

THE PROGRAM OF THE DAIRY PRODUCTS IMPROVEMENT INSTITUTE, INC.¹

A. C. DAHLBERG²

and

DONALD H. RACE³

Dairy Products Improvement Institute, Ithaca, New York

Three years ago "The Purpose, Plans, and Progress of the National Conference on Interstate Milk Shipments" was the subject of an address by your former chairman, J. L. Rowland, at the annual meeting of the Dairy Products Improvement Institute. Our members were impressed by the program of the conference. Now it is our privilege to tell you about the program of the Institute on sweet cream for manufacturing purposes which, we believe, should be brought to your attention.

A program on any phase of milk sanitation must recognize that in market milk areas sanitation from farm to consumer is one of the best of any food industry. The great advances in milk sanitation have been made by the cooperation of producers and processors with the various regulatory and educational agencies, and progress will be made in the future only through such mutual efforts. The Institute's program for the sanitary production of sweet cream for manufacturing purposes is based on the general application of the knowledge, practices and essential regulations for the production of quality milk. Experience shows that there is little difference of opinion among industry and regulatory officials as to facts and objectives but there is variance of thought concerning methods of accomplishing the results.

HISTORY

The Dairy Products Improvement Institute was incorporated as a non-profit organization under the Membership Corporation Law of the State of New York on July 30, 1947. The persons involved in the act of incorporation resided in the states of Massachusetts, New York,

and Pennsylvania. Details of the organization are given in its Certificate of Incorporation and By-Laws which are available as a pamphlet to those who are interested in them. At the first meeting of the Directors held on the day of incorporation Mr. W. A. Wentworth was elected President, an office which he still occupies, and the late Dr. Carl W. Larson was elected Managing Director each year until his retirement in June 1953.

Two conditions prompted the inception of the Institute. The first was that the northeastern states constituted a so-called cream deficit area. The shortage of sweet cream for manufacture into ice cream, sour cream, cream cheese, etc. was acute. Those persons in the dairy industry and in colleges who seemed qualified to evaluate this cream deficit problem were almost unanimous in the opinion that this shortage would become worse and would be permanent. The usual tables and graphs substantiated this prediction but subsequent developments have varied from it.

The second situation prompting the formation of the Institute was the existence of the Dairy Products Improvement Committee with headquarters in Chicago, Illinois, organized in 1944 for the purpose of aiding producers in the production of quality cream to supply this market. The late Dr. Hugo H. Sommer of the University of Wisconsin was selected to prepare and administer a comprehensive and practical program for the production of sweet cream of high quality. The Committee published the bulletin entitled "Production Requirements for Sweet Cream" which gave farm production details and a method of evaluating the quality of cream. Dr. Sommer's work was chiefly on farm production problems. There was an obvious need for a northeastern organization to serve the interests of the companies and the state and city regulatory

agencies located in the areas that expect to receive and accept cream to be produced under the program of Dr. Sommer.

The Dairy Products Improvement Institute had these problems in mind at the time of its inception. However, its objectives are broad and include more general work on milk and cream quality from production to acceptance in the market of utilization. The "Production Requirements for Sweet Cream" prepared by Dr. Hugo H. Sommer made no distinction between cream for bottling and for manufacture; however, the Institute has always considered milk and cream for manufacture into dairy products to be its principal field of activity.

OBJECTIVES AND METHODS

The objectives of the Institute as adopted by the Board of Directors are as follows:

"1. To promote the welfare of the dairy industry through raising the general level of quality.

2. To promote the acceptance and use of uniform and simplified sanitary standards with which to attain and measure that quality.

3. To expedite the movement of dairy products between political subdivisions by assisting health authorities to determine and to make effective only essential sanitary requirements to the end that duplicating and/or conflicting inspections, quality standards and quality measurements will be unnecessary and the best possible economic distribution of the products will be effected.

4. To formulate suggested sanitary standards for proposed adoption by health authorities covering new processing developments within the industry, and to disseminate these standards to interested parties".

The work of the Institute is based upon a long-term program to promote its objectives in several manufacturing fields involving milk and cream quality, sanitary regulations, and the movement of dairy products of acceptable quality standards into areas where it can be utilized most expeditiously.

A general statement is now being prepared for a booklet entitled "Requirements for the Sanitary Produc-

¹Presented before the National Conference on Interstate Milk Shipments held in Memphis, Tennessee on March 29 and 30, 1955.

², ³Advisor to the Board of Directors and Field Director, respectively, Dairy Products Improvement Institute, Inc., 302 East State Street, Ithaca, New York.

tion of Sweet Cream". It gives the essentials for the sanitary production of milk on the farm and its processing into sweet cream for use in dairy products. Standards of sanitary quality of the milk, raw and pasteurized cream are proposed based upon the sanitary requirements of public health and a high quality product of the dairy industry. This statement sets the minimum acceptable goals of excellence in methods of production and product quality. There is also an operating manual concerned with the details of milk production, separation, and cream processing which is of primary interest to the company producing the cream. It outlines the program giving the details of production and processing of cream to meet sanitary requirements and product quality. The Institute is not in a position to supervise and maintain the desired standards but often it can furnish information to both the producing and receiving plants and regulatory agencies concerning the approximate sanitary aspects of the production and processing of the cream in selected areas.

This program of the Institute shall be promoted by cooperation with all existing agencies active in work affecting the sanitary quality of sweet cream. There are regulatory agencies on both state and city levels in the areas of production and utilization which are mutually and vitally concerned and legally responsible for the healthfulness of milk and cream used for manufacture. Then there are the dairymen who produce the milk, the processors that produce the cream, and the operators of the plants where the products are utilized who are interested not only in the sanitary quality but also in other characteristics affecting the economic value of the product. The Institute offers to aid all parties whenever and wherever possible in the formulation and execution of proper specifications and standards.

The cream quality program of the Institute is based upon inspection of farms and plants by a regulatory agency to assure the presence of adequate facilities and good sanitary conditions, regular inspection and testing of the milk at the plant by qualified company men to detect

undesirable milk, work by the field sanitarians with those producers whose product does not meet standards, and proper processing and handling in the receiving plant and during storage and shipment to the place of utilization. Wherever milk supplies are ample it is recognized that the local dairymen ought to be able to supply local markets with quality cream for manufacturing.

SOME SPECIFIC PROBLEMS

The Institute takes the position that it is neither economically feasible in the dairy industry nor justifiable in the interests of public health to apply all of the present bottled milk sanitary requirements of production on the farm to all dairy products. As a matter of fact in those few areas under one set of sanitary regulations for milk it is generally understood or specified that the requirements do not include such products as butter, cheese, and evaporated milk. It is recognized that application of fluid milk regulations to all dairy products would create an impossible situation in respect to enforcement and the free movement of food products through the ordinary channels of trade. More liberal sanitary standards for these products cannot be excused or allowed on the grounds of the substitution of high heat treatment of any product for sanitation in its production.

The Institute recognizes the necessity for high sanitation and quality standards, but some of the sanitary requirements that are in effect for market milk are not necessary. Should the sanitary requirements for the production of market milk be limited to the essentials of sanitary milk production, then most of the reasons for two standards would be eliminated. The value of a single sanitary standard is recognized but the possibility of agreeing on required farm facilities acceptable to health and agricultural departments and economically feasible to the dairy industry is very remote at the present time. The Institute is endeavoring to assist in the formulation of such dairy farm inspection forms limited to the essentials of producing milk for bottling that the inspection may give a clear picture of the necessary facilities and conditions on the farm. The report of the sanitarian then could be applied as usual for

bottled milk but not as severely for milk for manufacture bearing in mind that the essential factors of sanitation should not be violated.

This question of dual sanitary standards for farm facilities and the limitation of the bottled milk standards to essentials is more than of academic interest. A specific example of this fact is the situation in New York. In 1953, it was the second highest state in total milk production. It ranked first in total milk consumption, first in the manufacture of cream cheese and sour cream, and second in cottage cheese, ice cream and total cheese production. Figures on total sweet cream production are not available but it is certain that most of it is produced on farms inspected for bottled milk and processed in plants similarly inspected. It has been stated that about 85% of all milk used to manufacture the approximately 95,000,000 pounds of cheese made in New York State is inspected under sanitary regulations for bottled milk by New York State and local health departments. About one-half of the entire milk supply of New York State is used for manufacture yet most of it is under fluid milk regulations. It ought to be clear, therefore, that sanitary regulations for milk for bottling in New York must be considered in any program of sanitation of milk for manufacture and that the bottled milk sanitation regulations do affect the cost of producing such milk. Fortunately, the regulations for the sanitary production of fluid milk on the farm in New York State have been held closely to essentials, otherwise dairymen of the state would be at a disadvantage in competing with sweet cream for manufacture from other states. It is gratifying to note that, except for the annual physical examination of herds, the Institute's program for the sanitary production of sweet cream is in good agreement with the bottled milk regulations in New York State.

Even though very good information establishes the essentials of sanitary milk production and there is general agreement on these facts, nevertheless, unanimity of opinion does not exist regarding sanitary requirements to be put into laws, ordinances and farm score forms. Major differences of opinion may

be selected which have been deeply entrenched by argument and practice. These differences in opinion and regulations have to do with items that are chiefly non-essential or on which there can be no definite answer that is exactly right at all times. For example, it is very desirable to specify a bacterial standard for the major grade of bottled milk and this standard could be uniform throughout the country. However, bacterial standards for such milk prior to pasteurization as received from the producer vary from 75,000 to 400,000 per ml. to no standard at all. With such discrepancies in requirements for the predominating grade of milk for bottling it is not surprising that acceptable bacterial regulations are difficult to establish to include milk for manufacture.

At the present time and until milk production requirements are more uniform in respect to non-essentials, there is no public health necessity for a single standard for the sanitary production of milk on the farm, in fact, there is good reason for two standards. Let us illustrate this point. Milk for bottling may be subjected to adverse conditions not encountered with milk for manufacture. Market milk may be cooled at the receiving plant and pasteurization delayed a day either through shipment to the plant of pasteurization or by hold over at the city plant. The milk is pasteurized at the relatively low temperature of 162° F. for 15 seconds followed by cooling to 50° F., or below, and it generally is not held much below 50° F. Delivery to the store or to the consumer usually occurs within 24 hours after pasteurization but the milk may be held as long as a week in the home refrigerator at an unknown temperature prior to consumption. On the other hand the situation is more favorable to the protection of the public health if the milk is made into cream for ice cream manufacture. The milk is separated into cream and immediately pasteurized at 155 - 160° F. for 30 minutes at the receiving plant. The cream is cooled to 40° F. or below at which temperature it is held until received and used at the city plant. The mix is pasteurized at 155 - 160° F. for 30 minutes, promptly frozen and held in the frozen state until

consumed. Protection of the public health and fine product quality to the consumer can be assured with less rigid sanitary standards for milk production on the farm when the milk is used in ice cream than as bottled milk.

The Institute favors the enforcement of the essentials of sanitary milk production on the farm but they should be only those requirements necessary to assure milk of high quality. Actually, the detailed specifications of farm sanitation of the Institute are comparable to those of many states and cities for the predominating grade of bottled milk and, properly enforced and promoted, they are ample to produce milk of excellent quality. Much of the work of securing the cooperation of producers ought to be done by the milk companies and producers' cooperatives rather than depending upon regulatory agencies.

Any program of milk production and processing must be based upon quality standards for the product which is the ultimate evaluation of the success or failure of the production program. Consequently, the Institute has adopted standards of quality for the milk as received from producers, for the raw cream at the processing plant, and for the cream immediately after pasteurization, and as received at the plant of utilization. These quality standards include flavor and odor as well as the usual sanitary standards for sediment and bacteria.

The bacterial standards of the Institute for raw milk for manufacturing purposes are more liberal than the most prevalent standard for bottled milk but they are within the range of these standards. Lest there be unjustified criticism of this phase of the Institute program it is well to point out that the maximum bacterial count of raw cream prior to pasteurization permissible under the Institute's program is the same as the standard of the U.S.P.H.S. and the bacterial count immediately after pasteurization is only half that permitted by the U.S.P.H.S. for Grade A cream.

It has been considered desirable to have the bacterial limits on raw milk for manufacture slightly more tolerant than those generally required for milk for bottling. There is no established public health reason for any selected bacterial

standard for milk for both bottling and manufacture, as previously mentioned. The history of the origin of the 200,000 bacterial count for raw milk does not indicate special reasons for this exact figure to assure consumers of a wholesome bottled milk supply. Establishment of one bacterial standard for milk used for all purposes would give impetus to the idea that the same facilities should be available on all dairy farms and such enforcement would increase expenses of dairy farmers producing milk for manufacture and would tend to increase the price of cream unnecessarily without public health advantage.

SUMMARY

The necessity for industry to carefully and systematically test the quality of the milk as received and of the processed cream as offered to the market is stressed in the program of the Institute. Such testing serves as the basis of the sanitation work of field sanitarians with milk producers. Records of such tests must be kept for examination by regulatory officials. If regulatory officials do some spot testing and checking of methods and farm inspections a very good idea of the sanitation may be readily obtained with a minimum of effort. When such data are available there is reason for a realistic evaluation and acceptance of the information.

This program by industry, based upon sound sanitary requirements and product standards, to produce the sanitary quality of cream desired by health and agricultural agencies and the market, and its coordination with law and ordinance enforcement should inspire more reliance on the part of a regulatory agency in the work of other agencies and of industry. It reduces the need for multiple and duplicating inspections and it stimulates acceptance by one regulatory agency of milk and cream approved by another. One of the very gratifying results of this work has been the splendid cooperation and assistance of the various health and agricultural officials who are cognizant of the problems and are willing to aid by their efforts.

In conclusion, it may be well to state that the Institute program is

Continued on Page 156

TABLE 3—RELATIONSHIP AMONG THE CONCENTRATION OF CALCIUM, THE TYPE OF WASHING COMPOUND AND THE FORMATION OF WATER STONE.

Alkali	Compound formed	Calcium concentration ^a (mols./liter)	Solubility products ^a (mols./liter)
Na ₂ SiO ₃	CaSiO ₃	9.05 x 10 ⁻⁶	7.33 x 10 ⁻⁹
Na ₂ CO ₃	CaCO ₃	1.20 x 10 ⁻⁴	1.44 x 10 ⁻⁸
Na ₃ PO ₄	Ca ₃ (PO ₄) ₂	3.78 x 10 ⁻⁴	3.43 x 10 ⁻¹⁸

^aTaken from chemical handbooks.

for 20 min.) and hand cleaned lines indicates that most of the internal surfaces and all of the bevels of the C.I.P. lines were more nearly satisfactory than the internal surfaces and bevels of hand cleaned lines. Gaskets from C.I.P. cold milk lines were more nearly satisfactory than H.C. lines. Regardless of the cleaning temperature the gaskets from hot milk lines, cleaned-in-place, were unsatisfactory when compared to gaskets from H.C. lines.

A comparison of the results from C.I.P. lines (150° F. or higher for 20 min.) with the proposed standard indicates that the majority (75 per cent or more) of the internal surfaces and bevels were satisfactory despite the fact that all the gaskets were unsatisfactory. At lower temperatures of recirculation (130-140° F.) the majority of the bevels and gaskets were unsatisfactory. Also at these lower temperatures the hot milk lines were not cleaned physically.

If hand and recirculating cleaning as used in these studies are to be judged in the light of the proposed standard of 100 colonies/8 sq. in., neither of the two cleaning methods appears to be fully satisfactory; indicating that the proposed standard may be too rigid. The reason for neither method being satisfactory was that the bevel and gasket surfaces generally exhibited a poorer bacteriological condition than the internal surfaces. Since the bevels and gaskets appear to be the limiting factor in both methods of cleaning it poses a question as to whether a bacteriological standard should be established for bevels and gaskets without considerably more study as to a logical number of organisms per 8 sq. in. Sufficient data have not been presented in this paper to warrant the proposal of a new standard.

SUMMARY AND CONCLUSIONS

The bacterial quality of the milk products passed through cleaned-in-place lines is equal to the quality of products passed through hand cleaned lines.

Higher temperatures in C.I.P. cleaning generally give better physical cleaning than lower temperatures in so far as hot milk surfaces are concerned.

Higher C.I.P. temperatures generally did not give better bacteriological cleaning than lower temperatures for surfaces of cold milk lines.

The internal surfaces of sanitary lines were cleaned more easily than either bevels or gaskets. This was true for both H.C. and C.I.P. lines.

Of the cleaners tested, which contained polyphosphates, cleaner A, which contained the highest concentration of polyphosphate in solution, gave the best physical cleanliness. Cleaner D, a chelated caustic, gave results similar to A.

Bacteriological results from C.I.P. lines (150° F. or higher for 20 min.) were consistently lower than those of H.C. lines and showed no coliform contamination; H.C. lines showed erratic results and spotty coliform contamination.

Microorganisms did not penetrate into the interior of the paper or fiber gaskets when used for a period up to 3 weeks in C.I.P. lines.

Velocities had no effect upon the cleanliness of bevels and gaskets at the temperatures employed. A velocity of 7 ft./sec. at 130° F. for 10 min. did show better results on internal surfaces of cold milk lines than a velocity of 2 ft./sec. at the same temperature.

The recirculation procedure used to collect the data in this paper is given in the experimental section.

Temperature in C.I.P. procedures has more effect upon cleaning efficiency than either time or velocity,

when the recirculating time is 20 min. or longer.

ACKNOWLEDGMENTS

The authors wish to express their appreciation to the Bowman Dairy Co. of Chicago, Ill. and the Carnation Co. of Los Angeles, Calif. for partial support of this project, and to Professor W. S. Rosenberger for his cooperation and the use of the facilities in the Market Milk Department.

REFERENCES

1. Brandsaeter, E., Stokkeland, K. and Ystgard, O. M. Vasketorsok med Plate-pasteurer. Melding nr. 45 fra Meiri-instituttet ved Norges Landbruks-hogskole. 1952. (Cleaning trials on plate pasteurizers. Bulletin No. 45 from the Dairy Industry Dept. of the Agricultural College of Norway. 1952).
2. Fisker, A. N. Chemical Cleaning of the Pasteurization Plant. Proc. 12th Intl. Dairy Cong. 3:319-325. 1949.
3. Havighorst, C. R. Permanent Welded Pipelines. Food Eng. 23 (9): 74-79. 1951.
4. Hodes, H. P. Cleaning-In-Place Pipelines. Milk Dealer. 42 (5): 44-45, 74, 76-78. 1953.
5. Holland, R. F., Shaul, J. D., Theokas, D. A. and Windlan, H. M. Cleaning Stainless Lines In-Place. Food Eng. 25 (5): 75-79. 1953.
6. Hucker, C. J. and Thomas, R. E. Pyrex Glass Tubing as a Substitute for Metal Milk Pipe in Dairy Plants. J. Milk and Food Technol. 6 (2): 4. 1943.
7. International Association of Milk and Food Sanitarians, United States Public Health Service, and Dairy Industries Committee. 3-A Suggested Method for the Installation and Cleaning of Cleaned-In-Place Sanitary Milk Pipelines for Use in Milk and Milk Products Plants. J. Milk and Food Technol. 16 (2): 77-78. 1953.
8. Moore, A. V. In-Place-Cleaning of Steel Sanitary Milk Processing Lines. Progress Rpt. 1472. Texas A. and M., College Station, Texas. 1952.
9. Moore, D. R., Ordal, A. J. and Tracy, P. H. Permanent Pipelines for Dairy Plants. J. Dairy Sci. 34: 804-814. 1951.
10. Parker, R. B., Elliker, P. R., Nelson, G. T., Richardson, G. A. and Wilster, G. H. Study Substantiates Benefits of Cleaning Pipelines in Place. Food Eng. 25 (1): 82-86, 176-178. 1953.
11. U. S. Public Health Service. Milk Ordinance and Code. Public Health Service Publication No. 229. 1953.

DAIRY PRODUCTS IMPROVEMENT

Continued from Page 143

designed for the production of high quality cream for manufacture yet it will give excellent milk for bottling. Even though the principal emphasis is on cream for manufacture the program in some areas must be co-ordinated with the sanitary control program for fluid milk.