmic transformation of the counts is used. In the present work estimates of the variance between duplicate plates ranged from 0.0060 to 0.0141. A pooled estimate of the variance with 200 degrees of freedom was found to be 0.0087. It can be stated with 95% confidence that the "true" variance between duplicate plates of instant nonfat dry milk is contained in the open interval (0.0072, 0.0107). The high estimate of the variance between duplicate plates of samples of instant nonfat dry milk may be explained by the predominance of spreaders in this product as reported by Mull and Smith *(8)*.

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BULLETIN ON PHS COURSES

The Public Health Service, U. S. Department of Health, Education and Welfare, through the Robert A. Taft Sanitary Engineering Center at Cincinnati has released its "Environmental Health Sciences and Engineering Training Program Bulletin of Courses" for the fiscal year July 1966, to June, 1967.

The program offers courses in such fields as radiological health, air pollution, environmental engineering and food protection, solid waste disposal, occupational health, computational analysis, water pollution control and various special activities. Courses will be given at the Center in Cincinnati and at other locations throughout the country.

A copy of the Bulletin of Courses may be obtained from the Director, Training Program, Robert A. Taft Engineering Center, 4676 Columbia Parkway, Cincinnati, Ohio 45226.

FIBERGLASS TUNNELS FOR WATER SUPPLIES AND SEWAGE DISPOSAL

According to *Water Control News,* a publication of Commerce Clearing House, Inc., new uses have been suggested for fiberglass. A California industrialist proposes a 30 foot fiberglass tunnel laid in the Pacific Ocean to transport drinking water to Los Angeles from Northern California supply areas. It is estimated that this could be done at one-fourth the cost of desalting sea water or one-half the cost of a land route project now under consideration.

Stream pollution problems similarly could be solved by laying fiberglass tunnels in streams such as the Hudson with inlet connections from municipal sewage facilities. Effluents could then be carried far out to sea for disposal by dilution or to large waste treatment plants.

NEW CONCEPT IN STUDENT TRAINING IN FOOD SCIENCES

The idea of training a college student as a specialist in one product or one phase of the food industry is obsolete, according to Harold E. Calbert, chairman of the Department of Food Science and Industries at the University of Wisconsin. The trend in many fields is toward specialization, while the food industry wants students with a broad background who are flexible enough to move into any phase of the business. These were some of the ideas expressed by Calbert in a panel discussion at the American Dairy Science Association meeting at Portland, Oregon, June 26-29.

The student majoring in food science today is much different from the student of 10 or 20 years ago, Calbert said. He doesn't want vocational training to become a butter maker, cheese maker, or ice cream manufacturer. He may only be interested in dairy industry, equipment industry, or the very broad area of food science.

The food industry also needs a different kind of graduate than it needed ten years ago. They want a student whose training qualifies him for different phases of work, but they expect to give him the specialized training on the job. A good college curriculum, Calbert point out, must fit the interest of this new kind of student and this new demand by industry. He said that Wisconsin meets these needs with a flexible curriculum with multiple options.

Under this program the student gets training in the basic subjects of chemistry, physics, biology, and mathematics. These are taught by subject matter departments, not by the food science department. The student also takes courses in communication, social sciences, and the arts to stimulate his thinking and broaden his education.

With this background the University of Wisconsin student chooses one of four options for specialization. The science option prepares him for research or product development. The engineering option prepares him for equipment design or plant layout. The production and technology option trains him in operating and supervising processing in dairy or food plants. Finally, the business and industry option is for the student who wants to enter management, sales, or business.

Calbert said that any food science department should offer technical courses in (1) food chemistry, (2) sanitation and quality control, and (3) principles of food processing. Such courses would deal with food additives, bacteriology, and food preservation. A food science curriculum can be oriented toward a specific product a student should have at least one product-oriented course. If he learns how to deal with butter, ice cream, or canned vegetables, he will have a springboard to use for almost any product.

The student who is ready to take a job in the food industry today, Calbert concluded, is the student who has learned how to think, the student who has an understanding of the principles of food science and can apply them to a broad range of products.

SOME FACTORS AFFECTING THE CORRELATION OF METHYLENE BLUE REDUCTION TIMES AND STANDARD PLATE COUNTS OF RAW MILK

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Summary

Standard plate and psychrophilic bacterial counts, on 312 samples of milk collected from farm bulk tanks and milk cans, were compared with methylene blue reduction times using the standard procedure or preliminary incubation of samples at 55 F for 18 hr prior to testing. When psychrophilic bacterial counts were less than 100,000/ml, according to standard plate counts a high proportion of methylene blue reduction times were properly classified. However, psychrophilic bacterial counts greater than 100,000/ml did not significantly decrease reduction times, thus a high proportion of such milks was not properly classified by methylene blue reduction times. The proportion of misclassification of samples having standard plate counts in excess of 200,000/ml and methylene blue reduction times of 5 and 6 hr was determined.

Pipeline milking and mechanical refrigeration enable rapid cooling of milk to 32 to 40 F in farm bulk tanks which minimizes the opportunity for bacterial reproduction. As a result, some procedures for the microbiological examination of raw milk often do not give a satisfactory indication of the sanitary conditions under which that milk was produced. Two and three decades ago investigators reported that the methylene blue reduction test (MBRT) corresponded favorably with estimates of bacterial population by the agar plate method *(1, 10)*. Later, Johns and Berzins *(7)* and Johns *(6)* examined the value of preliminary incubation (PI) of samples at 55 F for 18 hr prior to conducting resazurin tests. Their work indicated that microbial contaminants from soil and water reproduce during PI, whereas microorganisms from the udder do not. Initially Johns *(6)* indicated that PI increased the value of the resazurin reduction test as an indicator of the sanitary conditions under which milk was produced and handled. These results stimulated the use of PI in industry quality control programs. In later tests, however, Johns et al. *(8)* indicated that PI as an indicator of unsanitary milk production practices showed no significant advantage over either the standard plate count (SPC) or the standard resazurin test.

Since the data on reduction times were based either on milk production practices of 20 years ago or on reduction of resazurin, more recent data on MBRT and SPC of raw milk were needed to establish their present relationships.

Procedures

Samples of bulk tank and can milk were collected from dairy farms and plants located in three midwestern states. The sampling procedures and laboratory examinations conformed with the provisions of *Standard Methods for the Examination of Dairy Products (2)*. On arrival at the laboratory, all samples were shaken and split into two portions. The first portion was examined immediately, and the second portion was incubated at 55 F for 18 hr in a thermostatically controlled water bath prior to examination. This procedure is the same as that reported by Johns *(6)*. Incubation temperatures and times for SPC and psychrophilic bacterial counts (PBC) were 32 C for 48 hr and 7 C for 10 days, respectively. MBRT were determined at 35 to 37 C.

Results

A comparison of MBRT and SPC results, from standard and PI procedures on 282 milk samples collected from farm bulk tanks and milk cans at all locations, is shown in Table 1. Comparison of MBRT and SPC was measured for three bacterial count ranges. Table 1 shows that acceptable milks with MBRT of 6 to 8 hr had log mean SPC ranging from 42,000 to 390,000/ml, with 14% of these log-mean counts over 200,000/ml. According to the 11th edition of *Standard Methods for the Examination of Dairy Products*, raw milk with an MBRT of 6 hr or over is classified as acceptable. The proportion of reduction times of 6 to 8 hr to bacterial counts less than 200,000/ml using standard procedures was 0.84, whereas preliminary incubation of samples prior to determining reduction times (PI-MBRT) and bacterial counts (PI-SPC) resulted in a proportion of 0.79. As shown in Table 1, 38% of the milk samples with bacterial counts greater than 200,000/ml subjected to preliminary incubation had reduction times of 6 to 8 hr.

PBC's in excess of 100,000/ml did not consistently cause shorter reduction times when standard pro-

TABLE 1. COMPARISON OF STANDARD METHODS MBRT BEFORE AND AFTER PI WITH SPC AT 32 C ON RAW MILK COLLECTED FROM ALL SAMPLING LOCATIONS

Method	MBRT in hr	SPC <100,000/ml			SPC 100,000 - 200,000/ml			SPC >200,000/ml			
		No. of samples	Arith. avg	Log avg	No. of samples	Arith. avg	Log avg	No. of samples	Arith. avg	Log avg	Total samples
MBRT	8	142	27,000	18,000	18	150,000	140,000	13	440,000	370,000	173
	7	51	38,000	30,000	7	160,000	150,000	15	380,000	320,000	73
	6	11	51,000	42,000				10	520,000	390,000	21
	5	2	74,000	73,000	1	130,000	130,000	3	490,000	390,000	6
	4	1	63,000	63,000				4	350,000	340,000	5
	3							4	480,000	440,000	4
Total		207			26			49			282
		PI - SPC <100,000			PI - SPC 100,000 - 200,000			PI - SPC >200,000			
PI-MBRT	8	50	26,000	16,000	14	150,000	140,000	10	2,300,000	1,100,000	74
	7	57	45,000	39,000	14	150,000	150,000	19	1,400,000	750,000	90
	6	18	32,000	21,000	7	150,000	150,000	10	2,000,000	1,200,000	35
	5	6	55,000	46,000	9	140,000	140,000	30	5,200,000	1,500,000	45
	4	2	64,000	61,000				8	2,000,000	930,000	10
	3	1	67,000	67,000				12	10,000,000	5,100,000	13
	2							10	10,000,000	5,800,000	10
	1							4	17,000,000	17,000,000	4
Total		134			44			103			281

cedures were used (Figure 1). Although PI permits contaminating organisms to reproduce, the comparison of reduction times to bacterial counts after PI remained poor when PI-PBC's were in excess of 100,000/ml (Figure 2).

Results of samples collected at 12 locations (Table 2) show the comparative effectiveness of 3 different regulatory bacteriological procedures for milk having SPC <100,000, <100,000 - 200,000, and >200,000/ml. Viable count levels at two localities normally reporting reduction times were higher than those reported during a previous study *(3)* at nine localities where the SPC was the regulatory laboratory procedure.

The results were also subjected to statistical analysis on the relation of reduction times to bacterial counts. Since high PBC and PI-PBC ($\geq$100,000/ml) did not appear to decrease reduction times significantly, the degree of misclassification was determined. Classification of reduction times was based on two groups of results: (*a*) reduction times of 6 to 8 hr, representing milk having SPC's from 3,000 to less than 200,000/ml, and (*b*) reduction times of 1 to 5 hr, pertaining to milk having SPC's in excess of 200,000/ml. Table 3 lists all of the estimates of the proportions (P) of properly classified reduction time values to bacterial counts, at 32 C, when two ranges of PBC occur in samples. Hypotheses tested during the evaluation of MBRT and SPC using both standard and PI procedures are summarized in Table 4. The methods for these statistical tests used for the preparation of Tables 3 and 4 have been presented by Dixon and Massey *(4)*.

Analysis of the results shows that high psychrophilic bacterial counts ($\geq$100,000/ml) have an adverse effect on the proportion of proper classification. Preliminary incubation of samples seems to partially correct this effect as indicated by the interaction between methods and levels of psychrophiles. No other differences were detected in this analysis. All test were made at $\alpha = 0.05$ level, where α is the probability of rejecting a hypothesis when it is true.

DISCUSSION

Microorganisms in excess of 200,000/ml, as determined by bacterial counts at 32 C, apparently were not able to reduce methylene blue rapidly, either because they did not grow at 35 C or metabolized slowly, as might be expected from psychro-

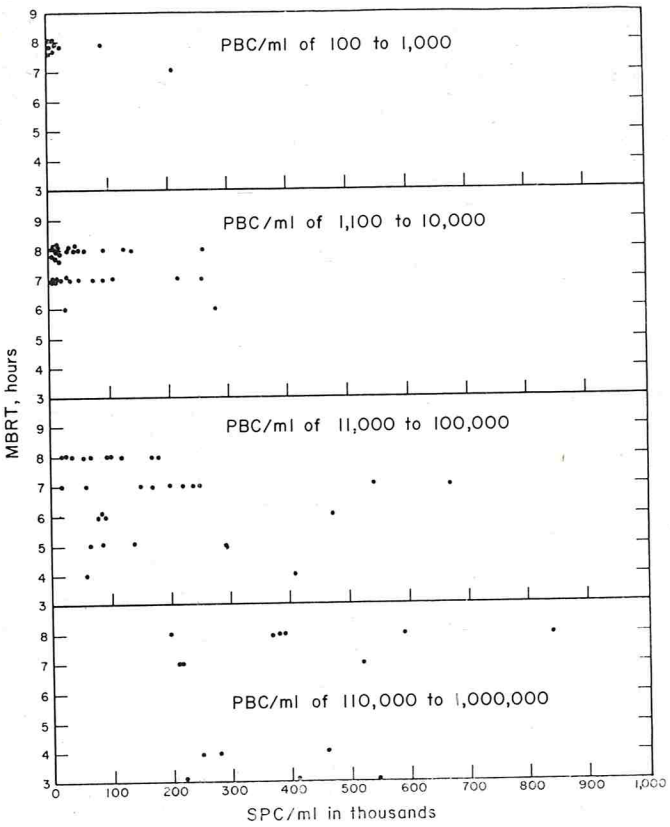

Figure 1. Comparisons of MBRT and SPC at various PBC ranges.

philes. The data demonstrated that milk having a PBC in excess of 100,000/ml also had a high bacterial count at 32 C, but reduction times at 35 C were not significantly lowered. Fifty-six percent of the milk samples having greater than 100,000 PBC/ml had SPC's in excess of 200,000/ml, but still had acceptable MBRT's of 6 to 8 hr. Since the temperature of milk in farm bulk tanks may often increase to 50 F or higher for at least 2 to 3 hr during milking times and still meet the provisions of the Milk Ordinance and Code (*9*), growth of psychrophilic and other bacteria capable of reproduction at 50 F can occur. At 41 to 44 F psychrophilic organisms of dairy origin normally require 8 to 10 hr for each generation, whereas at 50 F only 4 hr may be necessary for re-

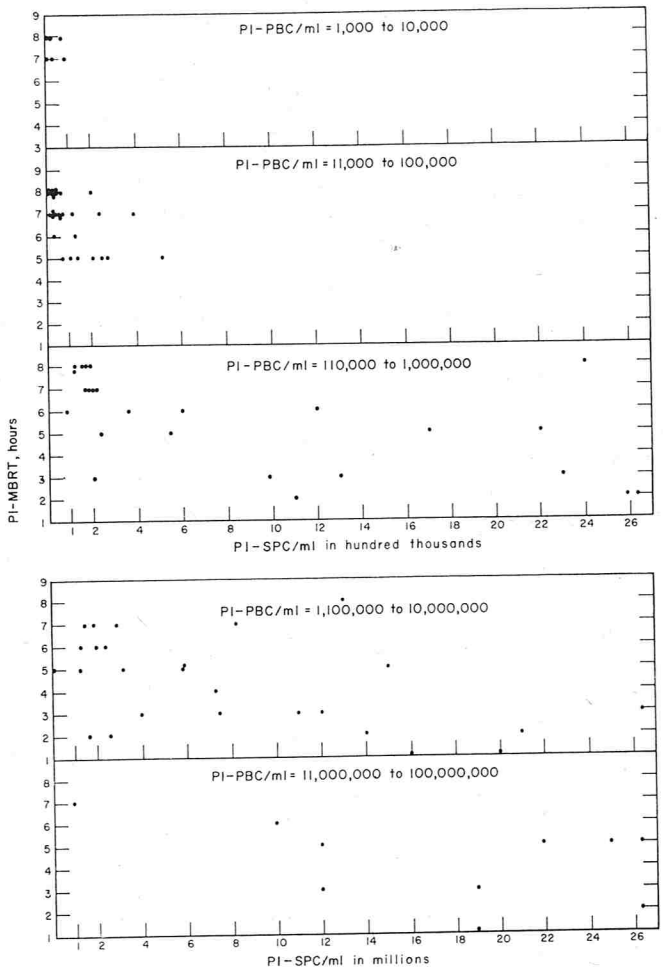

Figure 2. Comparisons of PI-MBRT and PI-SPC at various PI-PBC ranges.

TABLE 2. COMPARISON OF PROCEDURES USED FOR REGULATORY LABORATORY CONTROL OF THE BACTERIAL COUNT OF RAW MILK AT VARIOUS LOCATIONS

Regulatory laboratory procedure	Total samples tested	SPC <100,000/ml		SPC <100,000-200,000/ml		SPC >200,000/ml	
		No. of samples	%	No. of samples	%	No. of samples	%
MBRT[a]	186	153	82	167	90	19	10
DMC[b]	96	54	56	66	69	30	31
SPC[c]	2,021	1,879	93	1,940	96	31	4

[a]Methylene blue reduction test used as regulatory laboratory procedure at two locations.
[b]Direct microscopic count used as regulatory laboratory procedure at one location.
[c]Standard plate count used as regulatory procedure at nine locations. Data taken for comparison purposes from an interstate milk shipment study (*3*).

TABLE 3. EFFECT OF PSYCHROPHILIC BACTERIAL COUNT ON PROPORTION (P) OF PROPERLY CLASSIFIED MBRT OBSERVATIONS COMPARED TO SPC ON ALL SAMPLES

Method	PBC/ml			
	<100,000		≥100,000	
	P value	No. of samples	P value	No. of samples
MBRT	0.88	287	0.44	25
PI-MBRT	0.84	176	0.71	105
Weighted average proportion	0.86	463	0.65	130

production *(5)*. Where psychrophilic contamination of milk occurs during production or subsequent handling, 24 to 48 hours storage in farm bulk tanks permits adequate time for reproduction of these organisms. Failure of the MBRT to reflect the presence of large numbers of psychrophilic and facultative psychrophilic bacteria impairs the usefulness of the MBRT as a regulatory laboratory control procedure for the examination of raw milk for processing. Where PBC's were less than 100,000/ml, the agreement between MBRT and SPC was 88%.

The results of this study indicated the degree of misclassification of milk samples that can occur when MBRT's or PI-MBRT's of 5 and 6 hr are used for classification of unacceptable and acceptable milk, respectively. With samples having an SPC in excess of 200,000/ml, 63% of 52 samples had reduction times of 5 hr but 36% of 58 samples were misclassified by reduction times of 6 hr. The data showed that 157 samples had an SPC in excess of 200,000/ml, and 51.5% of these were misclassified since their reduction times were from 6 to 8 hr. Since a large percentage of samples had bacterial counts at 32 C of less than 100,000/ml, the proportion of agreement between MBRT and SPC appeared high. If a larger proportion of the samples examined had had SPC in the range of 100,000 to 300,000, the data indicated that the proportion of agreement of properly classified MBRT to SPC would have been lower. For milk samples having "poor" reduction times of 3 and 4 hr, and "good" reduction times of 7 and 8 hr, the log mean SPC showed good agreement.

ACKNOWLEDGMENT

The authors express their appreciation to James T. Peeler for his statistical analysis of the data presented in this paper.

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TABLE 4. SUMMARY OF STATISTICAL FINDINGS

Null Hypotheses tested	Test statistic	Critical value	Conclusion
1. The overall proportion of properly classified MBRT with SPC and PI-MBRT with PI-SPC are unaffected by two PBC levels.	$Z_{0.05} = \|4.68\|$	$Z_{0.05} = 1.96$	Reject[a]
2. Standard procedures and PI are unaffected by two PBC levels using proportions of properly classified MBRT and PI-MBRT with SPC.	$\chi^2_{1,0.05} = 73.8$	$\chi^2_{1,0.05} = 3.84$	Reject
3. The proportion of properly classified MBRT with SPC is unaffected by PI.	$Z_{0.05} = \|1.57\|$	$Z_{0.05} = 1.96$	Not reject[b]
4. The overall proportion of properly classified MBRT with SPC and PI-MBRT with PI-SPC are the same for bulk tank and can milk.	$Z_{0.05} = \|-1.58\|$	$Z_{0.05} = 1.96$	Not reject[b]

[a]The absolute value of the test statistic exceeds 1.96, and so the hypothesis is rejected.
[b]The absolute value of the test statistic does not exceed 1.96, and so hypothesis cannot be rejected.

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INTERPRETING A WATER ANALYSIS

A recent issue of the *Public Health Inspector*, the Journal of the Association of Public Health Inspectors, London, England, carried some interesting observations on the interpretation of water analyses. A hypothetical sample was taken from a private well and it was proposed to install a pump and air pressure tank to deliver the water under pressure to the home.

The analysis of the water was as follows:

Total hardness	183 ppm
Total alkalinity (as $CaCO_3$)	155 ppm
Total calcium (as $CaCO_3$)	164 ppm
pH value	7.3
Langelier index	Minus 0.27

The analysis is interpreted as to the significance of the values and the suitability of the water for the purpose intended.

Total Hardness

This figure includes both temporary and permanent hardness. Temporary hardness is, of course, due to the presence in the water of bicarbonates of calcium and magnesium. Permanent hardness is caused by the presence of calcium chloride, calcium sulphate, magnesium sulphate, magnesium chlorides and, to a very limited extent, calcium carbonate. (Calcium carbonate, unlike its bicarbonate, is only very slightly soluble in water.)

Waters having total hardness values below 50 parts per million (ppm.) are regarded as "soft"; those with hardness values above 200 ppm. are classed as "hard". The water referred to in the question is therefore moderately hard and is likely to be quite palatable.

Total Alkalinity and Total Calcium

The value for total alkalinity represents collectively the amounts of bicarbonates, carbonates and hydroxides of calcium, magnesium, sodium and potassium in the water. This value is expressed in terms of the equivalent weight of calcium carbonate.

The total calcium figure, which is also expressed in terms of its carbonate equivalent, includes all calcium compounds present and not merely the alkaline compounds referred to in the preceding paragraph.

Bicarbonates of calcium and magnesium are also the substances which most commonly account for the alkalinity of water. Since the total calcium actually exceeds the value for total alkalinity it is reasonable to assume the calcium and magnesium bicarbonates account for most, if not all, of the total alkalinity of the water sample.

The difference between total hardness and total alkalinity may therefore be regarded as the amount of permanent hardness present. The water has both permanent and temporary hardness but the temporary hardness exceeds the permanent hardness.

pH Value

A pH value of 7.3 denotes that the water is only slightly alkaline when assessed by the pH scale. Unlike the total alkalinity value, which takes into account only the compounds mentioned under that heading, the pH value also allows for the moderating effects (acidic in character) of sulphates, organic matter and free carbon dioxide.

Prepared graphs are available which enable the free carbon dioxide content of a water to be rapidly determined by reference to its pH value and alkalinity. The free carbon dioxide content of the water referred to in the question is about 15 parts per million.

*Langelier Index**

The ability of a particular water to absorb calcium carbonate depends on a complex interrelationship between the alkalinity of the water, its pH value, the amount of calcium present, the amount of free carbon dioxide present and the temperature of the water. Certain combinations of these factors will result in the water absorbing calcium carbonate; other combinations will cause the water to precipitate calcium carbonate.

For any given water at a particular temperature, irrespective of its actual pH value, there will be a pH value at which that water will neither absorb nor precipitate calcium carbonate. This value is called the "saturation pH value" or "$CaCO_3$ saturation index" of the water; it is referred to as "pH_s".

If the actual pH value of a water exceeds its pH_s value the water will deposit calcium carbonate as scale; if the pH is below pH_s the water will "dissolve" calcium carbonate; if both values are equal

(*Not in common usage in the United States. *Ed.*)

the water will neither "dissolve" nor precipitate calcium carbonate. These two values are for convenience merged into a single factor known as the "Langelier index" which equals pH MINUS pH_s.

Waters with a positive Langelier index are scale-forming and so tend to protect from corrosion the pipes through which they pass; water with a negative index are able to "dissolve" calcium carbonate and are potentially corrosive. The control of the solubility or precipitation of calcium carbonate in water, by adjustment of its Langelier index, offers a means of preventing corrosion or excessive scaling of pipes and fittings.

Suitability of the Water for the Purposes Proposed

Since its Langelier index is negative the water must be regarded as potentially corrosive. However, if the water were used in a hot water system, its Langelier index might become slightly positive because calcium carbonate becomes less soluble at elevated temperatures and the value for pH_s becomes less. To be on the safe side, however, the water should be treated so as to raise its pH value slightly above pH_s and so produce a positive Langelier index; this is especially important if electrically dissimilar metals are used in the water circuits.

Treatment could be by passage through calcined magnesium limestone in the pressure vessel or by the controlled addition to the water of hydrated lime, soda ash (sodium carbonate), or caustic soda (sodium hydroxide). Calcium and magnesium compounds would also increase the hardness of the water but sodium compounds would not—but they are more costly.

The Heed for Specialist Advice

The corrosion of metals is a complex process and cannot adequately be dealt with in a discussion of this type. If there is any doubt about the interpretation of analyst's reports on water samples, the advice of a chemist or of one of the firms specializing in the treatment of water should be sought.

ADDITIONAL PUBLICATIONS RECOMMENDED BY DAIRY FARM METHODS SUBCOMMITTEE

Another group of brochures, pamphlets and bulletins on subjects of interest to fieldman and sanitarians has been selected for abstracting. This is part of some 200 publications considered to be useful as educational material by the Subcommittee on Education, an active component of the IAMFES Committee on Dairy Farm Methods.

It is the purpose of the Subcommittee to further the distribution and use of this extension material originating from various university and state extension services, departments of health and of agriculture, equipment manufacturers and others. In the following abstracts the source of the material is given, as well as the date of publication if available.

FACTORS INVOLVED IN DEVELOPMENT OF RANCID FLAVOR IN MILK

This 27-page booklet summarizes the results of a seven year study of the factors considered to contribute to the development of rancid flavor of Fat Acid Degree values in milk. The factors investigated included length of time before cooling milk, the holding temperature of the milk, and length of the holding period. Also the season of the year, atmospheric temperature, level of production, stage of lactation and effect of feeding sorghum silage were considered for possible influence on rancidity.

Special attention was given to an apparent relationship with the increased use of pipeline and bulk tank systems. Among the conclusions drawn from the study were that FAD values increased as the holding temperature was lowered and the holding period lengthened. It was also noted that the stage of lactation appeared to influence the incidence of rancidity and that the rancid flavor problem was more acute in winter. Recommended procedures are offered the producer in eliminating rancid flavors.

This Bulletin B-593 was prepared by the Oklahoma State University Department of Dairying, Stillwater, 1962.

MASTITIS CONTROL IN MICHIGAN HERDS

Pointing out that statistical studies had shown more than 100% increase in mastistis infected cows in Michigan in a twenty year period, this publication offers the theory that there has been too much reliance on treatment as a substitute for approved herd management in the control of the diease. The average yearly dollar loss to the producer from infected cows is emphasized. Only good, sound prevention and control practices are effective in minimizing the problem.

The 22 page booklet is set up in separate sections as follows: Symptoms and Causes; Preventive Meas-

ures; Diagnosis and Treatment; Disadvantages of Random Treatment; Vaccination, Feeding and Dry Cow Management.

This Extension Bulletin 344 was published by Michigan State University Cooperative Extension Service, East Lansing. 1962.

THE FARM BULK MILK HAULER

The duties and responsibilities of the farm bulk milk hauler are adequately discussed in this 20 page Bulletin 1019 prepared by the Cooperative Extension Service, New York State College of Agriculture at Cornell University, Ithaca, N. Y.

The personal requirements of a capable milk hauler are listed and the recommended routine of operation is outlined. Construction and operation of bulk tanks and other matters including cleaning and sanitizing both tanks and tenders, sampling and sediment teating are reviewed. The booklet includes a brief discussion of common bacterial forms and flavors and odors and their causes and control.

A feature of the bulletin is a graphically illustrated section entitled "A Typical Trip for a Bulk Milk Hauler."

CAUSES AND PREVENTION OF SOME UNDESIRABLE FLAVORS IN MILK

This 35 page booklet emphasized the importance of palatability in the marketing of milk and milk products and reviews particularly the effects of certain feeds and feeding practices in the control of undesirable flavors in milk.

Based on a survey of some 11,000 taste tests, a study was made to find the causes of the off-flavors reported and to develop methods for preventing occurrence of these off-flavors. Various factors were investigated involving silage and feed flavor, spring pasture and feed flavor, summer pasture and feed flavor, and loose housing and milk flavor. The discussion concludes with details of studies of two dairy herds operated under specific feeding practices.

From conclusive information based on the data, recommendations are offered for control of particular off-flavors. This Bulletin 624 was published by the Agricultural Experiment Station, University of Vermont, Burlington. 1962.

OPACITY DEVELOPMENT AND CORRECTION IN CLEAR FLEXIBLE PLASTIC TUBING

This eight page article prepared by Chamberlain Engineering Corporation of Akron, Ohio, explores the conditions under which opacity or discoloration develops with the walls of clear flexible plastic tubing during the stages of rinsing, cleansing and sanitizing of the line under standard practices on the farm or in the plant. Reasons for the creation of the condition are reviewed and factors contributing to the development and retention of the discoloration are discussed in some detail.

The report lists various types and appearances of discoloration and suggests the causes for each and recommended practices for prevention. A plan for adequate and proper cleaning and sanitizing of the plastic tubing is offered, including a maintenance plan of daily inspection to avoid conditions likely to result in the development of opacity and discoloration.

The manufacturer provides a milkhouse card listing Do's and Don't in the care of the equipment.

EFFECT OF CHANGES IN MILKING MACHINE DESIGN ON MILKING RATE, MACHINE STRIPPING, AND MASTITIS

Stating that much of the developmental work in milking machine design has resulted from trial-and-error experimentation rather than from controlled laboratory experiments, this bulletin reviews studies conducted to determine the role of machine-design changes that influence or control the rate of milking, the machine stripping time and yield, and the incidence of udder infection and irritation.

A description is given of each of the experiments set up and the resulting information is carefully analyzed. Following a general discussion of the experiments, the effects of variation and changes in design are summarized.

This 30 page Bulletin 983 was published by the Cornell University Agricultural Station at Ithaca, N. Y. 1963.

BULK MILK COOLING

"Bulk Milk Cooling" is a 19 page mimeograph released by the University of Vermont Agricultural Extension Service at Burlington and written primarily for the producer contemplating purchasing a bulk cooler. After posing a number of questions concerning bulk milk handling, the article lists a number of important factors to consider before selecting equipment.

Pointing out that there are many types and brands of bulk tank coolers, the prospective purchaser is urged to consider size of tank, type of refrigeration, size of compressor, type and capacity of condenser, and tank design and construction. Other factors to consider are the size of milkhouse needed, electric wiring necessary and the cost of operating the unit.

The producer is reminded of the importance of proper cleaning and maintenance of the bulk tank and a few tips for good operation are offered. 1960.

PESTICIDES STILL A DAIRY INDUSTRY PROBLEM[1]

Ask any dairy leader to list major industry problems. Almost certainly he will include pesticides. And he may mention "Silent Spring". Consumers have been pesticide conscious ever since publication of the Rachel Carson's book just four years ago. The book has a world wide identification with the pesticide issue. And pesticides have become identified with the safety of the public supply.

"Silent Spring," and a subsequent report by a Presidential Advisory Committee in 1963, was followed by a whole chain of events, triggered by an aroused public opinion and increased scientific concern. Pesticides are with us still, and most people recognize the necessity of using them to safeguard human health, and the food supply for human beings.

No realistic appraisal of pesticides hazards to health has been made. These things, however, we know have happened since "Silent Spring:"

1. Pesticide production has increased: There are more brands, more varieties, more profits for manufacturers. And except in isolated circumstances, dairy and other food sales have not been hurt. The public is concerned, but not worried, as it was with fallout, for example.

2. Caution has increased in manufacturing, inspection, and use of pesticides.

3, Public health officials have undertaken large scale studies to determine possible relationships between long-term health effects and the use of pesticides.

4. Labeling and instruction on the use of pesticides is more precise; the U. S. Department of Agriculture, and various state departments of agriculture, have taken strong hand in this activity.

5. Research and education has expanded, at the producer level, and among consumers.

6. Pesticide levels in ready-to-eat foods have declined.

Many observers believe perhaps the most important of these developments is the public realization that the pesticide laws and regulations provide excellent protection for consumers.

The national interest has provided the springboard for Congressional legislation and policy statements by various federal agencies. Each of these statements is considered an important contribution to more cautious practices.

One of the most significant recent expressions of opinion came from an official of the pesticide manufacturer, Velsicol Chemical Corporation, Louis A. McLean: "The greatest good to come out of the controversy has been better liaison between various branches of government and sincere discussions between industry and conservationists." But the Velsicol official also noted that research on chemical insecticides has been sharply reduced because of the uncertainties of the market place.

New Tolerance Standards

Today's problem is that the chemical methods now available for determining minute pesticide residues are so sensitive that "zero" really has shrunk. Insignificant amounts of pesticide residue may occur on one crop as a result of application to another at some distance. New and sophisticated chemical methods are perfectly capable of measuring insignificant amounts. Nobody knows for certain what is the smallest amount of pesticide residue, alone or in combination with other residue, drugs, and other chemicals, that may be safely ingested by man during his lifetime.

Every responsible dairy leader understands pesticide residue must be kept out of milk, insofar as possible. This mean that feeds containing residues must not be fed to dairy animals. But odds and ends of residues do creep into dairy feed. A few years ago, they didn't show in the feed or in the milk. Now they do, simply because sophisticated laboratory techniques say they are there.

California Department of Agriculture officials have been especially concerned about this situation. Their testing, and similar observances across the nation, indicates that there is need for a tolerance for DDT, DDD, and DDE residues in whole milk of 0.1 ppm. On a butterfat basis this is 2.5 ppm., it is believed.

This is an insignificant amount from a practical standpoint, California officials explain, but it still is more than "zero." That is the background for a request to the Food and Drug Administration by the California Departments of Health and Agriculture for approval of new tolerance of this amount. This request still is under consideration, and the hope is that eventually such tolerance will be established.

Opportunity For Extremists

People probably are more aware that pesticides help, not hinder, human health. They probably know that science is on man's side. The chemical companies

[1]Adapted from *Trends* (May-June 1966), a publication of the National Dairy Council, Chicago, Illinois.

and their trade associations across the nation have done a masterful job of public education in this connection.

Until more progress has been made, however, there may be unfortunate statements by some of Rachel Carson's more vocal adherents, and also a certain hysteria and enragement in some parts of the agriculture and food industries. If so, the offenders could use this good advice from Dr. Robert White-Stevens of the American Cyanamid Co.: "The alleged hazards of pesticides that threaten human and wildlife are insignificant when compared to the desolation, want, disease, and death which would inexorably follow their removal from modern agriculture and public health management. It is certain that pesticides will play an increasing rather than decreasing role in the coming intensification of agriculture . . . In spite of the ardent advocates of biological control . . . it must be recognized that there is not one economic plant or animal raised today in the United States which is reliably protected solely by biological means."

PUBLIC REIATION CHALLENGE

Biological control cannot do the job that pesticides do. Yet pesticides cannot be completely controlled so that none appear in milk. Since this will be increasingly true, not less so, as techniques for detecting pesticides residues become even more sophisticated, scientific leaders have urged replacing the "zero tolerance" concept for some small tolerance that everyone can live with.

If tolerances are officially established, as is ultimately expected, the major job then facing the dairy industry will be more of a public relations task than a technical chore. For there will be those who will accuse the government of condoning "poison in milk." The public, even though great education has been accomplished during the past few years, will need thorough reassurance, skillfully disseminated. If the tolerances are coming, industry organizations such as National Dairy Council and governmental health agencies will be in the forefront of that public relations challenge.

NEWS AND EVENTS

PHS SUPPORTS RESEARCH ON SOLID WASTE HANDLING

Surgeon General William H. Stewart, Public Health Service has announced that more than $800,000 has been awarded in support of 23 research projects to develop knowledge which will help the Nation solve its solid wastes problems. The research grants were made in conjunction with a Department of Health, Education, and Welfare national program to improve waste-handling practices now associated with environmental health hazards and blight. The program was authorized by the new Solid Waste Disposal Act and is being conducted by the PHS Office of Solid Wastes.

"This expansion of research since the Office of Solid Wastes was established last November has to be counted as outstanding progress in getting under way an attack on environmental problems arising from waste generation and disposal by municipalities, industries, and agricultural operations across the country," Dr. Stewart said. "The projects, together with research to be performed under subsequent grants or by Federal scientists, constitute a major effort to bring solid waste disposal technology into this half of the 20th century. The national norm today in solid waste disposal is represented by the archaic crudities of open dumping and open burning and the overloading of antique incinerators. These and other practices not only deface the landscape, but compound pollution of air and water and generate additional health hazards by providing breeding places for hordes of disease-carrying rodents and insects."

With three exceptions, the research grants were awarded specifically to expand knowledge essential to eliminate or reduce health hazards from wastes. For seven of the research projects, the primary goal is information leading to the transformation of wastes into valuable products such as soil conditioners and fertilizers from animal wastes which harbor serious human disease organisms, or charcoal, roadway tars, and boiler fuel from municipal refuse.

For thirteen other projects, the objective is knowledge of how to improve human health protection through new approaches to waste disposal such as burning municipal wastes on ships at sea to avoid on-shore air pollution. Three grants were awarded to help finance technical conferences to stimulate innovation in solid wastes technology.

As another route to protecting public health through improved waste disposal practices, the Office of Solid Wastes has initiated steps to strengthen training in wastes management. Grants have been made to support solid wastes instruction for graduate engineers at four institutions of higher learning. Special courses are being provided, meanwhile, for

government and industry personnel with waste disposal responsibilities.

Other major phases of the national program are aimed at waste disposal improvement by (1) assisting public and private nonprofit agencies with up to two-thirds the costs of technological investigations and projects to demonstrate the effectiveness of improved disposal equipment and methods, (2) providing 50 percent of the costs of Statewide solid wastes management surveys and planning, and (3) helping States and political subdivision with specific waste disposal problems.

INDUSTRIAL WATER USE TO DOUBLE BY 1980

American industry by 1980 will be using about 394 billion gallons of water daily or nearly two-thirds of all the nation's water needs at that time, says a Commerce Clearing House report. This volume of water consumption by the country's factories, canneries, refineries, mines and power plants will be more than twice as much as the estimated 160 billion gallons these facilities are using daily today.

Industry and agriculture account for ninety per cent of water use, far outstripping home use. While industrial production has risen more than nine times since 1900, industry's use of water is eleven times greater, according to the CCH report based on government data. Currently, in one year's time, total industrial water use comes to 14 trillion gallons with the metal and chemical sectors of the industrial spectrum accounting for well over half the total, and paper products, petroleum and coal, food, and tobacco and furniture needs rounding out the picture.

What's done with this water is noteworthy in its own right, said CCH in announcing WATER CONTROL NEWS[1], a weekly newsletter which covers the availability, pollution, and treatment of water.

Industrial use of water is already enormous. It takes approximately 1,400 gallons of water to produce a dollar's worth of steel; 600,000 gallons of water to produce one ton of synthetic rubber; 770 gallons of water to refine one barrel of petroleum; 300 gallons of water to make one barrel of beer; 125 gallons of water to produce one gallon of whiskey; and 200 gallons of water to produce a dollar's worth of paper.

Industrial uses of water are varied. It is employed as a coolant and an ingredient and is used for washing and transporting all kinds of equipment and products. Some plants in fact use more water than the town or city in which they are located, CCH reported. A few need water purer than that drawn from the tap of America's kitchens.

Industrial "use" of water consists of pouring it back into the nation's waterways rather than actually consuming it. In many cases, much effort is needed to prevent this returning water from carrying injurious or harmful wastes with it. In the last 25 years, chemical production alone has expanded three times as fast as the rest of the economy, and the wastes incurred in this production are difficult to remove. Some of the detergents, herbicides and pesticides inevitably return to surface or underground waters to run their ominous course.

To combat this, new manufacturing processes are being developed which conserve and reduce the amounts of water needed. At the same time amounts of industrial wastes are being reduced through waste treatment, CCH reported. Along with treatment, extensive research of waste disposal problems is being conducted by every major industry in the nation.

Designed to keep industry and other water-conscious interests up to date on the latest developments, CCH's WATER CONTROL NEWS covers legislation, technical advances, water standards, desalination, sanitation specifications, interstate compacts, medical findings, international treaties, and conservation needs relating to the growing importance of water in the nation's life.

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150 MILLION SERVED BY MUNICIPAL WATER FACILITIES

More than 150 million Americans living in nearly 21,000 communities dotting the nation are served by municipal water facilities, according to a report by the Commerce Clearing House News Bureau.

Of these 19,236 water producing facilities serving these communities, 11,426 furnish completely treated water that goes to 137 million people, constituing 9 of 10 persons connected to public supplies. Water treatment by these facilities ranges from simple aeration to sophisticated purification-softening processes. Both treated and untreated water is served by 164 facilities to some 1.2 million persons while 39.7% of the total number of facilities provide only untreated water supplies to some 12.3 million individuals, according to a CCH study of the latest government data.

Overall, the number of facilities has increased by 8% since 1958 while the population served is greater by 13%—with fully 79% of the nation's population being served by public water facilities.

The number of municipal facilities using surface water sources—water visible in lakes, ponds, rivers

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[1]Published by Commercial Clearing House, Inc., 4025 W. Peterson Ave., Chicago, Ill. 60646.

and creeks—continued to decline, falling from 29.6% of the total in 1948 to 17.8% in 1963, said CCH, publishers of *Water Control News,* a weekly newsletter covering the availability, pollution and treatment of water.

Ground water sources served 77.5% o the facilities with 4.7% of the plants using a combination of both water sources. While water is being used by a smaller percentage of municipal facilities, it still serves 54.3% of the population connected to municipal water facilities. That portion of the population using both surface and ground water sources increased from 9.6% to 12.9% while the percentage of people using only ground water fell from 33.7% to 32.8%, according to the CCH report.

RESEARCH IN FOOD POISONING AT IOWA STATE

A five-year $900,000 grant for research in food poisoning has been awarded to the Iowa State University of Science and Technology at Ames by the Public Health Service. It is the largest single grant yet made for studies into foodborne illness by the PHS Division of Environmental Engineering and Food Protection.

Dr. William H. Stewart, Surgeon General, has pointed out that foodborne illness is a major public health hazard in the United States, affecting an estimated one million persons each year, and that the incidence today is still rising. Dr. John C. Ayers of Iowa State University, the project's program director, said the study could lead to improvements in the safe and sanitary processing of foods, and especially would assess recent innovations in food processing methods which result in changes of microbial flora in market foods.

Additional objectives in the series of studies of food infections, toxins and additives of microbial origin are: the development of new information in the complete food production chain, beginning at the farm, during transportation, in the processing plant, and in the final product. A better environmental picture will be sought of the pseudomonads, staphylococci, enterococci, lactics, corneforms, clostridia, salmonellae and other enterics, molds and yeasts found in food. Study will also be made of the impact of differing animal feeds, transporting vehicles, processing operations, equipment and personnel.

Dr. Ayers is Professor in Charge of Food Technology in the University's Department of Dairy and Food Industry. He is a food scientist who has published about 150 scientific articles, including papers for five international symposia, and is a member of the Food Protection Committee of the National Academy of Sciences. He was chairman of an ad hoc committee which in 1965 prepared the NAS publication, "Microbiological Contamination of Foods."

Other members of the project team include Dr. Warren Clark, Assistant Professor; Allen A. Kraft, Associate Professor; Tai Kwon, Assistant Professor; Davis Lillard, Assistant Professor; and Homer W. Walker, Associate Professor, all of the University's Department of Dairy and Food Industry; Richard H. Forsythe, Professor and Head of the Department of Poultry Science; and Lloyd Quinn, Professor of the Department of Bacteriology.

THE CHANGING DAIRY INDUSTRY

An article entitled "The Food Market Industries—Recent and Prospective Structural Changes" appearing in the May issue of the U. S. Department of Agriculture's publication, Marketing and Transportation Situation, reviews the changes in the structure of the dairy industry particularly in the post-war period.

The ranks of fluid milk handlers have been thinning ever since the development of city milk distribution began over 75 year ago. In the early days, very little happened to fluid milk between the farmer and the consumer. Equipment used was simple and the costs of a small distributor were not greatly different from those of a large one. The introduction of the glass milk bottle before the turn of the century was one of the earliest developments causing some shift in the shape of the scale curve. Even simple bottle-filling equipment was expensive when used for a few quarts of milk a day and, as a result, many small distributors went out of business.

In the first 2 decades of the 20th Century, many cities adopted ordinances requiring the pasteurization of milk. These requirements increased the costs of small distributors compared with those of large ones, and many were no longer able to compete. In the 1920s and 1930s, the introduction of classified pricing plans providing for uniform prices to producers by all handlers, both large and small, forced many small handlers to pay the same prices as their larger competitors. Many found it impossible to do so and they too went out of business. In the late 1930s and 1940s, the introduction of the paper carton acted to raise the cost levels of smaller distributors. Since World War II, several technological and economic developments—no single one of them outstanding—have tilted the scale curve even further.

The number of fluid milk bottling plants (excluding producer-dealers) in the United States declined

53 percent between 1948 and January, 1965. Most of the plants that went out of business were small. Some small plants increased their volume by installing new equipment or by fuller utilization of capacity. The distribution of plants by annual volume shows that plants bottling less than 5 million quarts of milk a year declined from 93 percent of the total in 1950 to 64 percent in 1964.

The number of plants manufacturing dairy products has fallen somewhat less rapidly than fluid milk plants. Between 1944 and 1961, this type declined 37 percent. (These are the only years for which data on the total number of plants manufacturing dairy products are available.) Between 1944 and 1964, the number of plants making butter, cheese, evaporated milk, and ice cream declined more than half. Plants producing creamed cottage cheese and nonfat milk declined somewhat less as production of these products increased more rapidly than many others.

DISTRIBUTION—WIDER VARIETY OF OUTLETS

The distribution system for fluid milk, which 40 years ago was based largely on home delivery, has changed to a wide variety of outlets including supermarkets, specialized dairy stores, convenience food stores, vending machines, gasoline stations, and drive-in dairies. The proportion of fluid milk sold on home delivery routes has declined from probably 80 to 85 percent of the total 40 years ago to 25 to 35 percent of the total today.

For a group of 80 fluid milk firms, home-delivery declined from 37 percent of the milk sold in 1954 to 29 percent in 1964. Wholesale deliveries increased from 48 percent in 1954 to 60 percent in 1964, and platform sales (to sub-dealers and some large retailers) declined from 11 to 9 percent.

The growth of supermarkets has also markedly affected the merchandising of ice cream. Thirty years ago drug stores sold most of the ice cream. After the introduction of the supermarket and the half-gallon container, retail sales of ice cream rapidly shifted to supermarkets. In recent years, specialty ice cream stores have entered the picture, most of them selling relatively high-priced ice cream to consumers who prefer ice cream of a higher butterfat content or different texture than that commonly sold in supermarkets.

The retail cheese market today is drastically different from that of 30 years ago. Development of new types of cheeses and new processing and packaging methods led to the present supermarket cheese departments with 50 to 100 or more varieties, types and packages, in place of the handful of varieties from which the grocer cut a chunk. Natural cheese from several countries and a seemingly endless variety of processed cheese, cheese foods and spreads are available—all prepackaged and many of them sliced.

In the postwar period, nonfat dry milk became a consumer product of some importance when the instantized product was introduced. It is sold under private labels by many retail groups and under a small number of packer labels of a few major companies.

THE NEXT DECADE

Where might some of these developments be expected to lead during the next decade? First, economies of scale will continue to favor large firms, and the number of firms will continue to decline. This does not mean that the largest firms will increase their share in many individual markets. Primarily, it will be a matter of more nearly equalizing the power of large and middle-size firms.

Secondly, shifts of major importance in the functions performed by different types of firms in the marketing system for fluid milk can be expected. By 1975, most fluid milk processors will have transferred the entire supply function to producer cooperatives, including management and disposal of surplus fliud-grade milk. Many manufacturing plants will supply cultured and concentrated products to fluid milk distributors.

As processors become more specialized in the processing function, individual plants will grow in size and distribute over wider and wider areas. Distribution areas of 300 to 500 miles from the fluid milk plant will not be uncommon 10 years from now.

Further technological developments are likely to reduce labor requirements in processing, particularly in cheese production, which now takes place in relatively small plants compared to plants manufacturing other dairy products.

MINIMUM STANDARDS FOR CIP FARM PIPELINE SYSTEMS

The Milking Machine Manufacturers Council of the Farm and Industrial Equipment Institute has adopted and published in booklet form "Minimum Standards for CIP Sanitary Milking Pipeline Systems Used on Dairy Farms."

The booklet contains definitions of certain terms commonly used, a statement of materials recommended in constructing pipeline systems and standards for manufacturing and installation. Suggested cleaning procedures under variable conditions are offered and an appendage describes currently used systems. It is stated that the Council's recommendations com-

ply with applicable criteria under 3-A Standards.

The Council consists of the following manufacturers of farm equipment: Chore-Boy Manufacturing Co., Division of Golay and Company; DeLaval Separator Co.; Hinman Milking Machine Co.; Jamesway Company Ltd.; Perfection Dairy Division, Sta-Rite Products; and Universal Milking Machine Division, National Cooperatives.

Offices of the Council are at 410 North Michigan Ave., Chicago, Ill. 60611.

HIGH LIGHTS OF MEETING OF NSF JOINT COMMITTEE

The NSF Joint Committee on Food Equipment Standards at their April 1966 Meeting carried out reviews of the following Proposed Standards and Criteria and proposed revisions:

1. Proposed NSF Standard relating to Commercial Kitchen Exhaust Ventilation Systems. This Standard received preliminary review and was referred to a Standards Task Committee for further review and development.

2. Proposed NSF Standard covering Bulk Milk Dispensers. This Standard is being developed with the full knowledge and cooperation of the 3-A Standards Committee, keeping with the long established agreement between the Foundation and the 3-A Standards Committee. The Standard was reviewed on a preliminary basis and will be subsequently redrafted by the Foundation's staff and transmitted for final review and ballot to members of the Joint Committee and their respective organizations.

3. Proposed NSF Standard for Food and Drink Dispensers. This new Standard was developed at the direction of the Joint Committee in order to provide necessary requirements for such dispensers as differentiated from Vending Equipment. Following this preliminary review the Standard will be redrafted and submitted for final review and ballot.

4. Proposed Revision to NSF Standard No. 4 relating to Commercial Cooking and Warming Equipment. This proposed revision was prepared by the Industry Task Committee in cooperation with the Foundation staff. Limitation of time prevented complete review of the proposed revision. Therefore, it was referred to a Standards Task Committee for further review, development and resubmission to the Joint Committee for final review.

Other actions of consequence during the course of the meeting included the receipt and review of an extensive report from the Industry Advisory Committee for NSF Standard No. 7 (Refrigerators and Freezers) covering the requirements of Item 4.052 relating to joints and seams in the food zone. The major point under discussion was the effective date of July 1, 1966. Based upon industry reports and the considerations raised during the discussion the Joint Committee concluded that there was basis for further study of the problem and took action to extend the effective date till July 1, 1969. Further, they requested the establishment of a Special Study Committee to study the practicability and feasibility as well as the implications of this requirement. The Special Study Committee is to also study and recommend a general protocol for cleanability evaluations as related to food service equipment.

The Joint Committee also acted to amend NSF Basic Criteria C-1, relating to Food Vending Machines, to reflect to current temperature requirements of the U. S. Public Health Service for stored refrigerated and hot foods. Previous temperatures of 50 F and 150 F are to be amended to 45 F and 140 F respectively.

A complete review and preparation of necessary revisions to NSF Basic Criteria C-1 relating to Food Vending Machines was also requested. This review and revision to be carried out in cooperation with the National Automatic Merchandising Association, if at all possible.

Progress reports were received by the Joint Committee, from the Foundation staff and a Special Study Committee, covering the cleanability and durability of cutting boards and wood top tables respectively. Final reports are anticipated during 1966.

Based upon the report received from a Special Public Health-Industry, User Task Committee chaired by M. B. Crabill, the Joint Committee acted to require effective on July 1, 1967, automatic thermostats on all wash and pumped rinse tanks in commercial spray-type dishwashing machines.

Based upon a request from the Industry Task Committee for NSF Standard No. 1 (Soda Fountain and Luncheonette Equipment) the Joint Committee unanimously concurred that the juncture between the walls of the base and the top of soda fountains, creamers, and bobtails and similar equipment be classified as non-food zone and, therefore, exempt from radii requirements of the food zone. However, it was their considered opinion that the materials used in the walls and tops, as well as to effect the juncture of the two, should meet material requirements for the food zone.

The Joint Committee re-examined their previous decision relating to the clearance beneath compressor spaces of bobtails, fountains and creamers. After due deliberation the Joint Committee deleted the

July 1, 1966 compliance date.

Seeking to more clearly define "Portable" as used in contexts of the various NSF Standards and Criteria relating to food equipment, the Joint Committee adopted unanimously the following specification to be reflected in all NSF Food Equipment Standards where applicable:

Portable: The unit shall be small enough and light enough to be easily moved by one person and shall comply with the following: (1) Not exceed 75 pounds in weight and have no dimension in excess of three feet in any one plane. (2) Have no utility connection; or have a connection that can be easily disconnected without tools; or have a flexible utility connection of sufficient length to permit the unit to be moved for cleaning."

A proposed addition to NSF Standard No. 2 relating to Wheeled Self-Leveling Utensil Storage Systems was presented and adopted unanimously. It will become effective July 1, 1967 and read as follows:

Wheeled self-leveling utensil storage systems designed for the transportation and for storage of multiuse utensils shall be enclosed on the bottom and all sides to a height of not less than 18 inches above the floor. The enclosed space shall be readily accessible for cleaning.

WISCONSIN RESEARCH SPEEDS UP CHEESEMAKING

Time-saving methods have come to almost all phases of industry today, but one of the last to become mechanized is cheesemaking. Slowly the drudgery and time-consuming work is being taken out of that job, too.

University of Wisconsin dairy scientists have found ways to make cheddar cheese, cottage cheese and Italian cheese in a fraction of the traditional time required. Now they have done the same thing to the process of making blue cheese by using hydrochloric acid to coagulate the milk. This has cut manufacturing time in half and cut the amount of rennet needed in half. In the traditional method of cheesemaking, lactic acid bacteria are added to the milk as a "starter," and it takes several hours before they produce enough acid to sour the milk and form the curd. Hydrochloric acid does the job in a few minutes.

Lactic bacteria have not been completely replaced, since they still must be used as a "starter," but it takes only one-fourth as much. In the direct acid method, hydrochloric acid acidifies the milk to pH 5.6. Then the cheesemaker adds rennet to coagulate the curd so it can be worked. (Rennet, which comes from calf stomachs, is still a very expensive material used in all cheesemaking.) Reducing the amount of rennet needed will also cut some cost in the new method.

After the curd is worked, lactic acid bacteria continue to increase the acidity so the pH of fresh cheese reaches 4.8 one day after manufacture. Wisconsin researchers have found that hydrochloric acid alone would not do the job because they could not control fermentation during the curing process. That's the reason that lactic bacteria still must be added at some time during the cheese process.

The proof of good cheese is in the eating, and all tests so far indicate that blue cheese made by the direct acid method has the same texture, color and quality as natural blue cheese and a satisfactory flavor. The process is not ready for commercial use yet, but cheesemakers should like it. Other direct acid cheesemaking processes have saved them time and money. With manufacturing time cut in half, blue cheese manufacturers will be able to double their production capacity without any extra workers, equipment or space. There will also be a slight reduction in the cost of materials since it only takes half as much rennet, an expensive material.

Direct acid methods for cheese were developed five years ago by the University of Wisconsin. Hydrochloric acid has been used to adjust acidity of milk for some time.

BROCHURE LISTS APPROVED MILK LABORATORIES

A new brochure entitled "Milk Laboratories Approved by Federal and State Agencies" describes the activities of the Public Health Service in milk laboratory certification as provided for in the "Procedures Governing the Cooperative State–Public Health Service Program for Certification of Interstate Milk Shippers."

This publication lists the Criteria for PHS Certification of State Milk Laboratory Survey Officers, the Central Milk Laboratories of States, the names of various State-Designated Milk Laboratory Survey Officers and the names, location, and the number of personnel in each of the official, commercial, and industry laboratories of the various States.

Copies may be obtained through the Publication Office, Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio 45226, or the Public Health Service Regional Offices.

FOOT-WEAR SANITIZER FOR SANITARIANS AND FIELDMEN

A practical new approach for sanitizing shoes and boots of sanitarians and dairy plant fieldmen visiting farms is now offered by Klenzade Products, Division of Economics Laboratory, Inc., Beloit, Wisconsin.

Sanitizing of footwear before entering or upon leaving farm premises has been a practice of many veterinarians and artificial inseminators. This has primarily been done to control the spread of infectious diseases from farm to farm. Infectious organisms, i.e., T. B., hoof and mouth, brucellosis, mastitis, etc. can be transported on footwear if proper procedures are not followed.

Since the prime responsibility of sanitarians and fieldmen is to teach proper sanitation, it is important that they also try to control disease spread by their own example. Before entering a feed room from a cow yard, they should use some means of protection to prevent the spread of infectious organisms to the feed.

One of the big stumbling blocks in footwear sanitizing has been a practical approach. Some people have carried a bucket and brush with a sanitizing solution while others have tried carrying foot-baths for this purpose. Both methods can be effective, but are cumbersome and impractical. Single-service plastic boots were tried, but cost made this practice prohibitive.

The Klenzade Foot-Wear Sanitizer, consisting of a plastic pistol grip sprayer and bottle filled with an Iodophor solution, provides an easy means of precaution. After removing extraneous soil from footwear by hosing or brush-washing, the Iodophor sanitizer is sprayed on.

Sanitarians and fieldmen may contact their area Klenzade representative to obtain without cost a unit for their own use. Complete instructions for use are on the label of the container.

NRA ESTABLISHES FOOD SERVICE EDUCATIONAL INSTITUTE

The National Restaurant Association Board of Directors has given final approval to formation of the NRA Food Service Educational Institute, according to Donald Greenaway, NRA Executive Vice President.

Planning for the Educational Institute began in late 1964, Mr. Greenaway said. Much preliminary work, studying and evaluating the fields of public relations, business promotion, education and training activities, public health, sanitation, safety, plus marketing and economic research preceded development of the final plan approved by the Board. "The ultimate purpose of the new Educational Institute will be to bring together all resources of the National Restaurant Association to better develop and implement our present and future long range objectives and programs, for further development and accelerated growth of the rapidly changing food service industry," Mr. Greenaway pointed out.

Important new gains for the total food service industry are expected from this new concept adopted by the Board. "More and more we are becoming one great industry." said Mr. Greenaway. "Operator, supplier, manufacturer and distributor can and must work more closely together. As part of this, a new marketing and operating information department is included in our future plans for the Educational Institute."

Richard K. Rodgers, of Chicago, has been chosen as Director of the new NRA Food Service Educational Institute.

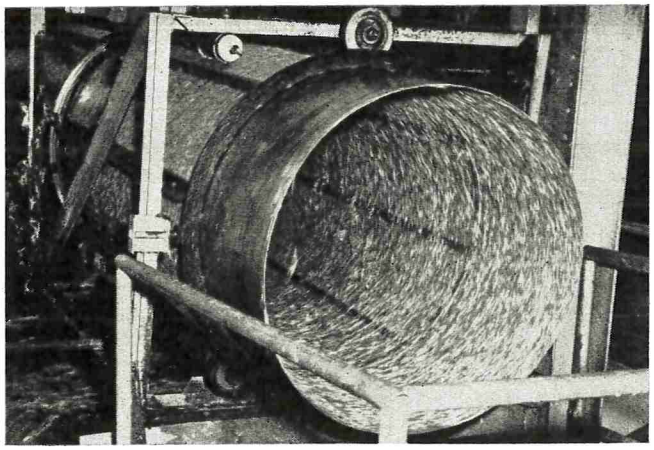
PROCEEDINGS OF CORNELL FOOD RESEARCH SYMPOSIUM AVAILABLE

Proceeding of the 1966 Cornell Symposium on Frontiers in Food Research are now available from the Department of Food Science, Cornell University, Ithaca, N. Y., 14850. The price for this 144 page publication is $4.00. This publication contains fourteen articles pertaining to various aspects of food research. The articles deal with three main topics, namely: (1) factors affecting quality, (2) quality measurements, and (3) new products and processes. The total scope of the proceeding is broad, but the individual articles pursue selected subjects in depth.

INFORMATION FROM INDUSTRY

Editorial Note: Following are items of information on products, equipment, processes and literature based on current news releases from industry. When writing for detailed information, mention the Journal.

ROTATING SCREEN DEWATERS FEATHERS



A dewatering drum, composed of a fine mesh stainless screen bolted onto structural supports, removes water from 9 tons of chicken feathers each day. The unit operates continuously nine hours daily at the plant of a large Maryland chicken grower. By reclaiming the feathers for by-product use, a substantial profit is realized annually.

Stainless screen covering its inner surface was woven by Cambridge Wire Cloth Company. As the feathers are machine-picked from the chickens, they are flumed to the revolving drum which is tilted to privide an eight-inch drop. It rotates slowly to drain the water from the feathers. Then they tumble onto a belt which conveys the recovered waste to a waiting truck for shipment to the rendering works.

For further information on dewatering screens, write to Manager, Wire Cloth Department, Cambridge Wire Cloth Company, Cambridge, Maryland 21613.

NEW BROCHURE GIVES LABELING HINTS FOR CANS

A new brochure, entitled "About Cans" and made available by the American Can Company, is a comprehensive study of cans, labels and canned foods. The 10-page brochure lists sizes and contents of the most-used cans for food, the laws about labeling, hints for making more descriptive labels for cans, and other data on storage and use of canned foods.

Contents of the most popularly used cans are listed in cupfuls, ounces and fluid ounces for the convenience of those writing for consumers. External can measurements, plus general industry terms for these cans, are listed for the benefit of food packers.

The brochure is available by writing: Manager, Marketing Food Packaging, American Can Company, 100 Park Avenue, New York, N. Y. 10017.

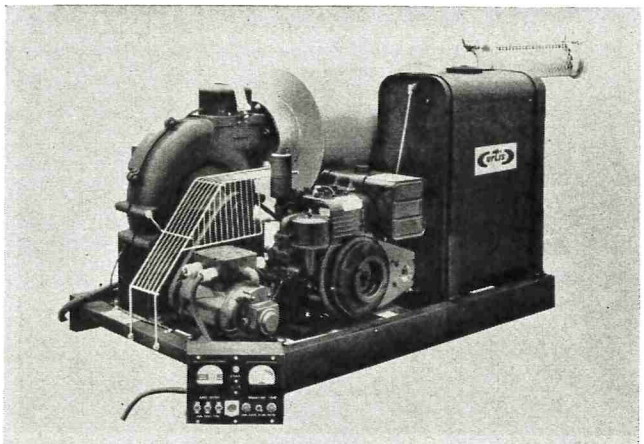
MILLIPORE MANUAL DESCRIBES NEW TECHNIQUES

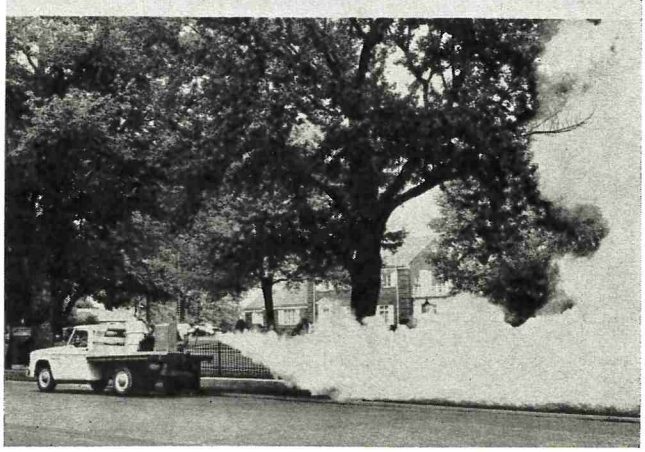
The latest techniques for culturing, staining and identifying bacteriological organisms collected from fluids on Millipore Manual ADM-40, "Techniques for Microbiological Analysis."

A section on Clinical Microbiology includes details on preparing fluids for filtration, staining acid-fast bacteria, culturing microorganisms and analyzing airborne organisms. A section on Industrial Microbiology covers the analysis of beer, wine, soft drinks, syrups and oils. The analysis of rinse waters, surfaces and utensils is described under Sanitary Microbiology. The section on Water and Milk Microbiology includes tests for coliform, Enterococci, Fecal Coliform, Total Count and Planton-Algae.

The manual also lists specifications of related apparatus for laboratory and field use. Copies are available free of charge from Millipore Filter Corporation, Bedford, Mass. 01730.

DYNA-FOG INSECTICIDE FOG APPLICATOR



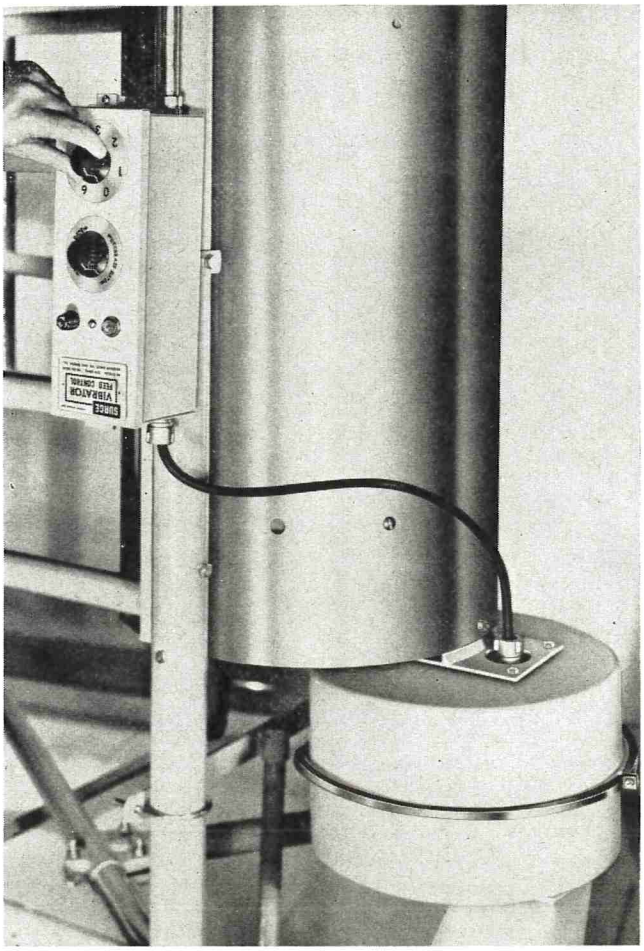


Dyna-Fog 1200B, the newest and largest machine in the broad line of Dyna-Fog generators, is designed for large area fogging and residual control, with output either as a thermal fog or fine insecticide mist up to 120 G.P.H. Its unique design principle employs a new use for the auto-

matic fuel oil heater, the gun type unit being the same type that has been used so effectively in household fuel oil furnaces for many years. In addition, the Dyna-Fog 1200B has its own self-contained 110 Volt AC generating and control system.

Fully equipped with remote controls, it can be started, fog output can be regulated and machine can be shut off from the cab of the vehicle on which it is mounted—a "one man" operation. Information on the unit can be obtained from Curtis Dyna-Products Corporation, Westfield, Indiana.

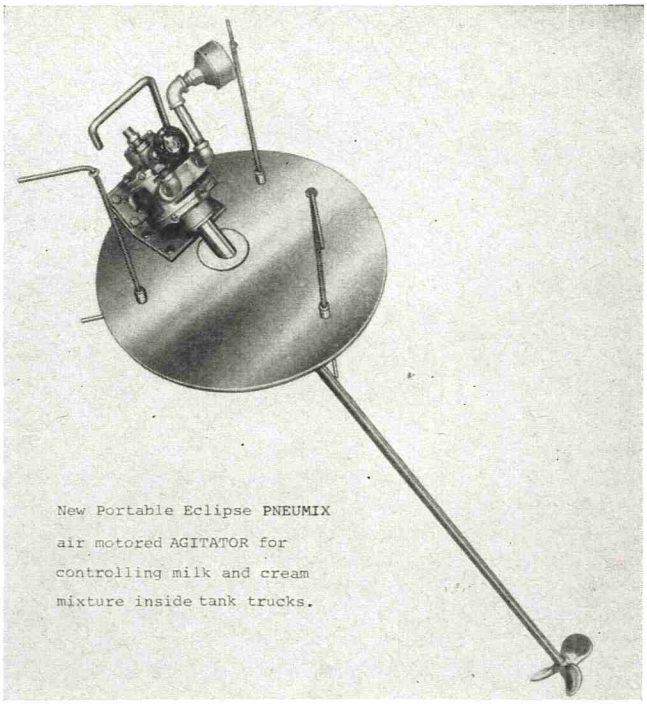
FEED COWS ELECTRONICALLY



Newest equipment in the field of automatic feed controls is the Surge Vibrator Feeder designed primarily for use in parlor milking installation—but, adaptable to certain stanchion barn arrangements. Quiet, dust-proof and adaptable to a wide variety of milking stalls, this new Babson Bros. Co. system provides the dairyman with control for each individual stall. With it, he can set both the amount of feed he wants it to dispense and the time he wants it to operate. This can vary from a little bit of feed over a long period—or a large amount fed out quickly.

This new Vibrator Feeder is designed for use with overhead feed conveyor systems and is available only through authorized Surge Dairy Farm Equipment Dealers.

PORTABLE AGITATOR FOR MILK TANK TRUCKS



New Portable Eclipse PNEUMIX air motored AGITATOR for controlling milk and cream mixture inside tank trucks.

The development of Pneumix air motored Agitators for stirring contents of milk tank trucks prior to unloading, has been announced by the Eclipse Air Brush Co., 28 Kulick Road, Fairfield, N. J. 07007.

The Pneumix air motored Agitator, with its unique blade arrangement and design, provides the perfectly controlled stirring action to achieve proper evaluation of the butterfat payloads. Attachment and adjustment of the Pneumix Agitator over manhole openings on the tops of milk tank trucks is fast and easy. No bolts are required as the flange is equipped with 3 spring-loaded clamps for quickly securing and releasing the Pneumix Agitator. Both air motor and shaft are mounted at a 45 degree angle for accurate, effective stirring of the milk and butterfat contents of the tank.

Instantaneous speed adjustment is controlled and maintained by a single accessible air throttle. Construction is rugged, yet simplified; lightweight for easy portability, installation and removal. Features include an explosion-proof air motor that will not overheat or burn out and has controlled torque and adjustable RPM.

PENNSALT INTRODUCES NEW "COSMIC" CHLORINATED CLEANER

A new, economical, heavy-duty chlorinated cleaner that cleans the toughest food soils on machinery and equipment as well as it cleans "ground-in" dirt on floors is now available from Pennsalt Chemicals Corporations.

Cosmic is a white, free-flowing granular compound that suspends, digests or emulsifies the heaviest of food soils. It dissolves quickly in water and can be applied by brush, spray gun, soak or circulation methods. The ingredients in Cosmic permit quick, free rinsing of soiled areas with little chance of streaks or residue remaining on the equipment. The

cleaner should not be used on aluminum or galvanized metal, and should be thoroughly rinsed before using an acid cleaner. It will not etch stainless steel, copper, brass or monel.

Cosmic has a wide range of applications throughout the food and dairy industries. In canneries, it is recommended for floors and walls, conveyor belts, cooking kettles and CIP lines. In meat plants, on smoke house floors and walls, processing kettles, rendering plants, meat centrifuges and CIP lines. In dairies, for HTST units, heavily-soiled vat pasteurizers and CIP lines.

For additional information write to Dairy and Food Department, Pennsalt Chemicals Corporation, 3 Penn Center, Philadelphia, Pa. 19102.

CROWN ADDS TUFFY MILK FILTERS

Crown Dairy Supply Company, Wakesha, Wisconsin, announces that "Tuffy Milk Filters" will be added to their complete line of milking machine replacement parts.

The sock filters are made of a new-type, non-woven, soft material that is extra strong, so that it can be used on pressure pump applications without breakage. A fiber filter disk is also available with a mult-directional, criss-cross pattern which is designed for more uniform strength, says the manufacturer.

For further information write, Crown Dairy Supply Company, 324 W. College Avenue, Waukesha, Wisconsin 53186.

NEW "FLIP-ZIP" TOP MILK CARTON

A new poly-coated paper milk carton featuring a tear tape which seals a serrated pouring lip is now being manufactured for dairy customers by Sealright Co., Inc., Fulton, New York.

Called the Sealking Flip-Zip, the improved gable top milk carton is said to be the first major innovation in paper milk cartons since Sealright introduced the plastic-coated paper bottle. The new carton has the most sanitary closure of any plastic-coated paper carton, according to Sealright. Also, the serrated pouring lip with a built-in channel provides better flow control than any existing paper bottle.

To open the new Flip-Zip gable top carton, the wings are flipped back to expose the zip opening tape. The tape is then removed by pulling one of the tape tabs projecting from either wing. Removal of the tape exposes the pre-cut opening spout. Once the tape is removed, the spout is completely free and pulls out easily. After use, it can be tucked in under the gable for reseal protection. In the dairy, the Sealking 300 GT machine automatically flame sterilizes, completely fabricates, fills and seals the half-gallon gable top cartons.

LITTERBUG INCLUDED AMONG SUMMER PESTS

Summer pests—mosquitoes, flies and gnats—are a nuisance but, financially, not nearly as big a nuisance as litterbugs.

Keep America Beautiful, Inc., the national litter-prevention organization, estimates that litterbugs will take a $200 million bite out of our tax moneys from June through September. That's the amount KAB says will be spent to clean up the litter left on streets, highways, waterways and other public areas by careless litterbugs.

Allen H. Seed, Jr., executive vice president of KAB, urges motorists and boaters to install and use auto and boat litterbags. "Extra care in disposing of litter on roads and in recreation areas will help tremendously to take some of the sting out of the litterbug," said Mr. Seed.

NEW OFFICERS FOR NRA

Watson B. Rulon was elected President of the National Restaurant Association at its 1966 annual meeting in Chicago. Mr. Rulon is the owner of the well-known Hogate's Sea Food Restaurants in Washington, D. C. Prior to becoming NRA President he served a term as Vice President and was Treasurer for four terms.

Elected Vice President was Robert D. Parks, an NRA Director and Executive Vice President of the Howard D. Johnson Company, Wollaston, Massachusetts. Ward Webster, owner of the Holly Grills, Inc., of South Haven, Michigan, was elected Treasurer.

Among Mr. Rulon's many NRA committee activities he has been Chairman of the Public Health, Food and Equipment Research Committee. He is Past President of the Restaurant Association of Metropolitan Washington and has been on the NRA Board of Directors for several years.

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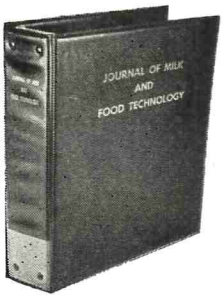

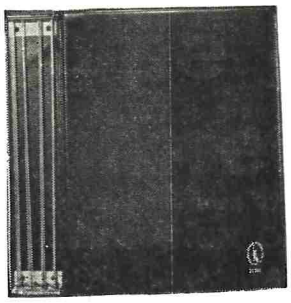

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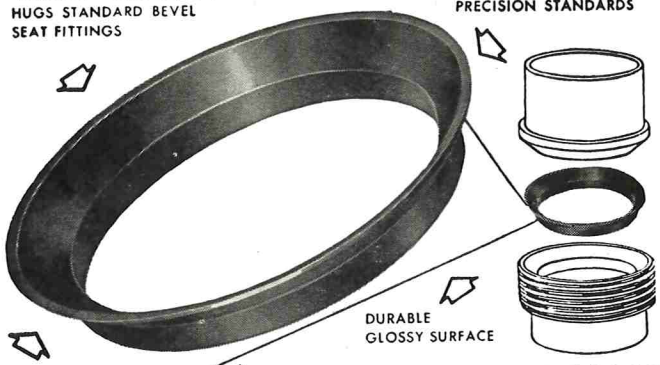

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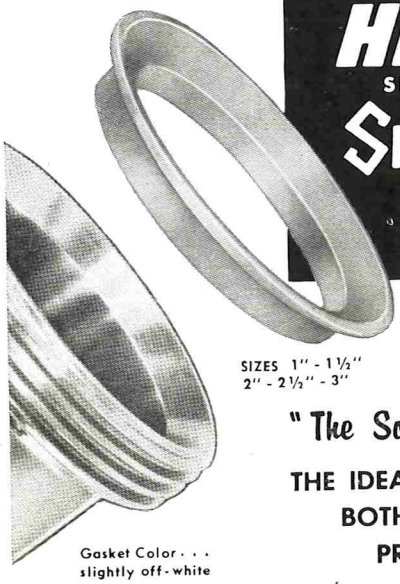

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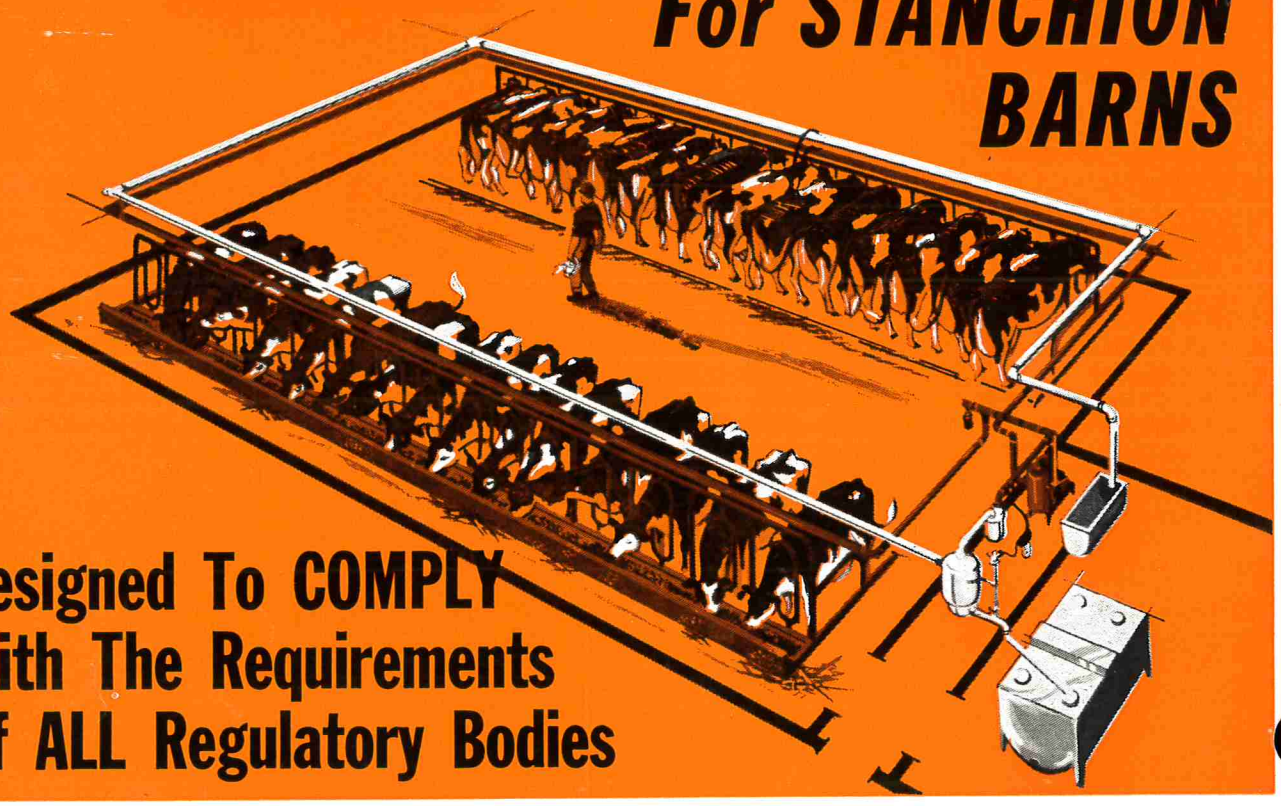

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