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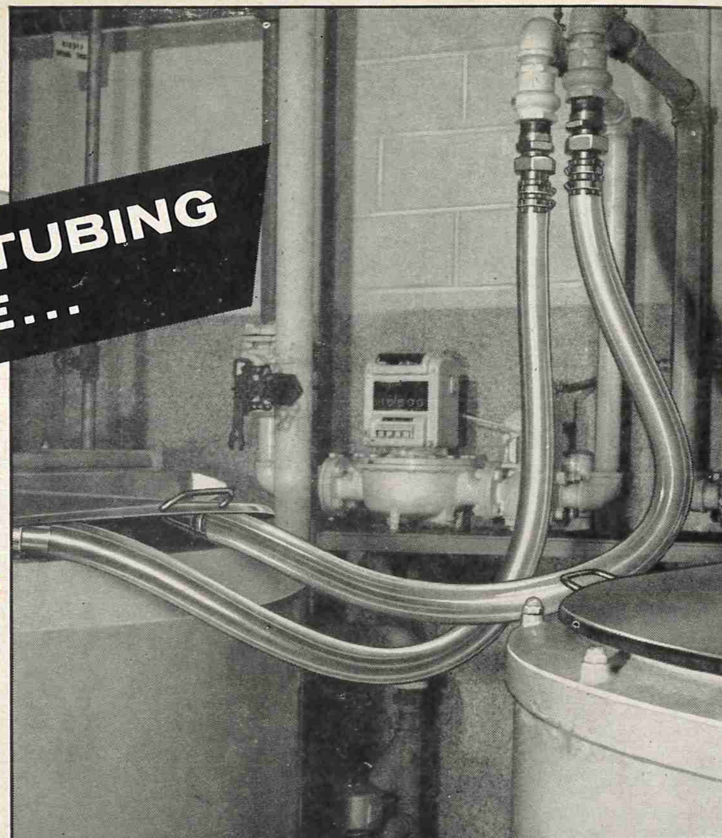

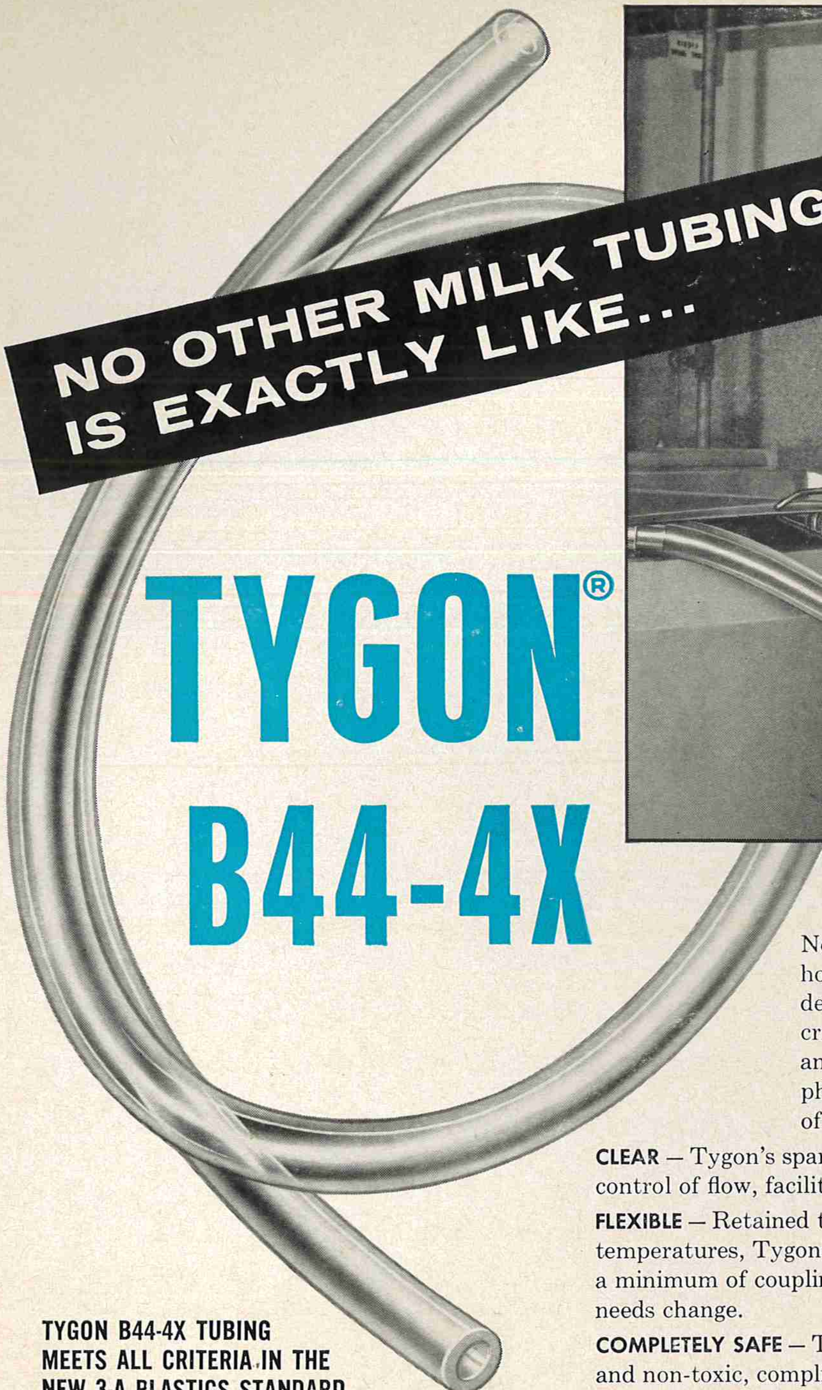

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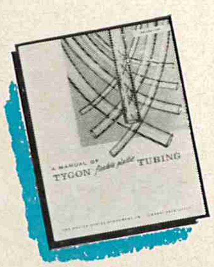

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IMPROVEMENT IN THE ENVIRONMENT THROUGH BETTER REGULATION[1]

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In preparing this paper, I had occasion to review the recently published "Study of State and Local Food and Drug Programs", a report to the Commissioner of the Food and Drug Administration, United States Department of Health, Education and Welfare. This is an impressive and timely study. Packed into its relatively few pages is an analysis of a large part of the field of sanitation—comprehensive in scope, scholarly in approach, thorough in detail. The authors of this report fortunately chose not to limit the compass of their research to state and local programs which parallel those of the Federal Food and Drug Administration but they elected instead to cover all of the activities of state and local sanitation concerned with health and consumer protection.

While not prepared to endorse all of the recommendations of this report without reservation, I think that it would be of value to offer a condensation of the summary and recommendations contained in this work as a frame of reference for discussion. Please keep in mind that the term "food and drug" as used throughout is intended to cover all of the activities concerned with health and economic protection at the state and local level. The condensation follows.

Summary of Findings

As our society advances in science and technology, becoming increasingly complex in size and scope, protection of the populace against environmental hazards becomes proportionately difficult for government and industry. Increases in size and breadth of interest of industry, ever directed toward larger markets of regional and national dimensions, call for government to adopt a unified approach to health and consumer protection programs in place of fragmentation of effort which leads to duplication, confusion, conflict and neglect. Federal, state and local authorities in food and drug programs largely overlap each other. They can complement and supple ment one another's abilities, but interagency relationships have been characterized by varying degrees of success in cooperation and coordination.

There is little basic uniformity in food and drug laws among the states nor adequate correspondence with federal legislation. State laws are generally not broad enough to cover consumer risks. Laws and regulations do not coincide. In general, state and local food and drug laws are a disjointed mass. While industry has achieved unity in organization and operations, there is no corresponding unity in health and economic protection. Rather there is competitive rivalry and duplication of responsibilities with confusing results in government health and economic protection programs.

Commitment of resources by state and local government is large in total but uneven in quality and size. They are often not based upon objective and comprehensive assessment or requirements. Many agencies are characterized by deficiencies in one or more of the elements necessary for an efficient and competent organization. Statutory inadequacies, fragmentation of administrative authority, differences in the personnel environment, and in the level of financial support, and lack of coordination are examples of these shortcomings. If state and local government agencies are to retain their broad responsibilities in health and economic protection programs, there must be improvement in the quality and range of resources available, and the efficiency of application must be improved.

In view of the foregoing, there is a need at all governmental levels to continually evaluate the total task, to bring about some basic uniformity of policy, practice and approach and also fully coordinated cooperation. This requires a balanced partnership of federal and state governments with consequent acceptance of a realistic formulation of their respective roles. On the federal level there must be sufficient authority to carry out the leadership role. On the state level improvements in statutory base, management, and in coordination of state-local efforts is necessary. The assistance of industry is also needed in certain of these area.

This concludes the findings. We will now go on to a synopsis of the more general recommendations contained in the report.

Summary of Recommendations

The interdependency and community of purpose among federal, state and local agencies should be expanded and further coordinated through a balanced federal-state partnership in which respective respon-

[1]Presented at the 52nd Annual Meeting of the International Association of Milk, Food and Environmental Sanitarians, Inc., Hartford, Conn., September 14-17, 1965.

sibilities are clearly delineated. The states should assume a broader and more meaningful role in food and feed regulation with emphasis on preventive compliance through public education and cooperation with industry.

A delineation of responsibilities in specific areas should be made. This recommendation is made with some detail in the report. The federal government should exercise more productive leadership in the coordinated use of total public resources for health and consumer protection. Much broader interagency coordination is needed through a cohesive federal policy and administration. In order to accomplish this, a balanced view should be sought and maintained by all of those having responsibilities in these fields at the federal level. Such a balanced view should then be communicated to the states without the narrowness caused by limited interests.

There should be an enlargement of federal assistance to state and local regulatory agencies to complement local agencies resources and upgrade their capabilities, to finance special projects, to improve administrative and technical practices, to recognize present contributions and to support better federal-state-local coordination. On the state level a broad appraisal of programs should be made with a view toward improvement. Consumer protection activities including legal bases should be evaluated for breadth of coverage and balance to assure that they are geared to present day needs and for uniformity with other states and consistency with federal legislation among other qualifications.

A variety of recommendations follow which call for improvements, delineation of responsibilities and coordination, balance in programs and efficient use of resources in and between the several areas of interest on the state and local levels. With regard to personnel, an effectively operative merit system, improved career opportunities and training, and pay commensurate with contributions is advocated.

A call is made to industry to work for a more unified and effective system of governmental food and drug operations. Officials and their associations should expand both their formal and informal activities in attacking major problem areas of food and drug programs.

Finally, states working together under inter-state agreements can provide facilities and program function that would not be feasible for them to do while working alone.

This concludes my resume' of the summary of findings and recommendations. It does not do justice to the report, and it can in no way replace careful reading of the study in its entirety. The salient features of the report have been presented only as a basis for further comment.

THE CHALLENGE TO PUT OUR HOUSE IN ORDER

This study presents a challenge to all of us who are associated with any of the areas to which it has devoted attention. There are those who may believe that their houses are in relatively good order and are not overly concerned. Others among us may feel that the shoe fits too well and that many of the shortcomings noted apply to our jurisdictions. I believe that we can all profit by an analysis of our organizations and operations in the light of this report. Certainly we can all do more to improve relationships with other agencies in the same field at our own or at different levels of government.

Perhaps this report has struck me with particular force because it sums up so cogently a great number of the issues which we have been thinking about, reading about and talking about for a number of years. Surely, you have been concerned, as I have, with the proliferation of problems in the field of sanitation because of the rapid changes which are taking place all around us. We all recognize the handicaps with which governmental agencies are faced in keeping up with shifting socio-economic patterns. Industry is and must be free to make innovations in products and in methods and distribution, overnight so to speak, if it is to survive in a strongly competitive environment. Government, on the other hand, should also be free to adjust to changing conditions. But it is fettered by rigidities established by law, tradition, by public opinion or rather the lack of it in most cases.

We work within this structure and attempt to keep up with the need for maintaining a healthy environment lacking proper statutory authority, without an adequate budget, unsupported by a concerned and knowledgeable public. Nevertheless we continue to try. Judging by the status of sanitation today compared to that which existed a hundred, fifty or even twenty years ago, we have done very well considering the barriers to progress which had to be surmounted in the process.

Over the past ten years or so, I am sure that I have read scores of articles and listened to a number of speakers, all pointing out the things which needed to be done to meet present and future needs in the field of sanitation. The trouble is that most of these failed to offer realistic solutions to the difficulties involved in achieving reasonably swift progress in governmental jurisdictions.

THE VALUE OF GOOD COMMUNICATIONS

Those among you who have been associated with governmental sanitation programs know that there is no panacea for these problems. Hard work is still the only reliable means of moving ahead in any of the areas which have been called to our attention. Perhaps you will agree, however, with a conclusion I have reached after some years of observation—that particular emphasis on one thing can multiply the value of all of our efforts in other areas. I refer to communications—the key to progress.

Within the organization, the quality of the flow of information back and forth between the several levels and the various units is an important factor in the effectiveness of the agency. The inspector in the field should know not only what he is doing but why he is doing it. Every member of the team should know the goal as well as his role. Any increase in the quality of information outward from the center usually means an increase in the quality of the information which is returned. Full information, in perspective, from the field is a valuable tool in making effective use of the human and material resources available in the regulation of sanitation problems. Good lines of communications are also necessary for adaptability in meeting new or changing situations effectively.

In a situation where overlapping of responsibilities and duplication of effort are major criticisms, good communications between agencies can help to bring order out of chaos. A unified approach by two or more organizations is only possible where a free exchange of ideas and information is taking place. Granted, that formal organizational setups which clearly establish jurisdictional lines are preferable to informal substitutes. However, while we wait for such permanent demarcations, we must rely on informal arrangements and agreements to eliminate conflict. This kind of cooperation is achieved through good lines of communication kept in good repair. I couldn't ask for better communications than those which exist between the Connecticut Department of Agriculture and Natural Resources, the State Health Department and the Department of Consumer Protection. I attribute the almost complete lack of jurisdictional difficulties between our agencies to the excellent rapport which is maintained by good lines of communications which have been built up over the years.

The kind of communication which we maintain with industries under regulation is a key factor, to my way of thinking, in our efforts at securing compliance from them. The advanced status of self-inspection and intra-industry regulations owes much to the efforts of regulatory agencies over the years in selling the idea that good practice is good business. The free flow of information in both directions between industry and the regulatory agency helps at the inspection level to develop preventive compliance through mutual understanding. At the policy making level, it assists in the formulation of programs which are effective and capable of implementation with a maximum of cooperation on the part of industry.

Good communications between professional associations is a requisite if they are to pull together toward agreed upon goals. In this respect the Sanitarians Joint Council is doing a fine job of providing the mechanism for coordinating the activities of the four organizations with which sanitarians are affiliated. It is important for sanitarians to present a united front in order to gain general acceptance of the goals of the several associations.

Public Education is Vital

The areas which I have mentioned so far are but necessary forerunners to the most important of these —communication with the public. It is in this province that the greatest need exists and where the greatest gains can be made. People are much more aware and knowledgeable about sanitation today than they have ever been. They are more careful in their choice of products; they are reading labels and they are looking for inspection stamps and grades. On the other hand, we know that most consumers are laboring under the delusion that all foods, drugs and devices, and indeed, most environmental hazards are in some way regulated by government for their protection. Failure to educate the public as to the extent and degree of inspection or other protective measures can lead to massive popular reactions which we have witnessed in the cranberry and broiler incidents, for example, in the not too distant past.

We have a continuing obligation to try to reach the public with full information on incipient problems to stop these scare reactions before they start. The late Rachel Carson's "Silent Spring" has, in retrospect, achieved much that is good in the regulation of pesticides. However, serious consideration should be given as to whether the end justifies the means in such instances. Too many improvements in sanitation and in other fields as well have been realized by the public alarm technique. We should be able to reach the people with more facts and less emotion. I can recall reading well written, comprehensive articles about the growing problem of pesticide control five or six years before "Silent Spring" was published. At least one of these was carried in the *Journal of Milk and Food Technology.* I submit that it is better to try to secure desirable action through calm and rational appeals through all of the channels of communication which are open to us, although it may take longer to get results.

There is a need for every sanitarian to devote at least a portion of his time to public education. Sanitation is a way of life—not just for the sanitarian—for everyone. The principles of sanitation must be brought home to the people in terms that they will understand. The goal should be a positive public attitude toward sanitation in which every citizen knows and accepts his role in maintaining a clean environment. And we should hammer away to sell the concept that failure to provide tax dollars for necessary sanitation programs and facilities does not save money—it costs money.

When the people are made aware of the dimensions of the sanitation hazards in their environment and the steps which must be taken to correct or to prevent them, many of the problems outlined in the Food and Drug Report become much less difficult to solve. An unconcerned legislature is no match for a well-informed public that knows what it wants. This is the best way to secure improvements in the legal bases of health and economic protection, to provide the funds for these programs and the funds to pay the professional sanitarian at a rate commensurate with his responsibilities and his contributions. The success of this approach in the field of education, with the dramatic improvements which it has brought in prestige and level of living to the teaching profession, should encourage us to adopt a more vigorous and perhaps better coordinated program in the area of sanitation.

In the final analysis, the difficulties which face us today are, in perspective, really no harder to solve than were the difficulties of yesterday. If the problems are greater and more complex today, so the resources which we have available to solve them are also more abundant and more sophisticated. As we have met such challenges without losing stride in the past, I have every confidence we will meet those of the present and of the future.

PUBLICATIONS OF INTEREST

Editorial Note: Listed below are books, pamphlets and reprints on a variety of subjects considered to be of interest. Request for material should be addressed to the source indicated. Note cost of books and certain items.

How to Maintain a High Standard of Sanitation in a Bakery. J. Carl Dawson. Bull. No. 176, Am. Soc. of Bakery Engineers, Room 833, 2 Riverside Plaza, Chicago, Ill. 60666

Water in Industry. Nat. Assoc. of Manufacturers, 2 E. 48th St., New York, N. Y. 10017 $2.00

The Challenging Problems of Water. Public Relations Dept. Calgon Corp., Calgon Center, Pittsburgh, Pa. 15230

Clean Waters for Ohio. Summer Ed. 1965. Ohio Water Pollution Bd. 450 E. Town St. Columbus, O. 43216

Radiation Preservation of Foods. Pub. No. 1273, Nat. Academy of Science — Nat. Research Council, 2101 Constitution Ave., Washington, D.C. 20418 $9.00

Hygienic Food Manufacturing and Handling. B. Graham-Rack and R. Brinstead. Food Trade Press Ltd., London, Eng. $6.00

Functions of Phosphates in Food Products. Stauffer Chemical Co. 380 Madison Ave., New York, N.Y. 10017

Canned Foods—An Introduction to Their Microbiology. A. C. Herson and E. D. Hulland. Chemical Pub. Co. Inc., 212 Fifth Ave., New York, N. Y. 291 pp, $10.00

Freeze-Drying Attitudes. Background of freeze-drying and present status. 1964. Kermit Bird, Economic Research Service, USDA, Washington D. C. 20250

Conf. on Nutrition in Space and Related Waste Problems. Tampa, Fla. 1964. Nat. Aeronautics and Space Admin. Supt. of Doc., Govt. Print. Office, Wash. D. C. 20402 $2.75

Freeze-Drying Booklet. With sketches and diagrams. FMC Corp., Freeze-Dry Dept., P. O. Box 580, Santa Clara, Calif. 95052

Microwave Processing Systems for Industry. Raytheon Co., Waltham, Mass. 02154

Botulism. Proceedings of a Symposium, 1964. PHS Pub. No. 999-FP-1. 327 pp. Publication Office, R. A. Taft Center, USPHS, 4676 Columbia Pkway, Cincinnati, O. 45226

Iodine as an Algaecide for Swimming Pools. J. B. Lackey et al. Leaflet No. 171. Florida Engineering and Experiment Sta., Univ. of Florida, Gainesville, Fla.

Waste Stabilization Pond Study, Lebanon, O. W. B. Horning et al. PHS Pub. No. 999-WP-17. R. A. Taft Center, 4676 Columbia Pkway., Cincinnati, O. 45226

Aerobic Treatment in Poultry Waste Disposal and Aerobic Stabilization Ponds. Proc. on 2nd Nat. Symposium of Poultry Waste Management, Univ. of Nebraska, 1964. SEC Pub. No. W64-20. R. A. Taft Center, 4676 Columbia Pkway, Cincinnati, O. 45226

Public Health Service Bulletins (July-Sept. 1965) (Order from Public Inquiries Branch, PHS, Washington D. C. 20201)

PHSP-386. An Industrial Waste Guide to the Meat Industry. 20c.

PHSP-546. The Vending of Food and Beverages—1965. 15c

PHSP-661. Municipal Water Facilities—Communities of 25,000 and over. 1964.

PHSP-758. Sewage and Water Works Construction. 1964.

PHSP-999-AP-10. Community Perception of Air Quality.

PHSP-999-AP-11. Selected Methods for Measurements of Air Pollutants.

PHSP-999-WP-21. Deep Well Injection of Liquid Wastes.

PHSP-999-WP-24. Advanced Waste Treatment Research.

PHSP-1049-A. Drinking Water Quality of Selected Interstate Carrier Water Supplies.

Care of Farm Dairy Equipment. C. K. Johns. Pub., No. 627. Information Div., Canada Dept. of Agriculture, Ottawa.

PRIVATE WATER SUPPLY PROBLEMS AND TREATMENT[1]

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Most of us take our water supplies for granted. We really don't know what it's like to be without water to drink. Yet, an adequate supply of good clean water is one of the most vital requirements for our human existence. Two factors closely related to an adequate supply are bacteriological quality and mineral content of the water. Bacteriological quality pertains to whether or not water is safe to drink. Mineral content primarily concerns substances in water that cause hardness, corrosion, bad taste, odor, and stains on clothing, utensils and plumbing fixtures.

In this article we will discuss some of the common water problems that are directly related to the mineral content of water used in our homes and on our farms. We will point out why these problems exist and what can be done about them. The number of mineral substances that affect the quality of water is quite lengthy but only a few commonly cause very much trouble. Nearly all water supplies contain some dissolved impurities and contaminants. There is no such thing as pure water except perhaps the small quantities that are produced in a highly specialized laboratory.

Water Problems

Comparatively speaking, water is the best known solvent in the universe. It dissolves a little of everything it touches. Rain and snow falling through the atmosphere absorb carbon dioxide, hydrogen sulfide, soot, and other industrial wastes originating on earth. These impurities make the water slightly acid and a better solvent of rocks and earth minerals. As it percolates down into the ground it dissolves organic materials and mineral compounds tied up in the soil and rocks. These dissolved substances are the impurities that give taste to the water as well as certain other characteristics which may be either good or bad.

Some of the problems or factors that affect the quality and usefulness of our water supplies are hard water, corrosive tendencies, bad taste and odor, color or staining characteristics and sediment. Most of these objectionable conditions are quite obvious wherever they exist, but knowing what to do about them is another matter. Some of these characteristics cause individual problems, and some times they may gang up and cause complex problems. Many times the treatment of one problem may create another. For example, neutralizing acid water with a limestone filter may cause hard water that will have to be softened.

The first step toward eliminating undesirable characteristics in your water supply is to identify the problem or problems. To do this a sample of the water should be tested. Most companies selling water conditioning equipment will make an analysis free of charge and will recommend the necessary conditioning equipment.

Hard Water

The problem of hardness is perhaps one of the most significant in water treatment. It is a characteristic that affects both the cleaning power of the water and the appearance of things washed in it. Hard water wastes detergents, cleans poorly and leaves deposits on dishes, glassware and stainless steel dairy equipment.

The degree of hardness is usually measured or expressed in grains of calcium carbonate per gallon of water (gpg) but other units can be used. The quantities of almost all other impurities such as iron, sulfates, nitrates and chlorides are usually given in parts per million (ppm). This is an expression indicating the pounds of impurities in a million pounds of water and 1.0 gpg is equivalent to 17.1 ppm.

Chemists and engineers prefer to use ppm for simplicity in mathematical computations. The water conditioning trade on the other hand prefers gpg to avoid the use of large numbers. For our purposes we can say that a sample of water is 10 grains hard or that it has 171 ppm of hardness compounds and they both mean the same thing.

There seem to be many opinions among both water users and sales people as to what is *hard* water. The Water Conditioning Foundation has suggested four classifications:

1.0 to 3.5 gpg—relatively soft water
3.5 to 7.5 gpg—moderately hard water
7.5 to 10.5 gpg—hard water
10.5 plus —very hard water

The culprits that usually cause hard water and give us the most trouble are the calcium and magnesium bicarbonates, sulfates and chlorides. All of

[1]Based on a paper presented at the 23rd Annual Pennsylvania Dairy Fieldmen's Conference, July 13-14, 1965; University Park, Pa.

these substances are easily dissolved from the rocks and minerals of the earth. The bicarbonates provide what is known as temporary hardness because when the water is heated it loses its hardness characteristics and becomes soft. The sulfates and chlorides cause a permanent hardness which is not affected when the water is heated.

The bicarbonates are usually the real trouble-makers. These compounds are found in nearly all ground water supplies in quantities sufficient to cause difficulties. These impurities combine with soap and some detergents to form a soap curd that floats on the water, sticks to sinks and bath tubs, and causes the familiar "bath tub ring." It impregnates laundered fabrics and gives them a dingy grey color.

When hard water is heated a chemical reaction takes place. The soluble bicarbonates break down into carbon dioxide, calcium carbonate or lime and soft water. The carbon dioxide gas escapes or is reabsorbed to some extent into the water and the insoluble lime settles out as a sludge. This sludge hardens and forms a *lime scale* in the bottom of utensils and dairy equipment. It will build up in a hot water pipeline and in time only a trickle of water can flow through it. In a water heater this accumulation of scale acts somewhat like insulation. It prevents the transfer of heat to the cold water and, of course, results in low heating efficiency.

The conventional way of softening all hard water in a home system is through the use of an ion exchange water softener. A water softener is a tank containing a filter bed of zeolite or a synthetic resin beads. The hard water flows through this softening bed and exchanges its calcium and magnesium hardness ions for sodium ions in the zeolite bed. After so long a time all of the softening capacity of the ion exchange material will be used up and it must be regenerated with salt or brine before it will soften more water. In the regeneration process, sodium ions from the brine will replace the calcium and magnesium ions that were retained in the water softener.

CORROSION

As we think of it in connection with water problems, corrosion is the disintegration of small areas of metal surface in pipes, pumps, tanks, well casing and plumbing fixtures. The usual symptoms are rust or rapid oxidation of the exposed metal surface. With iron or steel pipe in the plumbing system, one indication of corrosion may be rusty colored water running from the faucet when it is first opened. In time orange stains on sinks and bath tubs may appear. These symptoms may also be an indication of iron in the water itself which will be discussed later.

With copper tubing in the plumbing system a greenish, grayish deposit may build up at a leaking soldered joint. Instead of reddish-orange stains in sinks, there may be bluish-green stains that are just as hard as the orange stains to remove.

Several things may contribute to the corrosive characteristics of water. These include acidity or low pH, electrical conductivity, dissolved oxygen and high temperatures. Most corrosion problems, however, are due primarily to dissolved acids and acid forming substances in the water. In coal mining regions most of the acid sources in water supplies can be attributed to mine drainage. When the coal seams are opened and the covering pyrite materials are exposed to the air, rain and melting snow, relatively strong acids are formed.

Decaying leaves, vegetation and organic materials produce carbon dioxide and hydrogen sulfide gases and these too are dissolved by water and form more acid. This acid water drains either directly into the streams or seeps through the soil into the ground water. In streams, it leaves a bright orange stain on the rocks in the stream bed.

Two methods of correcting acid water conditions are to filter the water through a limestone neutralizer or feed a soda ash solution into the water system. An acid neutralizing filter is a tank similar to water softener but filled with limestone or marble chips. Water flowing through the filter dissolves some of the lime and thus raises the pH. The dissolved lime increases the alkalinity, makes the water hard and you may have to install a water softener to compensate for the hardness added by the calcium carbonate. Soda ash (sodium carbonate) is a strong alkaline material that is easily dissolved in water and it can be fed into the water system with a chemical feed pump or chlorinator. This treatment does not add hardness to the water and furthermore it can be mixed with the chlorine and fed with the same chemical pump used for the disinfecting solution.

Corrosion of unprotected metal surfaces may also be caused by dissolved oxygen. Cold water in a wild mountain stream will dissolve considerable oxygen in its travels. This dissolved oxygen attacks the bare metal, small pinholes develop and eventually it causes the pipe to fail. There is no simple effective method of combating this corrosion in the home water system. Addition of polyphosphate compounds to the water forms a tight film on the pipe-wall that may prolong the life of the pipe. Dissolved oxygen is seldom the cause of corrosion when the source of supply is a spring or a well.

TASTES AND ODORS

There are many common tastes and odors that affect the palatability of water. These characteristics are due to the organic and mineral substances dissolved by the water. Normally four basic tastes can be detected by the human sensory system. These are sweet, sour, bitter and salty. In the odor category there are perhaps 20 or more classifications including cucumber, earthy, fishy, musty, nasturtium, pig pen, rotton egg and others. A combination of these basic tastes and odors can affect the palatability of our water supplies.

The sources of bad tastes and odors can be attributed to many things including: sewage and industrial waste pollution; algae, fungi, diatoms, nemitodes, bacteria and other living water borne organisms; decaying organic materials such as leaves, vegetation and animal wastes; iron, manganese and other metallic compounds; and high concentrations of chlorides, sulfates and hydrogen sulfide.

The most effective solution to taste and odor problems is to locate the source of the trouble and try to eliminate it before it gets into the water. This may prove to be a difficult thing to do or even impossible in which case the only resort is some method of treatment. The usual methods of treatment are filtration through a carbon filter or chlorination followed by filtration. Finely divided particles of carbon have the ability to adsorb odors and tastes in water.

Where bad odor or taste is caused by sewage pollution and decaying organic wastes, the water should be chlorinated and then filtered through a sand filter. If the residual chlorine is objectionable, then it can be removed with a carbon filter. The chlorination-filtration treatment is also very effective in removing iron, hydrogen sulfide, or sulfate reducing bacteria, as well as pathogenic bacteria.

IRON, STAINS AND SEDIMENT

Last but not the least of our water problems pertains to stains, sediment and turbidity. These problems are caused by iron, decaying organic matter, soil particles, leaves and vegetation. Sediment consists of the courser particles that settle out while turbidity refers to the finely divided particles that stay in suspension.

Next to calcium and magnesium bicarbonates, iron occurs more frequently than any other impurity in our water supplies. Many times it is the most difficult impurity to treat because it occurs in combination with manganese, sulphur, and in water that is usually acid as well as hard.

In well water iron occurs most of the time in the dissolved ferrous state. The yellowish or reddish stains on concrete or wherever the water is spilled is usually an indication of iron.

As it comes from the well the water is clear, colorless and iron content cannot be detected because the compounds are completely dissolved. But when this water is exposed to the air in the pressure tank on an open container then the troubles begin. First it turns cloudy, then a reddish, brownish substance begins to form and it settles to the bottom. This sediment is the oxidized ferric form of iron. It is insoluble and it is the substance that stains and may make the water practically unusable.

As little as 0.3 ppm of iron stains equipment, clothing and everything it contacts. These stains are almost impossible to remove with the normal household cleaning agents. The reddish precipitated iron also settles out and builds up as sludge in tanks, water jackets and pipelines. It may eventually plug the pipe and the small trickle of water that does come through normally has a rusty red color.

There is a family of living organisms often called "iron bacteria" which appears to feed on metallic iron pipe as well as soluble iron compounds in the water. The usual symptoms of these organisms are slimy, mucous looking substances, suspended in the water as it comes from the well. When iron bacteria are present reddish slime coating usually will be found on the interior walls of the toilet flush tank. These iron organism colonies are very objectionable in appearance and they give the water an awful taste. Even without the bacteria, the ferrous iron imparts a distinctive metallic taste to the water.

TREATING IRON BEARING WATER

The usual method of conditioning iron bearing waters is to speed up the oxidation process so that the dissolved iron will precipitate. Then the reddish-yellowish sludge can be removed with a sand filter. Iron bacteria can be killed by chlorine treatment.

Iron is nearly always associated with acid water so the first step in treating iron water is to raise the pH to about neutral or slightly above 7.0.

The method of treatment from there on depends on the amount of iron indicated in the water analysis. The most effective method and one that works for all conditions up to 25 ppm is to chlorinate and then filter. We pointed out earlier that soda ash used for raising pH is compatible with chlorine. This being true, we mix soda ash and chlorine in the same solution and feed it into the water system using the one chemical pump. The soda ash neutralizes the acid and chlorine oxidizes the iron. The oxidized iron is then removed by passing the water through a sand filter.

Very small quantities of iron 0.2 to 3.0 ppm can be prevented from staining and causing red water by feeding a polyphosphate solution into the system. This does not remove iron but keeps it from staining and discoloring.

Some water softeners are effective for removing iron concentrations up to 3.0 ppm. The manufacturer's specifications for a particular water softener should be studied and his recommendations followed. Automatic water softeners that are regenerated every 24 hours seem to be more effective because the iron doesn't work its way down into the filter bed so tight that it cannot be backwashed and removed.

Oxidizing filters are satisfactory for iron removal up to 10 ppm if a high capacity pump to backwash the filter is used. These filters which look like water softeners generally contain different mineral beds and are regenerated with potassium permanganate instead of salt. Frequently, with an oxidizing filter, it will be necessary to use a limestone neutralizer to raise the pH and a water softener to remove the limestone hardness. This, of course, increases the cost of installation and the overall treatment. It also reduces the pipeline pressure at the faucet because the water has to go through 3 filters.

SUMMARY AND CONCLUSIONS

In conclusion, the identification of water problems and subsequent treatment can be somewhat complicated. We have pointed out some of the basic water problems caused by mineral impurities. We have also presented several methods of treatment that are effective in conditioning water supplies.

Salesmen, sanitarians and so-called water treatment experts should never attempt to make recommendations concerning water conditioning problems until they know what minerals are causing the problems. Nearly all manufacturers of water treating equipment will make a laboratory analysis free of charge and will even supply sample bottles and mailing cartons. If you complete the questionnaire furnished with the sample bottle, they will also make a recommendation for treatment.

Calcium and magnesium bicarbonates cause most hard water problems. Taste and odors are usually attributed to iron decaying organic matter and waste materials. In the final analysis, the best solution to a water conditioning problem will depend on the proper identification of the problem and the selection of equipment to do the job.

QUALITY—INDUSTRY'S GREATEST ASSET

R. F. RINTELMANN

Klenzade Products, Division of Economics Laboratory, Inc. Beloit, Wisconsin

The Dairy Industry, if it is to reach and maintain its proper goal in our present day economy, must direct every effort toward the marketing of quality products. Those of us in the industry must realize that the responsibility for quality lies almost entirely with us, and not with regulatory agencies at the local, state, provincial, or federal level. These agencies set minimum standards. Their primary function is to supply a sense of direction which is utilized by the industry in its effort to meet the demands of the consuming public.

Industry's responsibility begins with the production of milk on the farm. It ends with the finished product placed before the consumer. It is the joint responsibility of the producer and the processor to insure the delivery of a quality raw milk supply to the plant. The plant must maintain that quality in the finished product which ultimately reaches the consumer. Most milk producers have the means and ability to supply quality milk which will be controlled in a large measure by the quality standards of the processing plant.

There are many who sincerely believe that our industry's greatest potential danger lies in our failure to assume the responsibility for quality. It is obvious that if we are to be successful in today's competition, we must establish, meet and exceed adequate quality standards. To insure success we must provide proper education of the milk producers, employees of the receiving rooms, laboratories, processing rooms, field personnel and haulers.

Evidence of industry's failure to maintain quality standards is found in many areas. In some localities and branches of the industry, essential sanitation practices are given little attention. This has resulted in an open door for substitutes. Because the consuming public is continually reminded of the importance of sanitation, and interested in improving their standard of living, they will become increasingly critical of their purchases. An ill-kept dairy farm may result in the loss of many potential consumers of dairy products. Dairy products with poor keeping quality, objectionable odors, off-flavors, etc., may cause consumers to turn from dairy products to substitutes. Quality remains our best sales tool!

MEDIA FOR ENUMERATING STAPHYLOCOCCUS AUREUS TREATED WITH HYDROGEN PEROXIDE IN MILK[1]

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Summary

Several media were compared with plate count agar (PCA) for determining numbers of *Staphylococcus aureus* 196E (ATCC 13565) surviving hydrogen peroxide-catalase treatment in milk at 54.4 C. Time intervals required for 90, 99, 99.9, and 99.99% destruction of *S. aureus* were determined from survivor curves obtained with each medium. Statistical analyses were made of the intervals for 90 and 99.9% destruction. The time required for 99.9% destruction was significantly longer when survivors were enumerated on PCA than when enumeration was made on Staphylococcus medium 110 (SM110), Staphylococcus medium 110-Egg Yolk agar (SM110-Ey), tryptic soy agar, or trypticase soy agar (TSA). SM110-Ey was the only medium which inhibited growth of survivors sufficiently to give significantly shorter time for 90% destruction than PCA. Heart infusion agar (HIA) did not differ significantly from PCA in ability to support growth of survivors.

The effectiveness of bactericidal agents such as hydrogen peroxide is commonly evaluated by determining numbers of survivors with suitable recovery media. The media must support maximum growth of the untreated culture and surviving cells. The choice of media can be complicated by changes in growth requirements of bacteria receiving sublethal heat treatments or doses of bactericides. Nelson *(5, 6)* found that the kinds and amounts of nutrients, as well as the order in which they are added to a basal medium, influenced the number of survivors in a heat-treated culture.

McDivitt and Topp *(4)* compared several selective media for the enumeration of coagulase-positive strains of *Staphylococcus aureus* in unheated pure cultures. Plate counts on Staphylococcus Medium 110 with added brain heart infusion broth and egg yolk, nutrient agar with added polymyxin B sulfate (75 mg/liter), heart infusion broth with agar, and trypticase soy broth (BBL) with agar were similar to those obtained on plate count agar which was used as a standard medium. Busta and Jezeski *(2)* found that heat-shocked *S. aureus* 196E would not grow as well on SM110 medium as on PCA. The duration of heat treatment at 60 C needed for total destruction of *S. aureus* appeared to be shorter when survival was determined with SM110 than with PCA. This was apparently related to NaCl content, since reduction in the level of NaCl in SM110 gave greater numbers of heat-shocked *S. aureus*. Inhibition of growth of heat-treated *S. aureus* cultures by sodium chloride was also observed by Stiles and Witter *(8)* when 7.5% NaCl was added to trypticase soy agar.

Enumeration of survivors of hydrogen peroxide treatment undoubtedly poses the same problems which have been observed with heat treatments. In this study, media which have been suggested for enumeration of staphylococci were compared for their ability to support growth of survivors of hydrogen peroxide treatment in milk at elevated temperatures.

Methods

Culture preparation

Stock cultures of *S. aureus* 196E were prepared by propagation on Difco plate count agar (PCA) slabs for 16 hr at 37 C. Surface growth was harvested, suspended in autoclaved reconstituted nonfat dry milk (NDM), and lyophilized.

The lyophilized stock cultures were activated by incubation in brain heart infusion broth and then on PCA slants. The slants were refrigerated at 4 C after sufficient growth was attained and served as inoculum for replicate treatments. The cultures from slants were grown through four successive incubation periods in autoclaved reconstituted NDM (11% solids) prior to H_2O_2-catalase treatment. All incubation periods were 16 hr at 37 C. Numbers of *S. aureus* after incubation in the final milk culture approximated $1x10^{10}$/ml when counted on PCA.

Hydrogen peroxide-catalase treatment

Numbers of *S. aureus* were adjusted by serial dilution in buffered distilled water to approximately $1x10^5$/ml in the treatment medium of autoclaved reconstituted NDM at 54.4 C. Clumps of cells were dispersed by osterizing the initial dilution of the milk culture.

The concentration of H_2O_2 in milk was adjusted to 0.05% by adding 2 ml of 5.0% H_2O_2 to 198 ml of treatment medium. After treatment at 54.4 C for either 40 seconds, or 1, 2, 3, 4, 5, 7, 9, 11, 13, or 15 minutes, 9.0 ml portions of the milk-culture mixture were removed from the treatment flask and added to test tubes containing 0.5 ml of 0.1% catalase solution (Armalase A-100) at 32.5 C. All tubes were held at this temperature for 20 minutes to insure complete destruction of residual H_2O_2. Routine tests of milk for H_2O_2 with Peroxystyx[1] indicated this treatment was sufficient. The tubes were then placed in an ice bath until plating.

Enumeration of survivors

Numbers of cells before H_2O_2-catalase treatment and numbers of cells surviving the treatment were determined by standard plate count methods *(1)*. The following plating

[1]Published with the permission of the Director of the Agricultural Experiment Station of the University of Wisconsin.

media were compared with PCA: Staphylococcus Medium 110 (SM110), Staphylococcus Medium 110 with added egg yolk (SM110-Ey), trypticase soy broth with added agar-BBL (TSA), TSA with added yeast extract (TSAY), Difco tryptic soy agar, and heart infusion agar (HIA). All media were prepared according to instructions of manufacturers. The TSA and HIA were prepared according to Deneke and Blobel but without added fibrinogen *(3)*. Yeast extract was added to TSA at 2.5g/1,000 ml of media. The SM110-Ey was prepared by dispersing the yolks of two fresh eggs in 1,000 ml of autoclaved SM110 medium at 47 C. The eggs were dipped in alcohol prior to cracking.

After pouring, all plates were incubated at 37 C for 48 hr. The plates poured with SM110-Ey were allowed to stand for an additional 24 hr at room temperature after the 37 C incubation.

Analyses of data

At least three replicates were made for each comparison of the individual media with PCA. The logarithms of survivors were plotted against time, and time intervals for 90, 99, 99.9, and 99.99% destruction were determined from the graph for each medium. Statistical differences between destruction times with the different media were determined by analyses of variance *(7)*.

RESULTS

Counts before hydrogen peroxide treatment

All test media gave similar counts of the *S. aureus* cultures in milk before treatment with H_2O_2. The greatest difference was observed between PCA and SM110, the count obtained on PCA being 1.2 times greater than that obtained on SM110 (Table 1).

Counts after hydrogen peroxide treatment

The test media differed in their ability to support maximum growth of the staphylococci surviving H_2O_2 treatment (Table 1). The counts obtained on SM110 and SM110-Ey were much lower than counts obtained on PCA. After 7 min of treatment, the count of survivors was 243 times greater on PCA than on SM110; it was 259 times greater than the count obtained on SM110-Ey after 9 min of treatment.

No viable cells were found in the treated milk after 7 min of treatment at 54.4 C when survivors were plated on SM110 and after 9 min when plated on SM110-Ey. More than 15 min of treatment were required before survivors were not detected on PCA.

Counts of survivors were slightly higher on HIA than counts on PCA. Counts on both media were zero after 15 min of treatment at 54.4 C.

Differences between counts on PCA and TSA or TSAY were slight, but increased steadily during the first 7 min of treatment and then decreased after longer treatment. No growth was observed on TSA or TSAY after 11 min of treatment, as compared to 15 min using PCA. The differences in counts on tryptic soy agar and PCA also increased during H_2O_2 treatment.

Destruction rates

The counts of *S. aureus* in Table 1 were used to calculate mean time intervals to cause 90 to 99.99% destruction of the population in milk before H_2O_2 treatment. The time intervals obtained from counts on PCA were compared with the time intervals estimated from the counts on other media.

The lower counts of survivors on the soy media and selective media gave destruction rates which would appear to be more rapid than would be true if a more suitable recovery medium were used. This was especially true for SM110 and SM110-Ey (Table 2). The apparent time required for 99.9% destruction was 56 and 38% shorter when survivors were plated on SM110 and SM110-Ey rather than PCA.

The statistical analyses in Table 3 indicate that neither selective media would be satisfactory for determining numbers of survivors. The difference in time required for 99.9% destruction was statistically significant when results obtained with either of these media were compared with PCA. The difference in time for 99.99% destruction would undoubtedly be significant also. The time required for 90% destruction with SM110 was not significantly less than PCA. The significant difference between the time for 90% destruction with SM110-Ey and PCA was caused by uniformity of counts within each treatment time rather than large differences between treatment times.

The destruction times obtained with nonselective media, shown in Table 4, approximated PCA better than the selective media. The apparent destruction times were slightly longer with PCA than with other media, except the time for 99 and 99.9% destruction when heart infusion agar was used as recovery medium. The differences between PCA and HIA were slight, with the PCA showing a longer time for 99.99% destruction.

There was no significant difference between the time for 90% destruction when survivors were plated on PCA or the other nonselective media (Table 5). Only tryptic soy agar and TSA showed a significant difference from PCA at the 99.9% level of destruction. The time required for 99.9% destruction of the culture with TSAY as recovery medium did not differ significantly from the time obtained with PCA.

It should be noted that the rates of destruction as determined with PCA differed between trials, but the use of PCA as a control in each replicate allowed the comparison of destruction using PCA and the other media.

[1]Product of Miles Chemical Company, Division of Miles Laboratories, Inc., Elkhart, Indiana.

TABLE 1. MEAN COUNTS OF *S. aureus* 196E ON 6 MEDIA AND RATIOS OF THESE COUNTS TO THOSE ON PCA; COUNTS WERE MADE BEFORE AND AFTER TREATMENT OF TEST CULTURE IN MILK AT 54.5 C WITH 0.05% HYDROGEN PEROXIDE

Media	Before treatment	Minutes of treatment 4	7	9	11	13	15
PCA	153,000	25,200	10,600	6,440	2,980	161	14
SM110	124,000	1,400	44	0	0	0	0
Ratio-PCA/SM110	1.2	18.0	243.1	–	–	–	–
PCA	156,000	17,900	7,800	5,340	730	125	13
SM110-Ey	152,000	11,800	605	21	0	0	0
PCA/SM110-Ey	1.0	1.5	12.9	259.2	–	–	–
PCA	109,000	464	56	23	12	3	0
HIA	105,000	1,620	283	70	23	7	0
PCA/HIA	1.0	0.3	0.2	0.3	0.5	0.4	–
PCA	265,000	23,800	8,680	3,750	358	143	14
Tryptic soy agar	266,000	21,600	1,520	208	8	0	0
PCA/Tryptic soy agar	1.0	1.1	5.7	18.0	44.2	–	–
PCA	116,000	8,010	3,260	437	87	8	0
TSA	110,000	2,610	349	187	18	0	0
PCA/TSA	1.1	3.1	9.3	2.4	4.8	–	–
PCA	126,000	20,700	8,610	1,630	212	16	0
TSAY	126,000	8,020	1,080	177	55	0	0
PCA/TSAY	1.0	2.6	8.0	9.2	3.9	–	–

DISCUSSION

Heart infusion agar and PCA were the most satisfactory media used for counting *S. aureus* after treating with hydrogen peroxide in milk at elevated temperatures. The heart infusion agar gave slightly higher counts of survivors at various stages of treatment; however, the differences between the times required for 90.0 and 99.9% destruction of the cultures were not statistically significant when survivors were plated on this medium or PCA. Complete destruction of the cultures was attained after the same duration of treatment when survivors were plated on either medium.

The two soy media compared favorably with PCA as plating media for untreated cells, but were less satisfactory as recovery media for peroxide-treated cells. The time for 99.9% destruction was significantly shorter when survivors were grown on tryptic soy agar and on TSA than when survivors were grown on PCA. When TSA contained yeast extract, no significant difference was noted between it and PCA. This was probably caused by greater variation of the data in the TSAY trials; differences in time for destruction between TSAY and PCA were similar to differences between TSA and PCA.

Both of the selective media gave significantly lower counts of survivors than PCA. This probably was caused by effects of the high concentration of NaCl on the treated cells. When egg yolk was added to the SM110 medium, longer destruction times resulted, but the difference between SM110-Ey and

TABLE 2. MEAN TIME IN MINUTES TO CAUSE 90 TO 99.99% DESTRUCTION OF *S. aureus* 196E TREATED IN MILK AT 54.4 C WITH 0.05% HYDROGEN PEROXIDE WHEN SURVIVORS WERE PLATED ON SELECTIVE MEDIA AND PCA

Media	Replicates	Per cent destruction 90%	99%	99.9%	99.99%
		(Mean time for destruction)			
		Minutes			
PCA	5	4.03	6.98	9.48	10.38
SM110		1.80	2.92	4.33	6.12
PCA	5	3.37	6.11	8.90	12.02
SM110-Ey		2.49	4.02	5.53	7.20

TABLE 3. ANALYSES OF VARIANCE OF TIME INTERVALS FROM TABLE 2

Comparison	Source	Degrees of freedom	Mean squares for two levels of destruction 90%	99.9%
I. SM110 vs. PCA	Treatments	1	12.477[c]	66.203[b]
	Replicates	4	10.729[c]	22.757[c]
	Error	4	1.769	5.185
II. SM110-Ey vs. PCA	Treatments	1	1.980[b]	28.325[b]
	Replicates	4	11.367[a]	22.013[b]
	Error	4	0.155	2.197

[a]Highly significant ($P<0.01$); [b]Significant ($P<0.05$); [c]Not significant.

TABLE 4. MEAN TIME IN MINUTES TO CAUSE 90 TO 99.99% DESTRUCTION OF *S. aureus* 196E TREATED IN MILK AT 54.4 C WITH 0.05% HYDROGEN PEROXIDE WHEN SURVIVORS WERE PLATED ON NONSELECTIVE MEDIA AND PCA

Media	Replicates	Per cent destruction 90%	99%	99.9%	99.99%
		(Mean time for destruction)			
		Minutes			
PCA	5	1.22	2.85	5.38	9.48
HIA		1.20	3.59	6.32	9.39
PCA	3	3.82	8.62	11.90	14.46
Tryptic soy agar		3.47	5.91	8.43	11.07
PCA	8	1.89	4.19	6.92	10.75
TSA		1.77	3.53	5.28	7.09
PCA	3	3.77	6.41	9.47	12.88
TSAY		2.91	5.16	7.93	10.31

TABLE 5. ANALYSES OF VARIANCE OF TIME INTERVALS FROM TABLE 4

Comparison	Source	Degrees of freedom	Mean squares for two levels of destruction 90%	99.9%
HIA vs. PCA	Treatments	1	0.001[c]	2.172[c]
	Replicates	4	0.390[b]	9.112[c]
	Error	4	0.106	1.316
Trptic soy agar vs. PCA	Treatments	1	0.177[c]	17.715[b]
	Replicates	2	0.252[c]	1.956[c]
	Error	2	0.305	0.217
TSA vs. PCA	Treatments	1	0.563[c]	10.709[a]
	Replicates	7	3.890[b]	16.519[a]
	Error	7	0.775	0.535
TSAY vs. PCA	Treatments	1	0.882[c]	3.573[c]
	Replicates	2	7.630[c]	30.324[c]
	Error	2	0.501	0.859

[a]Highly significant ($P<0.01$); [b]Significant ($P<0.05$); [c]Not significant.

SM110 was slight. The turbidity of the SM110 and the SM110-Ey media made it more difficult to count the survivors accurately. Additional incubation at room temperature produced larger colonies on the plates.

ACKNOWLEDGMENT

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COURSE ON BACTERIOLOGICAL EXAMINATION OF FOODS

A training course, Food Microbiology, will be conducted by the Public Health Service, April 11-22, 1966, at the Robert A. Taft Sanitary Engineering Center, Cincinnati, for laboratory and supervisory personnel engaged in bacteriological examination of foods. This instruction enables the trainee to perform laboratory analyses with an acceptable level of precision and accuracy and to study a series of methods for examining foods. The course is conducted by personnel of the Division of Environmental Engineering and Food Protection.

Detailed information about the course is given in the new Training Program Bulletin of Courses which is available on request. Applications for enrollment or requests for information should be addressed to the Director, Training Program, Robert A. Taft Sanitary Engineering Center, 4676 Columbia Parkway, Cincinnati, Ohio 45226. No tuition or registration fee is required.

ONE QUALITY STANDARD FOR ALL MILK—AN ATTAINABLE GOAL[1]

H. L. Forest[2]

U. S. Department of Agriculture
Washington, D. C.

The cause of improving quality in dairy products should continue to command the attention of every person in the industry. Without a quality product there can be no real base for improving returns to dairy farmers. The more technologically advanced, the more complex, the more specialized and interdependent we become in this world, the greater is the need for maintaining quality. We need to anticipate changes in processing, product characteristics and equipment. We must be constantly on the alert that we do not effect counter changes which will weaken or slow down improvements in the quality of the finished products. We recognize this need and are diligently seeking and supplying ways and means of achieving milk quality.

This is an excellent time to take stock of the variety of efforts made, in and out of government, to promote the dairy industry. I have been asked to discuss the ramifications of some of our efforts in USDA especially on the matter of one quality standard for all milk. I am reminded that ours are continuing efforts by the words carved in stone over the 14th Street entrance to the Agriculture Building in Washington, D. C. which state, "Dedicated to the Service of Agriculture for the Public Welfare." Last February, Secretary of Agriculture Orville L. Freeman announced the formation of the Consumer and Marketing Service, bringing together into one agency the major consumer protection services, marketing services, marketing regulation programs, and consumer food programs of the Department of Agriculture.

The Dairy Division, is a unit of this service agency. We are proud of the opportunities to offer our services to consumers, to those engaged in marketing, and to producers. So that you may better understand our efforts let me give you selected examples of our services.

Service to the Consumer

Recall for a moment that you are also a consumer. As a typical American consumer, you shop for food once a week in a spacious, air conditioned supermarket, select from some 7,000 items and pay less than 19 percent of your spendable income for your food purchases.

No question arises with respect to the safety of the foods you buy because sanitarians like yourself and other dedicated men and women in industry are working behind the scene to protect the food supply. Every day somewhere, our Dairy Division inspectors, in addition to grading, are making detailed sanitation inspections of butter, cheese, dry milk and other dairy product manufacturing plant operations. This service is for voluntary use by the manufacturer and fees are charged to cover the cost. Nevertheless, this plant survey service increases every year. For example, we made more than 4300 inspections in 1964 as compared to about 1500 inspections in 1959. In addition, in 1964 we graded 62 percent of the butter and 59 percent of the nonfat dry milk production. Over 500 different brands of butter carry the U. S. grade shield. We are also providing our resident inspection and grading service at 12 grading stations and at 33 plants that have contracted for our quality improvement and control service programs.

This means to me that the dairy industry is behind efforts to encourage the manufacture of uniform high quality dairy products. This is one indication that the tide seems to be running toward one quality standard for milk because it takes good milk to make a good product. Manufacturers and processors know that with better quality milk it is easier to produce a higher quality finished product.

Our Federal milk market order programs also provide assurance to consumers of adequate supplies of high quality milk and some figures on milk quality may show the direction the dairy farmer is taking in marketing his milk. In 1964, 65 percent of the milk produced was eligible for fluid use. Sixty percent of the remaining 35 percent of the milk was produced in the three states of Iowa, Minnesota and Wisconsin. Only 17 percent of the milk marketed in the other 47 states was not eligible for fluid use. These figures reflect a steady trend toward one grade quality of milk.

This does not mean that there will not always be differences in milk quality. I'm confident that milk will always have to be checked, graded and selected to assure continuing high quality and the best utilization. There are, and history indicates there always will be, producers who are better equipped or better

[1]Presented at the 52nd Annual Meeting of the International Association of Milk, Food and Environmental Sanitarians, Inc., Hartford, Conn., September 13-16, 1965.

[2]Director, Dairy Division, Consumer and Marketing Service, USDA.

able to produce higher quality milk than others even under the same quality standards. For this reason, a milk processor or manufacturer cannot accept all milk that he receives without first checking the quality. This also means that laboratory control, inspections and field work will continue to be important at all times, if we are to maintain the highest quality.

SERVICE TO THOSE ENGAGED IN MARKETING

Our talks with plant managers about plant survey findings provide us with an example of the second type of service we offer and another indication of the trend toward one quality milk standard. We have found that the dairy industry is interested in having a more comprehensive description of good plant practices, procedures and equipment. Therefore, for the past several years we have been working on and plan to publish in the near future a revision of our present, "Minimum Specifications for Approved Plants". The revision is called, "General Specifications for Dairy Plants Manufacturing, Processing, and Packaging Dairy Products". It describes the general requirements applicable to all dairy plants regardless of the product manufactured. In addition, we have prepared supplements which will more specifically cover those points applicable to a particular product or group of similar products. We have already received assurance from industry leaders that the revised "specs" will be welcomed and should prove helpful.

Effective last April 1, the direct microscopic clump count maximum level in the U. S. grade standards for spray and roller nonfat dry milk was lowered from 250 to 200 million per gram. But the picture is actually brighter than this when we consider that, in the hot month of July, 60 percent of the 1060 carlots of nonfat dry milk we graded had DMC counts of 75 million per gram or less. Again we see that the trend is toward a better, uniformly high quality milk.

SERVICE TO PRODUCERS

Nearly 170,000 dairy farmers delivered 50 percent of the nation's fluid milk supply in 1964 to plants regulated by Federal milk orders; and prices received by thousands of other dairy farmers were influenced by the prices paid under these orders.

Milk orders are voluntary programs initiated by farmers. The order may be issued by the Secretary of Agriculture only after a public hearing, at which farmers, handlers and consumers may testify after the farmers vote approval through a referendum. The classified-use system of pricing milk provided in the orders has proven to be an effective means of reducing seasonal or other short-range fluctuations. This leveling tends to take away the pressure of production changes, encourages orderly marketing, and assures the processor an adequate supply of wholesome milk.

I have noticed that some of the local differences in codes which would impede the movement of milk, are often removed when a milk order is approved. As an example of the movement of milk between market orders, in October 1959 slightly more than 99 million pounds of milk was shipped from one order market to another. In October 1964, this figure more than doubled and was over 207 million pounds.

The factor of economics plays heavily in this trend toward one quality of milk. The national shift toward a more urban rather than rural economy has provided the dairy farmer with additional market potential. He sees that there are good markets for his milk other than close at home. He also sees that if he wishes to take advantage of these markets he must make the investment of time and money to produce a milk that can withstand the rigors of long distance hauling. He also sees that each market may have different sanitation codes or degrees of enforcement. But he also sees these differences in sanitation codes or enforcements are being resolved, largely through the great effort of sanitarians to improve and develop uniform codes. He sees that the enforcement or interpretation of the codes is more uniform due, in part, to meetings like this and the National Conference on Interstate Milk Shipments.

THE IMPORTANCE OF GOOD QUALITY

The improved technical know-how has also pushed the trend toward one quality of milk. Processing plants also are much larger and able to establish effective quality control methods. Quality minded plants don't want to receive low quality milk. It is becoming harder for producers of poor quality milk to find a market—due in part to differences in quality and in part to distance from the market. Until fairly recently it would have been almost impossible for the farmer to take advantage of better prices in other areas. Today the long distance shipment of milk is an every day occurrence. This opening of new markets is possible because the dairy farmer of today produces milk in sufficient quantity and of such quality that handlers can contract for and deliver the milk over great distances. Large scale distribution methods require volume and uniformity of quality.

On the production side, larger, more specialized dairymen are able to make the necessary investments for items such as bulk holding tanks, good housing facilities, etc. Because they are specialized they also have more "know-how". The introduction and wide spread use of the bulk milk tank has helped make this possible. In fact the bulk tank method of handling milk has enabled many farmers to meet qualifications as Grade A producers. The trend toward bulk handling is now moving into the area of manufacturing milk supplies where individual producer shipments are often much smaller than in fluid mrakets. At all levels technological advances have played an important part in quality improvement and make the achievement of uniformity less difficult.

Milk for Manufacturing Purposes

In 1963 the Dairy Division published the "Minimum Standards for Milk for Manufacturing Purposes and Its Production and Processing Recommended for Adoption by State Regulatory Agencies". This culminated several years of cooperative work with industry, university and state regulatory officials. These standards are available for voluntary adoption by the states to provide for a more uniform approach to the problem of improving the quality of milk used for manufacturing dairy products.

We are pleased that several states have already patterned revisions of their regulations after the proposed standards. The important thing is that every state should and probably will examine more closely its quality program for manufacturing milk and make sure that the program is adequate for the job.

I predict that the various quality requirements for milk will be adjusted and someday only one quality standard will be needed. Milk will flow freely to market and be used in the form that will return the most profit. This change will be possible because most farmers will produce the milk the processor needs to fill the desires of his customers.

In the past few years we have witnessed many improvements and each of us in our own way has contributed to the efforts which have advanced the dairy industry. We have actively worked for improvements in technical knowledge, such as more efficient transportation facilities and more effective milk handling techniques. We have counselled for the elimination of artificial trade barriers and encouraged the adoption of uniform milk quality standards by the states and municipalities. We have seen the growth of interdependence of markets. I should not leave this discussion without recognizing the great influence the USPHS Milk Ordinance and Code has had toward the improvement of milk quality. More progress will come, and at a faster pace, in keeping with the more rapid changes of other phases of life throughout the world.

Definitely the trend and need is for one quality standard. How or when this will occur we cannot say but the signs point that way. The idea is intriguing; it holds forth the opportunity for providing improved uniformly high quality dairy products to the consumer, the probabilities of increased consumption of dairy products, and more profit for the farmer. No door should be left unopened in our search for improved quality of dairy products.

MIF TAKES EXCEPTION TO FDA[1] VITAMIN D PROPOSAL

Because Vitamin D has so long been known as a desirable dietary component, particularly for young children, the Milk Industry Foundation has filed comments with the Food and Drug Administration questioning the wisdom of a proposed action which could tend to discourage the practice of using vitamin fortified milk in the diets of infants and children.

The FDA proposal would change the status of Vitamin D from a substance "Generally Recognized as Safe" to a food additive with a concomitant restriction that its addition to milk and milk products be limited to 400 USP units per quart. Such action, MIF says, would tend to create misgivings. The Foundation pointed out to FDA that fortification of milk and milk products with Vitamin D is universally recognized as desirable and is regarded as being largely responsible for preventing the incidence of rickets in the U. S., according to Dr. W. H. Sebrell, Jr. in a letter to FDA's Hearing Clerk. This is the basis for MIF's apprehension that to characterize Vitamin D as a food additive may tend to discourage mothers and others from using fortified milk for their infants and children.

The Foundation also contends that an absolute limit of 400 USP units is impractical and asks that skim and low fat milk be specifically included among products to which Vitamin D may be added.

[1]See page 87.

THE CELLULAR CONTENT OF COWS MILK.

I. AN EVALUATION OF THE CALIFORNIA MASTITIS TEST AS A METHOD OF ESTIMATING THE NUMBER OF CELLS IN MILK

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(Received for publication November 10, 1965)

Summary

Cell counts and California Mastitis Test (CMT) scores were compared on 1,214 individual quarter samplings. Despite the fact that there was a high correlation (>0.85) between CMT score and log of cell count, almost half (48.8%) of the quarters were misclassified by the CMT as compared to the cell counts obtained from Breed smears.

These data indicate that the CMT conducted on a single foremilk sample is a poor estimator of the inflammatory status of the quarter.

Fifty-five years ago Prescott and Breed *(4)* wrote, "For some time sanitarians have felt that it was important to be able to determine the number of body cells in milk. Large numbers have been held to be undesirable inasmuch as such conditions seem to be associated with abnormal conditions of the udder." Today we can at best only modify the degree of uncertainty expressed by these researchers. During the past eight or so years the California Mastitis Test (CMT), developed by Schalm and Noorlander *(5)*, has been widely used in milk quality and mastitis control efforts, and to some degree in mastitis research. Despite the absence of information concerning the range, distribution and uniformity of test results, the test has been recommended as a valuable tool for the veterinarian *(3)* and has been used as a basis for treating or culling cows and rejecting milk. These investigations were undertaken to evaluate the usefulness of the CMT as a method of estimating the number of body cells being shed by an individual quarter.

Materials and Methods

Originally our purpose was to use the CMT as a cow-side test to indicate changes occurring in the quarters of our experimental animals. The data presented here represent 1134 quarter samples collected in conjunction with our studies on the inflammatory response to infusions of sterile salt solutions. Each experimental group consisted of six first lactation heifers, maintained in our controlled environment chambers during the course of each infusion trial. From these cows, five-ml samples of strict foremilk were collected prior to each milking and at two equally spaced intervals between milkings. Immediately following the collection of the sample, the CMT was performed as an immediate cow-side indicator of the inflammatory status of the quarter. We also included samples from the quarters of 20 cows in the Beltsville breeding herd. These samples were collected prior to an afternoon milking. Cell counts were determined by counting 20 microscope fields of a Breed smear *(1)* prepared from the fresh quarter milk samples and stained by the Levowitz and Weber *(2)* method. We standardized our reading of CMT reactions against those of Dr. J. R. Schabinger, a Dairy Extension Specialist at the University of Maryland who has several years of intensive experience with the method in a pilot mastitis control program. We added to Schalm's *(6)* recommended scoring procedure the classifications >1 <2 and >2 <3 for borderline reactions.

Results

Table 1 summarizes the results from the 1214 samplings. The mean cell count corresponding to each CMT score is given at the bottom of the Table. With the exception of the mean cell count of 210,000 for the group scoring zero (occasioned by only eight samples with extremely high cell counts) the means for each CMT score were very close to the expected, based on Schalm's *(6)* suggested interpretation. Figure 1 shows the relation of mean cell count (plotted on log scale) to the numerical CMT score. This plot was used to interpolate a numerical score of approximately 0.2, 1.2 and 2.2 for the trace, >1 <2, and >2 <3 classifications, respectively.

The correlation between the indicated numerical scores and the log of cell count was 0.85. These mean cell counts, the good regression and the high correlation between CMT score and count indicate that the CMT is a good estimator of cell counts. These generally applied statistical relationships, however, are not sufficient criteria to judge the ability of the CMT to estimate the number of body cells being shed by a single quarter of one cow on a given day. In addition to the overall correlation between the CMT score and cell count, the range and distribution of counts for each CMT score must form the basis for our interpretation of the test results. These data, as shown in Table 1, may be characterized by the following observations:

Samples scoring CMT 0 (negative)

Most of the samples (77.7%) had counts below 200,000, i.e., within the customary limit of interpretation.

TABLE 1. CELL COUNT FREQUENCY FOR EACH CMT SCORE

Cell count x 10^{-6}	Percent of samples with indicated CMT score[a] 0	T	1	>1 <2	2	>2 <3	3
0.10 or less	*56.5*	48.8	28.0	13.3	8.3	5.7	
0.11 - 0.20	*21.4*	*20.7*	22.0	21.3	9.8	1.1	
0.21 - 0.30	9.7	*9.8*	7.9	5.3	5.2	2.3	1.4
0.31 - 0.40	3.4	*6.1*	7.9	12.0	6.3	3.4	
0.41 - 0.50	2.9	*2.4*	*6.3*	8.0	6.7	2.3	
0.51 - 0.60			*6.7*	6.7	5.2	1.1	
0.61 - 0.70			*2.1*	1.3	3.1	3.4	
0.71 - 0.80	2.9	8.5	*2.9*	4.0	2.6	1.1	3.3
0.81 - 0.90			*2.5*	1.3	*3.1*	1.1	
0.91 - 1.0			*1.3*	1.3	*3.6*	4.4	
1.1 - 2.0		3.7	*6.3*	17.3	*24.0*	26.1	11.7
2.1 - 3.0			2.9	6.7	*13.0*	15.9	14.3
3.1 - 4.0			1.3	1.3	*3.6*	15.9	11.3
4.1 - 5.0					*2.1*	6.8	*8.3*
5.1 - 6.0	3.4					2.3	*8.0*
6.1 - 7.0			1.6			2.3	*6.0*
7.1 - 8.0					2.5		*4.7*
8.1 - 9.0						4.6	*2.7*
9.1 - 10.							*3.7*
>10.							*24.7*
No. samples	238	82	239	75	192	88	300
Mean count	0.21	0.24	0.55	0.70	1.7	2.3	9.1

[a]Values shown in italics are within the customary cell count range for the respective CMT score.

A few samples (3.4%) had counts greater than 1 million and ranging up to 9.3 million. These high-count samples could not be discarded as recording or laboratory errors because the phenomenon persisted for several consecutive samplings of the quarters involved.

Our best statement concerning samples with a CMT score of zero is that 93.7 of the samples had counts of 500,000 or less.

Samples scoring CMT trace

Less than 40% of the samples fell within Schalm's suggested range of interpretation (150,000 to 500,000).

Almost half (48.8%) of the samples had counts below 100,000 (Schalm's suggested lower limit is 150,000). About 12% of the samples had counts over 500,000 which is the upper suggested limit for CMT trace samples.

Our best descriptive statement here is that 96.3% of the samples had counts of a million or less.

Samples scoring CMT 1

Approximately 28% of the samples fell within Schalm's range.

Our most frequent sub-class, containing 28% of the samples, is less than 100,000.

Most of the samples (65.8%) contained 400,000 or less cells; 6.1% had counts greater than 2 million.

We can state that 94% of the samples scoring CMT 1 had counts of 2 million or less.

Samples scoring >1 <2

More than half (51.9%) of the samples had counts of 400,000 or less (the lower limit for CMT 1).

We can say that 91.9% of the samples had counts of 2 million or less.

Samples scoring CMT 2

Half of the samples (49.4%) fell within the accepted range of interpretation.

Samples scoring CMT 2 show a long triangular distribution with 47.2% containing 800,000 or less and 2.5% containing 5 million or more (the upper and lower limits respectively).

We can state that 97.5% of the samples had counts of 5 million or less.

Samples scoring >2 <3

These samples have a very wide range with 20.4% having counts of 800,000 or less.

We can say that 95.3% of these samples had counts of 7 million or less.

Samples scoring CMT 3

About half (58.1%) of the samples had counts within the accepted range of interpretation (>4,000,000).

We can say that 95% of the CMT 3 samples had counts exceeding 1 million.

DISCUSSION

These data suggest that the CMT is a poor estimator of the concentration of cells in the secretion of an *individual quarter.* Despite the high correlation between the mean relationships, we have been unable to develop a meaningful set of statements for interpretation of count limits. Based on the wide range of interpretation referred to above, 47.8% of the samples were misclassified.

A much wider range of CMT score interpretation is warranted, and the overlapping is too great to permit one to derive any information about the concentration of body cells in a quarter from intermediate CMT scores.

There are three possible sources of error inherent

TABLE 2. COMPARISON OF CMT SCORES AND CELL COUNTS OBTAINED FROM ALTERNATE QUARTER SAMPLINGS AT BEGINNING OF MILKING

	Group 1		Group 2	
	Cell count Sample 3 vs. 1	CMT score Sample 4 vs. 2	Cell count Sample 4 vs. 2	CMT score Sample 3 vs. 1
Increased	12	4	7	8
No change	9	50	25	16
Decreased	39	6	28	36
Total samples	60	60	60	60

in the collection and interpretation of these data: First, scoring the CMT reaction is inherently subjective. Published descriptions of discrete reaction stages cannot completely eliminate differences in judgement as to degree of intensity. In the attempt to standardize our scorings against those of an expert practitioner, the results on individual quarters of twenty cows convinced us that we had achieved close agreement. These samples, however, did not show an increase in the accuracy of classification as measured by cell count. Even though it be impossible to maintain the exact same standard at all scorings, one can with certainty rank the intensity of reaction among samples represented in the paddle at the same time. In these data, however, 18% of our quarter samples did not rank the same in count and CMT score.

The second source of error concerns the accuracy of the cell count obtained from the Breed smears. This is a major problem in its own right, and we are currently investigating it. At present it will be sufficient to state that counting errors follow the Poisson distribution and that counting errors associated with our procedure should not account for a major share of the misclassifications reported here. If either or a combination of these sources of error were major factors we would expect to obtain distributions with frequencies peaking near the mean, and with long tails on either side. In these data there is no indication of distributions with the most frequent sub-class near the mean for each score.

A third possible source of error involves the sampling procedure. The cell counts were determined from a smear made from a 0.01 ml subsample of the first 5-ml of milk drawn from the quarter; the CMT was performed at the cow's side on the next stream of milk. If there were real differences between the cell count in the first 5-ml and the next stream of milk these differences would contribute to the disagreement between the two estimates of cell count. The phenomenon would also lessen the reliability of a single sample in reflecting the cell concentration of the quarter. Preliminary data concerning this source of variation is shown in Table 2. Prior to an evening milking, we collected four consecutive 5-ml samples from two groups of cows. Cell counts and CMT's were conducted on alternate samples. These results indicate that most quarters exhibit a decrease in cell count through the four samples. In both groups, the mean cell count decreased 50% between the earlier and later samples. In group 1, the CMT score did not change significantly between samples 2 and 4; in group 2, 20% of the quarters decreased in CMT score between samples 1 and 3. Since repeatability of results is one of the important considerations in evaluating the inflammatory status of the individual quarter the variation in cell content between samples merits further study.

It is apparent that this type of error could markedly influence the cell count distributions obtained in this study. Since the CMT was always performed subsequent to sampling for Breed smear, one would expect on the basis of these findings that any noncomparability of the methods would tend to be in the direction of spuriously low CMT values. Inspection of Table 1, on the other hand, shows that any shift of values to correct such an error would only magnify the deviation of our results from the generally accepted relationships between cell con-

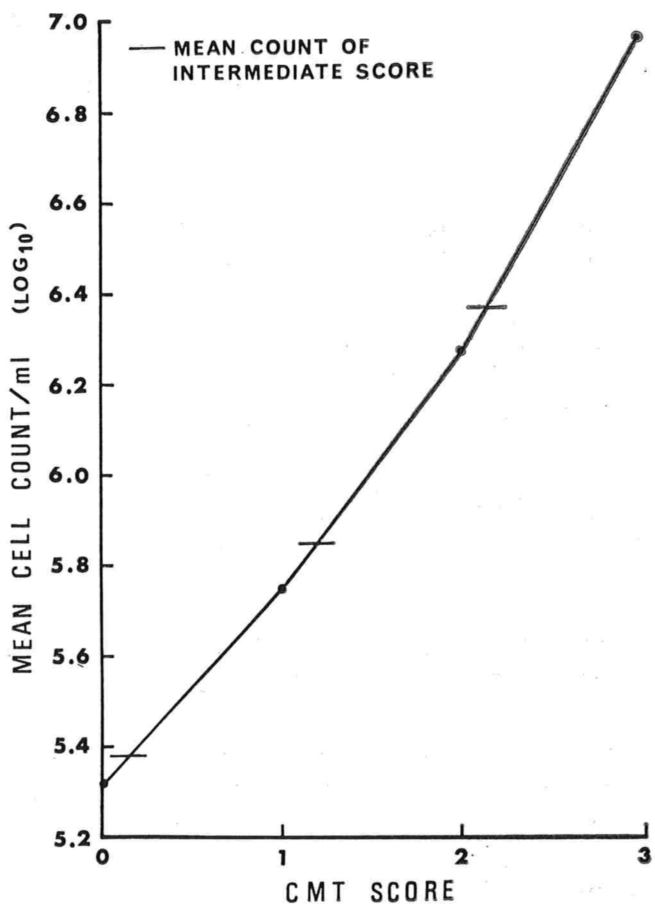

Figure 1. Relation between mean direct microscopic cell count and CMT score.

centration and CMT score. In a subsequent publication we shall show the relationships found to exist between the direct microscopic cell counts and the CMT on split quarter milk samples.

Since much of the literature concerning the relationship between cell count and CMT score gives only the means or correlation coefficient, it is impossible to determine whether the findings reported here differ in fact or interpretation from a number of reports that indicate good results with the CMT. Our results appear to be in very close agreement with those reported by Spencer and Simon *(7)*. Reporting on results of a modified CMT, designated the Brabant Mastitis Reaction, Van Der Schaaf *(8)* also indicated similar findings.

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FDA PROPOSAL TO REDUCE VITAMIN D IN FOOD PRODUCTS

The Food and Drug Administration, Department of Health, Education, and Welfare, is publishing a proposal which, if adopted, would reduce the amount of vitamin D that may be added to food products. Purpose of the proposal is to prevent possible injury to infants.

Commissioner George P. Larrick said that last November Dr. Robert Cooke of Johns Hopkins University had expressed concern that the ingestion of excessive amounts of vitamin D was a possible cause of infantile hypercalcemia. This is a condition which in its severe form involves not only an increase of calcium in the blood but changes in the bony structure of the face, an effect upon the aortic valve of the heart, and mental abnormalities.

On the basis of Dr. Cooke's views, the Commissioner invited the Committee on Nutrition of the American Academy of Pediatrics and a joint Committee of the Council on Foods and Nutrition and the Council on Drugs of the American Medical Association to look into this problem. Both Committees recommended that, while there has been no positive demonstration of a cause and effect relationship of vitamin D to this disease, there should be restrictions on the marketing of foods containing added vitamin D.

The Committees made clear that there is abundant scientific evidence to demonstrate that an excessive intake of vitamin D is of no value. Four hundred USP units per day will meet the full requirements of infants, children and nursing mothers. For years large therapeutic doses of vitamin D have been held to prescription sale. "In the light of all we know about vitamin D," Mr. Larrick said, "I have reached the conclusion that prudence calls for issuing a proposal based on the recommendations of the expert committees since the restrictions suggested would not deprive the public of any needed nutrients."

The proposal would permit the continued addition of vitamin D to such foods as milk, milk products and infant formulas at a level of 400 USP units per quart. Over the counter vitamin D preparations would be limited to a dosage of 400 USP units of vitamin D per day. The proposal would deny authority for the addition of vitamin D to standardized foods such as enriched flour, enriched corn meal, enriched rice, enriched macaroni products, enriched bread and margarine.

THE QUALITY OF RAW MILK FROM SELECTED OHIO MARKETS. I. FLAVOR[1]

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(Received for publication October 13, 1965)

Summary

An 8-month survey was made on the flavor of raw milk supplies from four major Ohio markets. A total of 317 milk samples obtained from farm bulk tanks and from tank trucks were examined fresh and after storage at 38-40 F for 48 hours. Approximately 40% of the industrial producer's fresh milk supply had highly satisfactory flavor quality and the flavor of 10% of the shipments was completely undesirable. The combining of the producers' milk in the tank pick-up truck resulted in milk for the plants having a flavor that was neither very good nor very bad. The most common flavor defect was "feed" but other flavors frequently encountered were "cowy" and "rancid." A significant flavor deterioration occurred in the raw milk during its storage for 48 hr at 38-40 F. The principal changes involved the development of such flavors as "rancid," "unclean" and acid-associated flavors such as "malty." The rancid flavor was a common defect in the milk after storage during the winter season, and unclean, musty, oily and the acid-associated flavors were frequently found in the milk after storage during the summer season. The results suggest the need for more adequate milk flavor control measures and that milk should be processed as soon as possible after reaching the plant if it is to possess the finest possible flavor.

As a part of a survey of the quality of the raw milk supply of selected Ohio markets, attention was given to the flavor of 287 samples of milk obtained directly from bulk tanks at the farm and from the 30 tank trucks used to transport this milk to the plant. The results are presented in this paper.

Procedure

Sample Collection

The survey encompassed four major Ohio market areas over an eight-month period, July through February. Milk was collected from farm bulk tanks just before the milk was transferred to the tank pick-up truck and from the tank trucks transporting the milk upon their arrival at their destination. At the time of sampling, the odor of the milk was observed, the milk was agitated, its temperature determined and samples taken aseptically and placed in sterile glass containers *(1)*. The samples were kept refrigerated and transported directly to the laboratory for examination.

Flavor Evaluation

One portion of each milk sample was examined for flavor immediately upon arrival at the laboratory and another portion was held for 48 hr at 39-40 F before evaluation. All samples were pasteurized (145 F for 30 min) and cooled to 60 F before being evaluated by a panel of three judges using the numerical scoring guide developed by the American Dairy Science Association *(2)*. Each sample was given a numerical evaluation based on its flavor which placed it into one of the following four classes: "Excellent" (40 or higher), "Good" (38-39.5), "Fair" (36-37.5) and "Poor" 35.5 or below).

Results and Discussion

General

In the process of collecting milk for flavor evaluations, observations were made regarding (*a*) the quantity of milk delivered, (*b*) the number of producers supplying milk for the particular tank truck load, (*c*) the temperature of the milk and (*d*) the accuracy of the bulk tank thermometers.

The quantity of milk supplies per producer per shipment ranged from 110 to 7,894 pounds with the majority supplying from 1,000 to 2,000 pounds. The milk from 96% of the producers was collected on alternate days.

The individual trucks collected milk from 3 to 17 producers per trip with over one-half collecting from more than 10 producers per trip. The tank truck loads of milk ranged from 6,210 to 24,319 pounds with 76% being between 10,000 to 20,000 pounds.

The temperatures of the milk at the farms ranged from 32 to 44 F with 77% of the shipments having temperatures of 38 F or below and 22% of the supplies having temperatures of not above 35 F. The temperature of the milk in the tank trucks at the end of the route was 40 F or less on all but one of the 30 routes.

Nine per cent of the thermometers installed on the bulk tanks varied from the official thermometer by more than the recommended tolerance of 2 F and 6% were not functioning.

Milk Flavor Classification

A summary of the flavor evaluations of the fresh and the stored milk is presented in Table 1.

In the flavor categories, it is assumed that the classifications of "Good" and "Excellent" represent

[1]Article 95-65. The Ohio Agricultural Research and Development Center.

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TABLE 1. FLAVOR CLASSIFICATION OF RAW MILK SAMPLES FROM FARM BULK TANKS AND TANK TRUCKS

Flavor classification	Farm bulk milk samples		Tank truck milk samples	
	(No.)	(%)	(No.)	(%)
Evaluated fresh				
Excellent	1	0	0	0
Good	115	40	5	17
Fair	139	49	25	83
Poor	32	11	0	0
Total	287		30	
Evaluated after 48 hr storage at 38-40 F				
Excellent	1	0	0	0
Good	37	14	0	0
Fair	155	58	24	86
Poor	76	28	4	14
Total	269		28	

highly satisfactory milk, the classification of "Fair" represents "acceptable milk" but of inferior quality, and the classification of "Poor" is milk which is unacceptable, and if it were delivered to the plant as an individual producer's supply, should be rejected. On the basis of this classification, the results on the fresh milk from producers' supplies reveal that from the flavor standpoint, 40% of the milk is highly satisfactory, about one-half of the milk is acceptable but inferior, and about 10% of the milks are of reject quality.

The flavor results for freshly-delivered tank truck milk reflect the influence of blending the individual producers' supply: there is less superior-flavored milk and no reject flavored milk - and the milk largely falls into the in-between categories of "Good" to "Fair." Actually, the milk in 25 of the 30 shipments was graded "Fair," indicating that it was generally of inferior quality.

Storage of the milk for 48 hr at 40 F resulted in considerable deterioration in the flavor. For the farm bulk tank milk, only 14% of the samples were rated as "Good" or better, and 28% were found to have highly objectionable flavors and were placed in the "Poor" category. The same general downward trend in flavor quality was also observed for the tank truck milk as the result of storage. None of this milk had a highly satisfactory flavor following the storage and some of the shipments had reached the reject or "Poor" classification in flavor by the end of the storage period.

The results suggest that raw milk is susceptible to appreciable flavor deterioration even within a two-day refrigerated storage period and emphasize the need for dairy plants to establish suitable flavor control measures both on the farm and in the plant. Factors involved are the flavor quality of the raw milk as it leaves the farm, satisfactory storage temperatures in the plant and the utilization of the entire lot of milk at the earliest possible moment. It is obvious that any appreciable delay in the processing of milk may result in a lower flavor quality of the milk.

Specific Flavor Defects

The odor of the milk in the farm bulk tanks was generally identified as "feed," although about 10% of the milks exhibited "cowy" or "barny" and "musty" odors. The low temperature of the milk in the bulk tanks made it difficult to grade the milk by odor alone.

The flavor defects noted in the milks and the frequency of their appearance are presented in Table 2. For both the fresh farm bulk tank milks, and the tank truck supplies, feed flavor was predominant, being present in 85% of the producers' samples. "Cowy" or "rancid" were other defects noted to an appreciable extent in the producers' supplies.

After storing the bulk tank milk, the incidence of rancid, oxidized and miscellaneous flavor defects increased significantly. The significant increase in flavor defects grouped as "Miscellaneous" resulted largely from the development of an off-flavor characterized as "unclean" which was attributed to growth of psychrophilic bacteria. Acid-associated flavors such as malty, also occurred to a limited extent in these milks. Thus, there is an indication of considerable deterioration in the raw milk flavor due to microbiological activity during storage.

The predominance of feed flavor in the fresh milk

TABLE 2. FREQUENCY OF OCCURRENCE OF SPECIFIC FLAVOR DEFECTS IN RAW MILK SAMPLES FROM FARM BULK TANKS AND TANK TRUCKS

Flavor defects	Farm bulk milk samples		Tank truck milk samples	
	(No.)	(%)	(No.)	(%)
Evaluated fresh				
No criticism	1	0	0	0
Feed	245	85	27	90
Rancid	11	4	0	0
Oxidized	1	0	0	0
Cowy (barny)	25	9	0	0
Miscellaneous	5	2	3	10
Total	287		30	
Evaluated after 48 hr storage at 38-40 F				
No criticism	1	0	0	0
Feed	168	63	22	79
Rancid	26	10	2	7
Oxidized	12	4	0	0
Cowy (barny)	26	10	2	7
Miscellaneous	36	13	2	7
Total	269		28	

TABLE 3. SEASONAL VARIATION IN THE FLAVOR OF RAW MILK FROM FARM BULK TANKS EVALUATED FRESH AND AFTER STORAGE

	Season of the year					
	Summer		Fall		Winter	
	(No.)	(%)	(No.)	(%)	(No.)	(%)
	Flavor classification - fresh					
Flavor class						
Excellent	1	1	0	0	0	0
Good	51	59	20	47	34	25
Fair	26	30	32	49	81	60
Poor	19	10	3	4	20	15
	Flavor defects - fresh					
Flavor criticism						
No criticism	1	1	0	0	0	0
Feed	71	81	59	91	114	85
Rancid	4	5	1	1	6	4
Oxidized	1	1	0	0	0	0
Cowy (barny)	10	12	3	5	12	9
Miscellaneous	0	0	2	3	3	2
	Flavor classification - after storage					
Flavor class						
Excellent	1	1	0	0	0	0
Good	16	23	12	18	9	6
Fair	39	57	41	63	75	56
Poor	13	19	12	19	51	38
	Flavor defects - after storage					
Flavor criticism						
No criticism	1	1	0	0	0	0
Feed	41	60	48	74	79	59
Rancid	2	3	1	2	23	17
Oxidized	1	1	4	6	7	5
Cowy (barny)	9	13	5	8	12	9
Miscellaneous	15	22	7	10	14	10

supply suggests the need for more attention to the feeding and milking sequence, barn ventilation, and other good dairy husbandry practices. Furthermore, the "cowy" and "barny" defects are indicative of an animal health problem and/or poor barn ventilation.

The rancid flavor is particularly deserving of attention. The results from one route during the month of January are of particular interest. Seventeen samples from farm bulk tanks and one representative composite sample from the tank truck were obtained. When fresh, only two samples from the bulk tanks were criticized for rancid flavor; however, after storage, 11 of the samples were found to be rancid. The mixed-delivery sample which was satisfactory in flavor when fresh, developed rancidity during the 48-hr storage period. These findings indicate the potential danger of incorporating milk susceptible to rancidity in a tank truck or in a storage tank, particularly when prolonged storage is involved.

Seasonal Flavor Variation

The seasonal variation of the flavor of the fresh and stored milk is presented in Table 3. The results indicate the percentage of milk classed as "Good" was 59% for the Summer and 25% for the Winter. This seemed to be a reflection of poor feeding practices and unfavorable stable conditions during the winter period. "Feed" was the most predominant flavor defect (81-91%) in all three seasons of the year. No significant seasonal trend was observed in the other flavor defects.

After the milk was stored for 48 hr at 38-40 F, there was a marked decrease in the percentage of milk samples scored "Good" in all three seasons of the year. The percentage of milk classed as "Good" decreased from 59 to 23% in the summer, 47 to 18% in the fall and from 25 to 6% in the winter. Thirty-eight percent of the milk samples were classed as "Poor" after storage in the winter season. The incidence of rancidity increased from 3% in the summer to 17% in the winter. In contrast, miscellaneous flavor defects such as unclean, musty, oily and acid-associated flavors (malty) decreased from 22% in the summer to 10% in the winter season suggesting that bacterial activity involved in flavor deterioration is especially troublesome in the summer season.

REFERENCES

1. American Public Health Association. Standard Methods for the Examination of Dairy Products. 11th Ed. 1790 Broadway, New York, N. Y. 1960.

2. Dairy Products Judging Committee, American Dairy Science Association, Scoring Guides for Use with A.D.S.A.-D.I.S.A. Contest Score Cards. Report, 1962.

SPOILAGE IN CANNED FOODS[1]

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The most obvious indicator of spoilage in a canned food is bulging of one or both ends of the can, with the implication that the food has undergone spoilage by the action of gas-forming bacteria. However, there are various conditions other than bacterial growth which will produce swelling, and these will be discussed later. In any event, canners caution consumers not to use any can with a bulged end or ends.

The appearance and odor of the can contents may also be indicators of spoilage. If the product is broken down and mushy, or if a normally clear brine or sirup is cloudy, spoilage may be suspected. Again, these conditions may be due to some cause other than bacterial growth, such as poor quality of raw material, or starch cooking out of a product. Particular attention should be paid to the odor. An experienced bacteriologist can often tell by the odor whether spoilage was due to leakage or to underprocessing.

A diagnosis of bacterial spoilage should always be confirmed by a laboratory study of the sample. A pH determination and a microscopic examination of a stained smear may be adequate, but sometimes culturing may be necessary.

Some spoilage is due to bacteria which produce acid but little or no gas. Cans spoiled by these organisms are called "flat sours," because the cans appear normal, that is, the ends are flat but the contents are sour.

Can Swelling of Non-microbial Origin

Certain products, particularly those of low pH, are more or less corrosive to tinplate. As corrosion progresses, hydrogen gas is evolved, and eventually the cans become springers and swells. The higher the storage temperature may be, the shorter will be the shelf life of the cans. The product in these cans is harmless, and may safely be eaten. However, since the consumer has no way of determining whether or not such swelled cans have undergone bacterial spoilage, she is advised not to use them. A regulatory agency may be faced with deciding what should be done with canned foods in storage which contain a percentage of hydrogen springers. In most cases it is possible to salvage the flat cans if they are consumed promptly.

There are some products high in sugar which may break down chemically while in storage, particularly if storage temperatures are too high. A notable example is molasses. The product undergoes what is known as a "frothy fermentation," with evolution of carbon dioxide gas. Again, the product may safely be eaten.

Another cause of swelling may be overfilling, particularly in the smaller can sizes, or those with a large lid area in proportion to height, such as sardines in oil. If the appearance, odor and pH of the product are normal, and microorganisms are not present as determined by microscopic examination, overfilling should be suspected. This may be checked by the appearance of the opened cans and by weighing them.

A fourth cause of swelling may be filling cans at too low a temperature and then transporting them to a higher altitude. The low initial vacuum in the cans, and the reduced atmospheric pressure may result in a few cans becoming springers. The same thing may occur with cans closed with cold product on a cold day. A proportion of the cans may become springers when they are stored in a warm room.

Causes of Microbial Spoilage

Microbial decomposition of a canned product may result from one of three causes; incipient spoilage before processing, contamination after processing, or underprocessing. There are a few products which may be confusing to an inexperienced investigator, namely, those which are purposely fermented before canning such as olives, sauerkraut and okra, and products to which yeast has been added as a nutritional supplement. In all of these, considerable numbers of microorganisms may be found, but this is no indication of spoilage. In these products, spoilage would be indicated only if cultures demonstrated the presence of viable organisms.

Incipient Spoilage Before Processing

Product is sometimes held too long after blanching or canning before retorting. This may be due to a power failure, to a breakdown of machinery, or to the slow accumulation of sufficient cans to

[1]Adapted from material used in National Canners Association training schools for Food and Drug Administration inspectors.
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fill a retort. The bacterial growth which occurs may cause little obvious spoilage. There may be a slight drop in pH, and a few bacterial cells may be seen under the microscope in nearly every field. No viable bacteria can be recovered on culturing. Occasionally, particularly in the case of leafy vegetables, such as spinach, sufficient growth may occur in the cans after closure to result in appreciable gas production, with resulting partial loss of vacuum. The low vacuums may lead to excessive internal pressures in the cans during retorting, and some of the cans may buckle, with consequent straining of the seams.

Such products do not constitute a health hazard, and only in extreme cases could be considered as adulterated.

LEAKER SPOILAGE

Spoilage due to contamination after processing, or "leaker spoilage," as it is more commonly called, may occur as a result of improper construction of either the top or bottom double seam, or of the side seam. Generally speaking, however, it is usually the top double seam which is at fault. Denting on or close to a double seam may also cause it to leak. Insufficient solder at the lap may sometimes be a problem.

At the end of a process, the compound in the double seams is somewhat fluid, and during the cooling, particularly at the time when sufficient vacuum has formed to suck in the bulged ends, a few cans may aspirate a minute amount of cooling water. The compound may set almost immediately, and close the leak. There is no detectable loss of vacuum when this occurs. If the cooling water is highly contaminated with bacteria, it is possible for an occasional bacterial cell to be admitted, and spoilage may result.

Another cause of leakage may be improper control of pressure during cooling of the cans after the process. At the end of the heating period, cans have built up considerable internal pressure, particularly at the higher retort temperatures. During the process this is partially balanced by the external pressure of the steam. When the steam is shut off, however, and cooling begins, there may be a rapid drop in retort pressure unless air is admitted to compensate for the loss of steam pressure. If the pressure drops too rapidly, particularly with cans of larger diameter, the excessive internal pressure may cause buckling of the ends, with possible loosening of the double seams. Such cans should be reformed, held for a month, and then examined for possible spoilage.

In general, less trouble with leakage occurs when cans are air cooled than when they are water cooled. During the long, slow air cool, product tends to dry in the seam, and seal any holes.

Nearly all leaker spoilage is caused by non-sporulating bacteria, although occasionally yeasts and molds may be responsible. Owing to the size of a yeast cell, it takes a much larger hole in a can seam to admit one than it does a bacterial cell.

The bacteria most commonly identified with contamination after processing are the lactobacilli, the micrococci and the leuconostoc. Since the lactobacilli are more resistant to heat than the others, they are more likely to be encountered in cans which leaked while they were still quite hot.

Leaker spoilage usually shows up fairly rapidly as swells, although it may sometimes take several weeks until all spoilage has ceased. If many swells are present, a small proportion of flat sours may be expected, and normal appearing cans should be examined with this in mind. Sometimes, if there has been an appreciable loss of vacuum, it may be possible to sort out the flat sours by flip vacuum testing, but sometimes souring occurs with little or no loss of vacuum. Where appreciable numbers of high vacuum flat sours are present, the only way of salvaging the good product is to open all the cans, make a pH determination, and repack the product from the normal cans. This is seldom economically feasible with low cost items, or with those which are particularly heat sensitive.

A problem with which the regulatory health officer may be faced is what to do with a lot of canned foods which contains occasional flat sours. There must be some administrative tolerance in such cases, because it is impossible for the industry to operate without an occasional defective container. Flat sour spoilage, whether due to leakage or to thermophiles which have survived the process, does not constitute a health hazard.

It must not be forgotten that, over the years, the can manufacturers and the canning industry have made tremendous strides in reducing the incidence of leaker spoilage. The amount of spoilage which would have been accepted as normal twenty years ago, would be deemed excessive now. In consideration of all the factors involved in seam formation and can handling on modern high speed lines, the freedom from leaker spoilage which the industry now enjoys is remarkable.

In California, the canners, the can manufacturers and the State Department of Health have developed a minimum program of double seam inspection which has been recommended to the industry as a further step in improving control of the double seaming operation. Schools for training seam inspectors for canners have been held and additional schools are planned.

SPOILAGE DUE TO UNDERPROCESSING

Spoilage due to underprocessing may result from the growth of any one of many different species of microorganisms. The particular species which may be involved depends on the nature of the product and the amount of heat which it has received. For purposes of differentiation, we may divide canned foods into several categories; low acid - pH above 4.6; acid - pH above 4.0; acid - below 4.0; and those which are acid and also high in solids.

Low acid foods

Included in this group are meats, fish, poultry, most vegetables, and many specialty products, such as pork and beans, spaghetti, beef stew, soups, etc. All of these products are considered susceptible to spoilage by *Clostridium botulinum,* and consequently the criterion of a safe process must be that it be adequate to kill very large numbers of the most heat resistant spores of this organism.

Botulinum belongs to the genus *Clostridium,* because it is characterized by being an anaerobic, spore-forming rod. It is distributed in the soil throughout the world, and six types have so far been recognized, designated as A, B, C, D, E and F. All types produce a highly potent endotoxin, which is liberated on autolysis of the cells. Each type is distinct, in that the antitoxin produced against the toxin of one will not neutralize the toxin produced by any of the others. All types have been implicated in outbreaks of human botulism, but C, D and F only rarely. Most outbreaks of botulism in humans have been caused by the toxin of types A, B and E. Type E botulism has been associated mostly with fisheries' products. Types C and D have been responsible for much botulism in birds and animals, while type F is a newcomer and little is known about it yet. The toxin of all types is relatively heat labile, being destroyed in about 10 minutes at 180 F.

Spores of types A and B are highly heat resistant, and it is to destroy these that most processes for low acid canned foods are designed. Type E spores have relatively little resistance to heat, and can be killed in about ten minutes at 180 F.

Most strains of *Clostridium botulinum* have a growth range between about 50 and 100 F but type E strains have been proved to grow slowly down to 38 F. Germination and outgrowth of *Clostridium botulinum* spores in a favorable food product are inhibited at about pH 4.7, although in commercial practice pH 4.6 is the accepted limit in order to provide a safety factor. In a less favorable medium, the organism may not grow even at a considerably higher pH. Figs, for example, are required to be acidified only to below pH 4.9.

There have been outbreaks of botulism from home preserved fruits and pickles, but in all cases, except unacidified figs, growth of *Clostridium botulinum* occurred after prior spoilage by molds or yeasts. This appreciably changed the character of the product and raised the pH to a level at which dormant spores of *Clostridium botulinum* could germinate.

Other bacteria which are significant in the spoilage of low acid foods are the thermophiles, *Clostridium thermosaccharolyticum* and *Bacillus stearothermophilus.* The former is a strict anaerobe and a gas former, while the latter is a facultative anaerobe and produces flat sours. Both have a growth range between about 100 F and 165 F, although there are some strains which may grow at somewhat below 100 F. Their spores are so resistant to heat that even 10 or 20 spores per can may be significant from a processing standpoint, and botulinum processes may not be adequate to prevent spoilage. Canners of products in which thermophilic spoilage may be a problem, such as peas, corn, certain baby foods, and meat prepared in thickened gravy, must exercise great care in preventing product contamination, or must keep it at a very low level by constant attention to sanitation and by carefully controlling the level of contamination of ingredients, such as sugar, starch, spices, etc. Unfortunately, thermophiles, particularly *B. sterothermophilus,* may grow in equipment which is in contact with food, if the temperature is within the growth range. Consequently, product should always be held at above 165 F or at room temperature to prevent the growth of thermophiles.

Some canned products may contain viable thermophilic spores which may never cause spoilage because normal storage temperatures are seldom above 80 F. On storage at a temperature too low to permit growth, flat sour spores tend to die out. However, if cans containing viable spores are shipped to an area where the temperature is very high, thermophilic spoilage may be a problem. This is noticeable also in certain hot vended foods. Very slow cooling after retorting of certain canned foods in which some thermophilic spores have survived the process, may also result in spoilage. Such foods should be water cooled to below 100 F.

Acid foods - pH above 4.0

Foods in this category are, among others, tomatoes and tomato juice, pears, figs, and in certain seasons soft ripe apricots and freestone peaches. Many acidified vegetables fall into this group. Spore forming bacteria are the significant spoilage organisms, including the butyric anaerobes, *Bacillus coagulans,* and the thermophiles. Non-sporulating bacteria, especially the lactobacilli, are of importance only in products such as tomato juice and nectars, which are presterilized, and where a hot fill is relied on to sterilize the container, which is given little or no subsequent process. Too low a filling temperature may result in spoilage.

Contamination of acid foods may take place directly from the soil, or bacterial build-up may occur in product preparation and conveying lines. The greater the contamination, the greater is the possibility of spoilage. Since most acid products lose quality rapidly on over-heating, it is desirable to keep contamination at as low a level as possible. In low acid foods there is a fixed criterion for a process, the destruction of spores of *Clostridium botulinum.* In acid foods there is no such criterion, and to obtain the best quality, canners desire to use the lowest possible processes which will inactivate enzymes and prevent spoilage. The process levels used generally depend on the pH of the product; the lower the pH, the shorter the process necessary.

The butyric anaerobes are spore forming rods, which produce gas during growth, a preponderance of which is hydrogen. Their growth range is between about 60 and 95 F. The spores are not especially heat resistant, but they are sufficiently so to be a serious problem to canners of tomatoes and fruits with a pH above about 4.3. Most of California's spoilage problems in canned tomatoes are due to these organisms. Acidification of nectars to below pH 4.1 is practiced largely to prevent butyric spoilage.

B. coagulans has been the principal spoilage agent in canned tomato juice, and has caused some serious economic losses. It will grow from room temperature to about 125 F and can be classified as a facultative thermophile. The spores are more heat resistant than those of the butyric anaerobes, but less resistant than those of the obligate thermophiles. Spoilage is indicated by an off flavor, with a slight to a considerable drop in pH. It produces flat sours, with little or no loss of vacuum. It is, therefore, impossible to sort out spoilage except by opening all the cans. There is no health hazard involved in consuming the spoiled product, and canners have even used tasting as a means of separating out spoiled material.

Spoilage by the obligate thermophiles is uncommon, but does occur occasionally in canned tomatoes and certain fruits.

Acid Foods - pH below 4.0

This group includes a wide variety of products, such as apples, berries, plums, citrus fruits, pickles, etc. Spore forming bacteria will not grow at such a low pH, and spoilage, which rarely occurs, is attributable to non-sporulating bacteria, yeasts and molds. These organisms are all low in heat resistance, so that processes sufficient to inactivate enzymes are also adequate to insure commercial sterility.

Acid Foods with High Solids

This group includes jams and jellies, catsup, tomato paste, etc. Sporulating bacteria are not a problem and spoilage is generally due to the lactobacilli, yeasts or molds. Spoilage due to underprocessing generally results from inadequate heat in the container after hot filling and before cooling.

CONCLUSION

In the foregoing I have attempted to summarize the principal spoilage problems encountered by the canning industry. There are special cases and unusual spoilage organisms which there has not been time to mention. Food microbiology is a broad field, with many ramifications, and most of the published information is in the scientific literature rather than in text books.

3-A ACCEPTED PRACTICES FOR PERMANENTLY INSTALLED SANITARY PRODUCT-PIPELINES AND CLEANING SYSTEMS

Formulated by

International Association of Milk, Food and Environmental Sanitarians
United States Public Health Service
The Dairy Industry Committee

It is the purpose of IAMFES, USPHS, and DIC in connection with the development of the 3-A Sanitary Standards program to allow and encourage full freedom for inventive genius or new developments. Practices for permanently installed sanitary product-pipelines and cleaning systems heretofore or hereafter developed which so differ in design, material, fabrication, or otherwise as not to conform with the following practices, but which, in the fabricator's opinion, are equivalent or better may be submitted for the joint consideration of IAMFES, USPHS, and DIC at any time.

A. *SCOPE*

These 3-A Accepted Practices provide for the installation, cleaning, and sanitizing of rigid sanitary pipelines for milk and milk products in which the joints are welded or are provided with appropriate sanitary C-I-P connections. These 3-A Accepted Practices also include provisions for rigid cleaning solution lines and cleaning systems.

B. *DEFINITIONS*

(1) *C-I-P Pipelines*: Shall mean rigid pipelines which have welded joints or have sanitary cleaned-in-place connections or joints of such design as to form a substantially smooth, flush interior surface.

(2) *Tungsten Shielded Arc Method*: Shall mean electric welding with a tungsten electrode shielded by an inert gas, to produce a straight butt fusion weld.

(3) *Product Contact Surfaces*: Shall mean all surfaces that are exposed to the product or from which liquids may drain, drop, or be drawn into the product.

(4) *Solution Contact Surfaces*: Shall mean the interior surfaces of the circuit which are used exclusively for supply and re-circulation of cleaning and/or sanitizing solutions.

(5) *Non-Product Contact Surfaces*: Shall mean all other exposed surfaces.

C. *MATERIALS*

(1) All product contact surfaces shall be of stainless steel of the AISI 300 series[1] or corresponding ACI[2] types (See Appendix, Section A.), or equally corrosion resistant metal that is non-toxic and non-absorbent or heat resistant glass piping, except that rubber or rubber-like materials or plastic materials may be used for sealing applications. Paper gaskets shall not be used.

(2) Solution contact surfaces shall be of stainless steel of the AISI 300 series[1] or corresponding ACI[2] types (See Appendix, Section A.), or equally corrosion resistant metal that is non-toxic and non-absorbent or of heat resistant glass piping; provided that plastic or rubber and rubber-like materials may be used for sealing applications and short flexible take-down jumpers or connectors.

(3) Plastic materials used for sealing applications and solution contact surfaces shall conform with the applicable provisions of the "3-A Sanitary Standards for Multiple-Use Plastic Materials Used as Product Contact Surfaces for Dairy Equipment, Serial #2000."

(4) Rubber and rubber-like materials used for sealing applications and solution contact surfaces shall conform with "3-A Sanitary Standards for Multiple-Use Rubber and Rubber-Like Materials Used as Product Contact Surfaces in Dairy Equipment, Serial #1800."

(5) Lines and fittings for the application of air under pressure shall comply with the applicable provisions of "3-A Accepted Practices for Supplying Air Under Pressure in Contact With Milk, Milk

[1]The data for this series are contained in the following reference: AISI Steel Products Manual, Stainless and Heat Resisting Steels, April 1963, Table 2-1, pp. 16-17. Available from: American Iron and Steel Institute, 633 3rd Avenue, New York 17, N. Y.

[2]Alloy Casting Institute, 300 Madison Ave., New York, New York 10017.

Products, and Product Contact Surfaces," April, 1964, as amended.

D. *FABRICATION*

(1) All product contact surfaces of sanitary piping utilized in C-I-P systems shall be at least as smooth as a No. 4 mill finish on stainless steel sheets. (See Appendix, Section B.)

(2) The finish of solution contact surfaces whether sheet, tube, casting, or other shall be equal in cleanability to stainless steel with No. 4 finish or No. 2B mill finish, (pit free) as applied to stainless steel sheet. Castings for pumps or other appurtenances shall meet at least NAS-823[3] Cast Surface Comparison Standard surface C-50/500, (See Appendix, Section D.) and tooled or polished areas shall be at least as smooth as 150 grit properly applied.

(3) Product lines and equipment shall have C-I-P fittings or welded joints.

(4) Solution lines and equipment shall have C-I-P fittings or welded joints.

(5) Welded joints shall be smooth and free from pits, cracks, inclusions, or other defects.

(6) Removable fittings may be used with or without gaskets and shall be of such design as to form substantially flush interior joints.

(7) Appurtenances having product contact surfaces shall be cleanable, either when in an assembled position or when disassembled. Removable parts shall be readily demountable.

(8) All internal angles of 135° or less on product contact surfaces shall have minimum radii of 1/4 inch except where smaller radii are required for essential functional reasons, such as sealing ring grooves and pumps.

(9) All internal angles of 135° or less on solution contact surfaces shall have minimum radii of 1/4 inch except where smaller radii are required for essential functional reasons, such as for sealing ring grooves and in pumps.

(10) All solution contact surfaces shall be cleanable, either when in an assembled position or when disassembled. They shall contain no pockets or crevices that are not readily cleanable. Removable parts shall be readily demountable. Solution system appurtenances shall be accessible for inspection to determine freedom from biological, chemical, or physical soil contamination.

(11) Non-product contact surfaces shall have a smooth finish, be free of pockets and crevices, and be readily cleanable.

E. *INSTALLATION*

C-I-P pipeline circuits shall meet the following installation criteria:

(1) The C-I-P pipelines together with gaskets, if used, shall be supported so that they remain in alignment and position. The support system shall be designed so as to preclude electrolytic action between support(s) and pipeline(s).

(2) Each separate cleaning circuit, including product and solution lines, shall be provided with a sufficient number of access points, such as valves, fittings, or removable sections to make possible adequate inspections and examinations of the interior surfaces.

(3) Relatively horizontal lines shall be self-draining and pitched to drain points.

(4) Upon completion of welded pipeline installation and prior to use all interior line and weld areas shall be subjected to circulation of cleaning solution of 0.5 to 1.0% alkalinity at a minimum of 160°F. for 30 minutes, followed by an adequate post rinse, followed by circulation of a 0.5% minimum and 1% maximum phosphoric or nitric acid solution at 150-180°F. for 10 minutes to clean all interior surfaces of ferric impurities. This treatment shall be followed by an adequate rinse.

F. *LAYOUT AND ENGINEERING REQUIREMENTS*

(1) Prior to installation a drawing or equivalent plan shall be made available to the regulatory agency by the processor for each installation, or subsequent addition or modification, showing each permanent circuit to be cleaned, noting thereon the size and length of piping, fittings, pitch, drain points, access points, relative elevations, location and specifications of circulating unit, and other pertinent facts.

(2) The circulating unit, consisting of a motor driven pump and solution tank, shall provide a minimum average solution velocity at any instant of not less than five feet per second through each pipe and/or fitting in the circuit. In split flow arrangement, pressure differential must be maintained to assure the five feet per second minimum flow rate. This operation is to be checked by observation and tests. The rate of flow per second through the piping of known diameter can be determined from the following table:

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[3]National Aircraft Standard 823.

TIME, IN SECONDS, TO DELIVER 10 GALLONS AT VARIOUS VELOCITIES

Nominal Pipe Size	Inside Dimension	1	2	3	4	5	6	7	8	9	10
		Average velocity, feet per second									
	Inches	Sanitary Stainless Steel Pipe									
1	0.900	301.2	150.6	100.3	75.3	60.2	50.3	43.1	37.7	33.4	30.1
1–½	1.400	124.7	62.4	41.5	31.2	24.9	20.8	17.8	15.6	13.8	12.5
2	1.875	70.1	35.0	23.3	17.5	14.0	11.7	10.0	8.8	7.8	7.0
2–½	2.375	43.6	21.8	14.3	10.9	8.8	7.2	6.2	5.5	4.77	4.4
3	2.875	29.8	14.88	9.9	7.4	6.0	5.0	4.3	3.7	3.3	3.0
4	3.844	16.8	8.4	5.6	4.2	3.4	2.8	2.4	2.1	1.85	1.7
		Glass Pipe									
1	1.157	245.1	122.6	81.6	61.3	49.0	40.9	35.0	30.6	27.2	24.5
1–½	1.672	108.9	54.5	36.3	27.2	21.8	18.2	15.6	13.6	12.1	10.9
2	2.172	61.3	30.6	20.4	15.3	12.3	10.2	8.8	7.7	6.8	6.1
3	3.203	27.2	13.6	9.1	6.8	5.4	4.5	3.9	3.4	3.0	2.7
4	4.265	15.3	7.6	5.13	3.83	3.04	2.6	2.2	1.92	1.7	1.52

(3) C-I-P systems shall be designed so that the suction intake of the primary circulating pump shall be flooded at all times during the cleaning cycle.

(4) Solution temperature shall be automatically controlled by the use of a temperature regulator with a response range of ± 5°F.

(5) The system shall be provided with a recording thermometer having a scale range of 60° to 180°F. with extension of scale on either side permitted: graduated in time scale divisions of not more than 15 minutes. Between 110° and 180°F., the chart shall be graduated in temperature divisions of not more than 2°F., spaced not less than 1/16 inch apart, and be accurate within 2°F. ±. The sensor shall be protected against damage at 212°F. The sensing element of the recording thermometer shall be located in the return solution line.

(6) All connections between the solution circuit and the product circuit shall be so constructed as to positively prevent the comingling of the product and solution during processing.

G. *INSTALLATION WELDING REQUIREMENTS*

(1) All welding of sanitary product pipelines and solution lines shall be made by the Tungsten Shielded Arc Method or another equally satisfactory method may be used. The following precautions shall be taken.

(a) Inert back-up gas shall be used to protect and control the interior of the weld.

(b) The weld surface (interior, face and exterior) shall be cleaned and freed of all foreign matter and surface oxide before welding. Iron free abrasive shall be used when cleaning surfaces.

(c) All tube and fittings ends shall be square cut and deburred.

(d) Welding procedures shall assure uniform and complete penetration of weld at all times.

(e) All welds having pits, craters, ridges, or imbedded foreign materials shall be removed and the joints shall be properly re-welded.

(f) Internal and external grinding and/or polishing of welds is not required.

(g) An acceptable sample weld piece shall be provided at the beginning of each day and/or section welding operation or when required.

(h) A boroscope or other acceptable inspection device, to inspect representative welds, shall be made available by the processor.

H. *CLEANING AND SANITIZING PROCEDURES*

(1) A rinsing, cleaning, and sanitizing regimen which has been demonstrated to be effective shall be employed. Because of the possibilities of corrosion, the recommendations of the cleaning compound manufacturer shall be followed with respect to the time, temperature, and the concentration of specific acid or alkaline solutions and bactericides. To insure proper strength of solution and to avoid corrosion, the cleaning compound shall be completely dissolved or dispersed prior to circulation. One regimen found to be satisfactory is as follows:

(a) Immediately after concluding the day's operations, all connections between cleaned-in-place lines and processing equipment which are not included in the cleaning circuit shall be removed, the openings capped, by-pass connections made, and the lines rinsed thoroughly with tempered water (not to exceed 120°F., entering circuit) continuously discarding the rinse water near the downstream end of the solution return line until the discarded effluent is clear.

(b) All solution and product contact surfaces not cleanable by mechanical cleaning procedures shall be cleaned manually.

(c) Circulate an effective detergent solution for a period of time at a concentration and temperature capable of effectively removing the soil residue in the circuit.

(d) Thoroughly rinse the detergent solution from the circuit.

(e) Circulate an acid detergent, when needed, as a supplement to the routine circulation. Follow this acid detergent treatment with a thorough rinse.

(f) Sanitize all product surfaces with one or a combination of the following commonly used methods:

(1) Circulation of water at a minimum temperature of 170°F. (at the discharge end) through the circuit for five minutes and drained.

(2) Pumping of an approved chemical sanitizer solution of acceptable strength and recommended temperature through product lines and equipment for at least one minute and drained.

(3) Exposure to steam at a temperature of 170°F. (at the drainage outlet), for 15 minutes or at a temperature of 200°F. for five minutes. (Approved sanitation procedures and related recommendations are provided in detail in the Grade "A" Pasteurized Milk Ordinance—1965 Recommendations of the U. S. Public Health Service.)

(2) Prior to installation, a description of the cleaning regimen which has been demonstrated to be effective for each circuit shall be made available by the processor.

APPENDIX

A. *STAINLESS STEEL MATERIALS*

Stainless steel conforming to the applicable composition ranges established by AISI for wrought products, or by ACI for cast products, should be considered in compliance with the requirements of section C. (1) herein. Where welding is involved the carbon content of the stainless steel should not exceed 0.08%. The reference cited in C. (1) sets forth the chemical ranges and limits of acceptable stainless steels of the 300 series.

Cast grades of stainless steel equivalent to types 303, 304, and 316 are designated CF-16F, CF-8, and CF-8M, respectively. These cast grades are covered by ASTM[4] specifications A296 and A351.

B. *PRODUCT CONTACT SURFACE FINISH*

Surface finish equivalent to 150 grit or better as obtained with silicon carbide, is considered in compliance with the requirements of section D. (1) herein.

C. *TYPES OF WELDS*

(1) *Automatic Welds*—A fully automatic weld is described as that made by equipment which starts and completes the weld, strikes, and controls the arc with no manual adjustment of control during the welding cycle and will consistantly make repetitive welds.

(2) *Semi-automatic Weld*—A semi-automatic weld is described as that made by equipment which requires manual strike and/or control and will consistently make repetitive welds.

(3) *Hand Weld*—A weld in which the positioning of the arc is manually controlled.

D. *CAST SURFACES COMPARISON STANDARD*

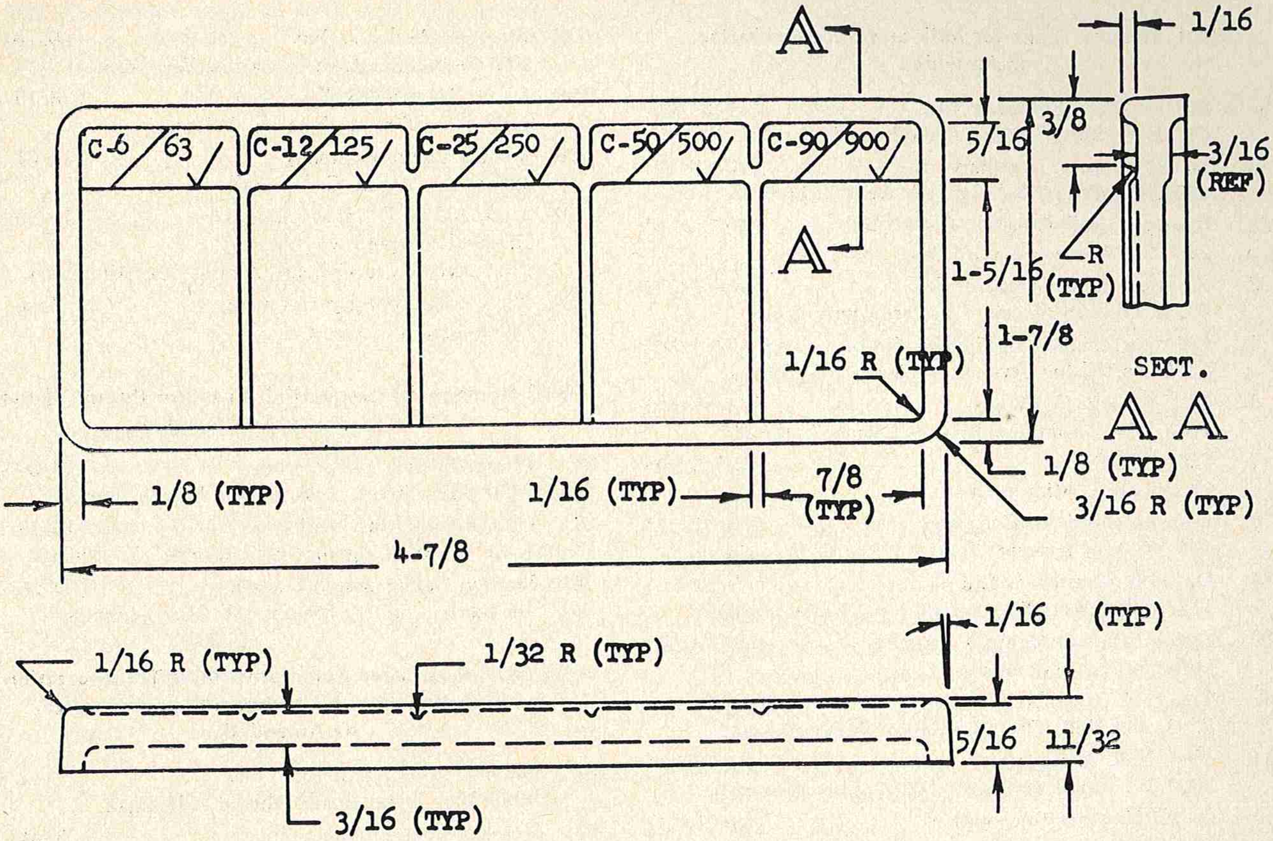
A copy of National Aircraft Standard 823 (NAS823) is appended to these practices.

Because the intent of the standard is that it be a visual guide, Approximate RMS finishes are shown as references only. The reason for establishing a visual standard is to overcome the obvious inadequacy of any arithmetical or geometrical measuring system when applied to a surface as variable as that found on a casting.

This standard is available from: Aluminum Co. of America, 1145 Wilshire Boulevard, Los Angeles 17, California.

These practices become effective on June 9, 1966 at which time the 3-A Suggested Method For The Installation And Cleaning Of Cleaned-In-Place Sanitary Milk Pipe Lines For Use In Milk And Milk Products Plants, dated March-April, 1953, is rescinded.

[4]Available from American Society for Testing and Materials, 916 Race St., Philadelphia 3, Pa.



MATERIAL: 356 ALUMINUM ALLOY WITH SUITABLE CONTAINER & ENCLOSURE

NOTES:
1. SURFACES TO HAVE ROUGHNESS SHOWN WITHIN APPROX. ± 20 MICROINCHES PER MIL-STD-10 WHEN MEASURED ON AN INSTRUMENT HAVING CONICAL STYLUS WITH .005 TIP RADIUS AND .300 INCH CUTOFF WIDTH.
2. "C" NUMBER MAY BE USED FOR DRAWING CALLOUT.
3. MARK NAS NUMBER, RAISED OR DEPRESSED, ON THE BACK.
4. TOLERANCE ON FRACTIONAL DIMENSIONS ± 1/32.
5. MICROINCH NUMBERS SHOWN FOR REFERENCE ONLY.

CUSTODIAN: AIRCRAFT RESEARCH AND TESTING COMMITTEE		
PROCUREMENT SPECIFICATION NONE	TITLE CAST SURFACE COMPARISON STANDARD	CLASSIFICATION STANDARD PART NAS 823

HOLDERS OF 3-A SYMBOL COUNCIL AUTHORIZATIONS ON FEBRUARY 20, 1966

0101 Storage Tanks for Milk and Milk Products, as Amended

97 Beseler Steel Products, Inc. (3/24/58)
417 East 29th, Marshfield, Wisconsin

116 Jacob Brenner Company, Inc. (10/ 8/59)
450 Arlington, Fond du Lac, Wisconsin

28 Cherry-Burrell Corporation (10/ 3/56)
2400 Sixth Street, S.W., Cedar Rapids, Iowa

102 Chester-Jensen Company, Inc. (6/ 6/58)
5th & Tilgham Streets, Chester, Pennsylvania

1 Chicago Stainless Equipment Corp. (5/ 1/56)
5001 No. Elston Avenue, Chicago 30, Illinois

2 CP Division, St. Regis (5/ 1/56)
1243 W. Washington Blvd., Chicago 7, Illinois

117 Dairy Craft, Inc. (10/28/59)
Holdingford, Minnesota

76 Damrow Brothers Company (10/31/57)
196 Western Avenue, Fond du Lac, Wisconsin

115 DeLaval Company, Ltd. (9/28/59)
113 Park Street, So., Peterborough, Ont., Canada

109 Girton Manufacturing Company (9/30/58)
Millville, Pennsylvania

21 The J. A. Gosselin Co., Ltd. (9/20/56)
P. O. Box 280, Drummondville, Quebec, Can.

44 The Heil Company (10/26/56)
3000 W. Montana Street, Milwaukee, Wisconsin

114 C. E. Howard Corporation (9/21/59)
9001 Rayo Avenue, South Gate, California

127 Paul Mueller Company (6/29/60)
1616 W. Phelps Street, Springfield, Missouri

143 Portersville Stainless Equipment Div., (5/16/63)
Gibson Industries, Inc.
Portersville (Butler County), Pennsylvania

39 Stainless & Steel Products Co. (10/20/56)
1000 Berry Avenue, St. Paul 14, Minnesota

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

0204 Pumps for Milk and Milk Products, Revised, as Amended

29R Cherry-Burrell Corporation (10/ 3/56)
2400 Sixth Street, S.W., Cedar Rapids, Iowa

147R R. S. Corcoran Co. (1/ 8/64)
132 E. Jefferson Street, Joliet, Illinois

63R CP Division, St. Regis (4/29/57)
1243 W. Washington Blvd., Chicago 7, Illinois

65R G & H Products Corporation (5/22/57)
5718 52nd Street, Kenosha, Wisconsin

169R Hinckley Pump Corporation (6/17/65)
10620 Firestone Blvd., Norwalk, California

145R Jabsco Pump Company (11/20/63)
1485 Dale Way, Costa Mesa, California

26R Ladish Co., Tri-Clover Division (9/29/56)
2809 60th Street, Kenosha, Wisconsin

148R Robbins & Myers, Inc. (4/22/64)
Moyno Pump Division
1895 Jefferson Street, Springfield, Missouri

163R Sta-Rite Products, Inc. (5/ 5/65)
234 South 8th Street, Delavan, Wisconsin

72R L. C. Thomsen & Sons, Inc. (8/15/57)
1303 53rd Street, Kenosha, Wisconsin

52R Viking Pump Company (12/31/56)
406 State Street, Cedar Falls, Iowa

175R Universal Milking Machine Div., (10/26/65)
National Cooperatives, Inc.
First Avenue at College, Albert Lea, Minnesota

5R Waukesha Foundry Company (7/ 6/56)
Waukesha, Wisconsin

0402 Homogenizers and High Pressure Pumps of the Plunger Type, As Amended

87 Cherry-Burrell Corporation (12/20/57)
2400 Sixth Street, S.W., Cedar Rapids, Iowa

37 CP Division, St. Regis (10/19/56)
1243 W. Washington Blvd., Chicago 7, Illinois

75 Manton-Gaulin Mfg. Co., Inc. (9/26/57)
44 Garden Street, Everett 49, Massachusetts

0506 Stainless Steel Automotive Milk Transportation for Bulk Delivery and/or Farm Pick-up Service, As Amended

131 Almont Welding Works, Inc. (9/ 3/60)
4091 Van Dyke Road, Almont, Michigan

98 Beseler Steel Products, Inc. (3/24/58)
417 East 29th, Marshfield, Wisconsin

70 Jacob Brenner Company (8/ 5/57)
450 Arlington, Fond du Lac, Wisconsin

118 Dairy Craft, Inc. (10/28/59)
Holdingford, Minnesota

66 Dairy Equipment Company (5/29/57)
1919 So. Stoughton Road, Madison 14, Wisconsin

43 Damrow Brothers Company (10/25/56)
196 Western Avenue, Fond du Lac, Wisconsin

123 DeLaval Company, Ltd. (12/31/59)
113 Park Street, South, Peterborough, Ont., Can.

121 The J. A. Gosselin Co., Ltd. (12/ 9/59)
P. O. Box 280, Drummondville, Quebec, Canada

45 The Heil Company (10/26/56)
3000 W. Montana Street, Milwaukee 1, Wisconsin

93 Pennsylvania Furnace & Iron Co. (2/ 6/58)
316 Pine Street, Warren, Pennsylvania

85 Polar Manufacturing Company (12/20/57)
Holdingford, Minnesota

144 Portersville Stainless Equipment Div., (5/16/63)
Gibson Industries, Inc.
Portersville (Butler County), Pennsylvania

71 Progress Industries, Inc. (8/ 8/57)
400 E. Progress Street, Arthur, Illinois

80 C. Richardson & Company, Ltd. (11/24/57)
Wellington Street, So., St. Marys, Ont., Canada

40 Stainless & Steel Products Company (10/20/56)
1000 Berry Avenue, St. Paul 14, Minnesota

47 Standard Steel Works, Inc. (11/ 2/56)
16th & Howell Streets, North Kansas City 16, Mo.

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

0800-07 Fittings Used on Milk and Milk Products Equipment, and Used on Sanitary Lines Conducting Milk and Milk Products and Supplements 2, 3, 4, 5, and 6, as Amended

79 Alloy Products Corporation (11/23/57)
1045 Perkins Avenue, Waukesha, Wisconsin

138 A.P.V. (Canada) Equipment, Ltd. (12/17/62)
103 Rivalda Rd., Weston, Ont., Canada

82 Cherry-Burrell Corporation (12/11/57)
2400 Sixth Street, S.W., Cedar Rapids, Iowa

124 Delaval Company, Ltd. (2/18/60)
113 Park Street, South, Peterborough, Ont., Canada

67 G & H Products Corporation (6/10/57)
5718 52nd Street, Kenosha, Wisconsin

105 Girton Manufacturing Company (7/25/58)
Millville, Pennsylvania

89 Burton Klemp Corporation (3/24/60)
6613 28th Avenue, Kenosha, Wisconsin

34 Ladish Co., Tri-Clover Division (10/15/56)
2809 60th St., Kenosha, Wisconsin

149 Q Controls (5/18/64)
Occidental, California

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

151 Tubular Components, Inc. (11/18/64)
Butternut Drive, East Syracuse, New York

86 Waukesha Specialty Company (12/20/57)
Walworth, Wisconsin

0902 Thermometer Fittings and Connections Used on Milk and Milk Products Equipment and Supplement 1, as Amended

32 Taylor Instrument Companies (10/ 4/56)
95 Ames Street, Rochester 1, New York

1001 Milk and Milk Products Filters Using Disposable Filter Media, As Amended

85 Ladish Co., Tri-Clover Division (10/15/56)
2809 60th Street, Kenosha, Wisconsin

1102 Plate-Type Heat Exchangers for Milk and Milk Products, As Amended

20 A.P.V. Company, Inc. (9/ 4/56)
137 Arthur Street, Buffalo 7, New York

30 Cherry-Burrell Corporation (10/ 1/56)
2400 Sixth Street, S.W., Cedar Rapids, Iowa

14 Chester-Jensen Co., Inc. (8/15/56)
5th & Tilghman Streets, Chester, Pennsylvania

38 CP Division, St. Regis (10/19/56)
1243 W. Washington Blvd., Chicago 7, Illinois

120 Delaval Company, Ltd. (10/ 3/59)
113 Park Street, South, Peterborough, Ont., Can.

17 Delaval Separator Company (8/30/56)
Poughkeepsie, New York

15 Kusel Dairy Equipment Company (8/15/56)
100 W. Milwaukee Street, Watertown, Wisconsin

1202 Internal Return Tublar Heat Exchangers As Amended

103 Chester-Jensen Company, Inc. (6/ 6/58)
5th & Tilghman Streets, Chester, Pennsylvania

96 C. E. Rogers Company (3/31/64)
8731 Witt Street, Detroit 9, Michigan

152 Sanitary Processing Equipment Corporation (11/18/64)
Butternut Drive, East Syracuse, New York

1303 Farm Milk Cooling and Holding Tanks—Revised, As Amended

99R Henry C. Bergmann, Inc. (3/28/58)
4350 W. Artesia St., Fullerton, California

19R Brown Equipment Mfg. Company (9/ 1/56)
418 Kearns Bldg., Salt Lake City, Utah

11R CP Division, St. Regis (7/25/56)
1243 W. Washington Street, Chicago 7, Illinois

119R Dairy Craft, Inc. (10/28/59)
Holdingford, Minnesota

4R Dairy Equipment Company (6/15/56)
1919 S. Stoughton Road, Madison 14, Wisconsin

92R Delaval Company, Ltd. (12/27/57)
113 Park Street, South
Peterborough, Ontario, Canada

49R Delaval Separator Company (12/ 5/56)
Poughkeepsie, New York

94R Esco Cabinet Company (2/ 6/58)
West Chester, Pennsylvania

10R Girton Manufacturing Company (7/25/56)
Millville, Pennsylvania

95R Glove Fabricators, Inc. (3/14/58)
7744 Madison Street, Paramont, California

51R C. E. Howard Corporation (12/20/56)
9001 Rayo Avenue, South Gate, California

61R James Mfg. Co., Sani-Kool Division (4/ 2/57)
104 W. Milwaukee Avenue, Fort Atkinson, Wisconsin

41R Mojonnier Bros. Company (10/22/56)
4601 W. Ohio Street, Chicago 44, Illinois

12R Paul Mueller Company (7/31/56)
1616 W. Phelps Street, Springfield, Missouri

112R Nichols Refrigeration Company (2/23/59)
P. O. Box 357, Medina, Ohio

58R Schweitzer's Metal Fabricators (2/25/57)
806 No. Todd Avenue, Azusa, California

50R Emil Steinhorst & Sons, Inc. (12/20/56)
612-616 South Street, Utica 3, New York

134R Universal Milking Machine Division (5/19/61)
National Co-operatives, Inc.
First Avenue at College, Albert Lea, Minnesota

6R U. S. Industries, Inc., (6/26/56)
Farm & Home Products Div.
Tomahawk, Wisconsin

42R VanVetter, Inc. (10/22/56)
2130 Harbor Avenue S.W., Seattle, Washington

18R Whirlpool Corporation, St. Paul Division (9/20/56)
850 Arcade Street, St. Paul 6, Minnesota

55R John Wood Company, (1/23/57)
Superior Metalware Division
509 Front Avenue, St. Paul 17, Minnesota

170R The W. C. Wood Co., Ltd. (8/ 9/65)
5 Arthur Street, South, Guelph, Ont., Canada

16R Zero Sales Corporation (8/27/56)
Washington, Missouri

1400 Inlet and Outlet Leak Protector Plug Valves for Batch Pasteurizers

122 Cherry-Burrell Corporation (12/11/59)
2400 Sixth Street, S.W., Cedar Rapids, Iowa

69 G & H Products Corporation (6/10/57)
5718 52nd Street, Kenosha, Wisconsin

27 Ladish Co. - Tri-Clover Division (9/29/56)
2809 60th Street, Kenosha, Wisconsin

78 L. C. Thomson & Sons, Inc. (11/20/57)
1303 43rd Street, Kenosha, Wisconsin

1500 Manually-Operated Bulk Milk and Milk Products Dispensers Multi-Service Milk Containers, and Dispensing Mechanisms

74 American Industries, Inc. (9/11/57)
7100 France Ave., South, Minneapolis 14, Minnesota

150 Brown Equipment Mfg. Co. (6/10/64)
418 Kearns Bldg., Salt Lake City, Utah

23 Monitor Dispenser Co., Inc. (9/27/56)
West Main Street, Stroudsburg, Pennsylvania

62 Norris Dispensers, Inc. (4/ 8/57)
2720 Lyndale Avenue, South, Minneapolis 8, Minnesota

108 Stevens-Lee Company (8/12/58)
822 W. 59-1/2 Street, Minneapolis 19, Minnesota

1602 Evaporators and Vacuum Pans, As Amended

132 A.P.V. Company, Inc. (10/26/60)
137 Arthur Street, Buffalo 7, New York

111 Blaw-Knox Company, (2/12/59)
Dairy Equipment Division
750 E. Perry, Buffalo, N. Y.

110 Arthur Harris & Company (11/10/58)
210-18 North Aberdeen Street, Chicago 7, Illinois

128 Mojonnier Bros. Co. (7/ 6/60)
4601 W. Ohio Street, Chicago 44, Illinois

164 Mora Industries, Inc. (4/25/65)
112 South Park Street, Mora, Minnesota

107 C. E. Rogers Company (8/ 1/58)
8731 Witt Street, Detroit 9, Michigan

1702 Filers and Sealers of Single Service Containers, As Amended

157 Crown-Zellerbach Corporation (3/17/65)
1 Bush Street, San Francisco, California
(Not to be renewed)

139 Exact Weight Scale Company (4/15/68)
538 East Town Street, Columbus 15, Ohio

137 Ex-Cell-O Corporation (10/17/62)
P. O. Box 386, Detroit 32, Michigan

140 General Films, Inc. (4/23/63)
Covington, Ohio

153 Mantes Scale Co. (1/ 6/65)
489 Sixth Street, San Francisco, California

142 Polygal Company (4/15/63)
Div. of Inland Container Corp.
6343 E. Westfield Blvd., Indianapolis, Indiana

1901 Batch and Continous Freezers, As Amended

141 CP Division, St. Regis (4/15/63)
1243 W. Washington Blvd., Chicago 7, Illinois

146 Cherry-Burrell Corporation (12/10/63)
2400 Sixth Street, S. W., Cedar Rapids, Iowa

2200 Silo-Type Storage Tanks for Milk and Milk Products

168 Cherry-Burrell Corporation (6/16/65)
2400 Sixth Street, S.W., Cedar Rapids, Iowa

154 CP Division, St. Regis (2/10/65)
1243 W. Washington Blvd., Chicago 7, Illinois

160 Dairy Craft, Inc. (4/ 5/65)
Holdingford, Minnesota

156 C. E. Howard Corporation (3/ 9/65)
9001 Rayo Avenue, South Gate, California

155 Paul Mueller Co. (2/10/65)
1616 W. Phelps Street, Springfield, Missouri

165 Walker Stainless Equipment Co. (4/26/65)
New Lisbon, Wisconsin

2300 Equipment for Packaging Frozen Desserts, Cottage Cheese and Milk Products Similar to Cottage Cheese in Single Service Containers

174 Anderson Bros. Mfg Co. (9/28/65)
1303 Samuelson Road, Rockford, Illinois

178 John A. Carrier Corporation (2/18/66)
Middlesex Turnpike, Burlington, Iowa

2400 Non-Coil Type Batch Pasteurizers

161 Cherry-Burrell Corporation (4/ 5/65)
2400 Sixth Street, S.W., Cedar Rapids Iowa

158 CP Division, St. Regis (3/24/65)
1243 W. Washington Blvd., Chicago 7, Illinois

177 Girton Manufacturing Co. (2/18/66)
Millville, Pennsylvania

166 Paul Mueller Co. (4/26/65)
1616 W. Phelps Street, Springfield, Missouri

2500 Non-Coil Type Batch Processors for Milk and Milk Products

162 Cherry-Burrell Corporation (4/ 5/65)
2400 Sixth Street, S.W., Cedar Rapids, Iowa

159 CP Division, St. Regis (3/24/65)
1243 W. Washington Blvd., Chicago 7, Illinois

167 Paul Mueller Co. (4/26/65)
1616 W. Phelps Street, Springfield, Missouri

2600 Sifters for Dry Milk and Dry Milk Products

171 Entoleter, Inc. (9/ 1/65)
Subsidiary of American Mfg. Co.
1187 Dixwell Avenue, Hamden, Connecticut

173 Food & Chemical Equipment Div. (9/20/65)
Blaw-Knox Company
1325 S. Cicero Avenue, Chicago, Illinois

172 Southwestern Engineering Co. (9/ 1/65)
6111 E. Bandini Blvd., Los Angeles, California

176 Sprout, Waldron & Co., Inc. (1/ 4/66)
Munsy, Pennsylvania

ASSOCIATION AFFAIRS

INTERIM REPORT OF THE COMMITTEE ON APPLIED LABORATORY METHODS—1965

It is the opinion of the Committee that the following should be the goals for the current two year program:

1. To provide assistance, wherever possible, in the preparation of the 12th Edition of Standard Methods for the Examination of Dairy Products and the 12th Edition of Standard Methods for the Examination of Water and Wastewater and to serve as a sounding board for the IAMFES membership in regard to laboratory methodology to be included in both editions of Standard Methods as well as those now included in the 9th Edition of Official Methods of the Association of Official Agricultural Chemists (AOAC).

2. To be well informed on the subject of media certification and the programs suggested by APHA and others for implementing certification, and to provide an expression of the feelings of IAMFES when and where pertinent.

3. To develop a continuing program concerned with new laboratory testing procedures or the validation of some that already have been proposed for inclusion in the 12th Edition of Standard Methods; to provide valuable and extremely useful data in advance of preparation of the 13th Edition of Standard Methods.

4. To emphasize the need of IAMFES for an Applied Laboratory Methods Committee and establish new areas of interest where the best opportunities for committee contributions now exist. To restate all charges to the committee and provide specificity to the general objectives where necessary.

Activities

Participation in Revision of 11th Edition of Standard Methods

As shown in the interim report (*Jour. Milk and Food Technol.*, June 1964) most of the A. L. M. committee are serving as chairmen or subcommittee members in the preparation of the 12th Edition of Standard Methods for the Examination of Dairy Products (SMEDP). Final drafts of most of the chapters have been prepared and submitted to members of the various subcommittees for review prior to transmittal to chairman and vice-chairman of the APHA Subcommittee on Standard Methods.

Some of the changes of laboratory methodology in the revision of the 11th Edition of Standard Methods include incubation of plated dry milk samples at 32° C for 48 hours, incubation of plates for psychrophilic bacterial counts at 7° C for 10 days, and coliform counts of plates incubated at 32° C for 24 ± 2 hours. The A.O.A.C. methods I and II for determination of phosphatase have been deleted as well as the Scharer "one hour" laboratory method; the Modified Spectrophotometric, Cornell and Rapid Dialysis Methods have replaced the deleted methods.

Media Certification

Since the last report (June, 1964) of the Public Health Committee of the American Dairy Science Association, there has been no further progress on the development of protocol for check testing of viable count media by independent organizations in addition to industry evaluations. The coliform group chapter subcommittee (SMEDP) recognized the need for certification of coliform plating and vertification media. The use of various lots and brands of coliform media by some laboratories has indicated that the variability of growth inhibiting ingredients in these media inhibits growth of typical coliform bacteria. The development of criteria for the certification of coliform media should be considered and preemptive studies conducted to develop criteria for evaluating a suitable formulation of growth and inhibitory ingredients in these media. In this regard, there appears to be need for the ALM Committee to represent the International for APHA committee action on this subject.

Future Committee Responsibilities

Although it has been difficult during the last five years to establish a unified committee program due to the unavailability of committee members to meet and discuss problems related to the responsibilities of this committee at some time other than the annual meeting, much information has been obtained through correspondence with individual members. The possibility of additional meetings of this committee, where necessary, will be considered in advance of annual meetings of the ADSA, APHA, and ASM.

Considerable efforts are being made by the U. S. Public Health Service, Food and Drug Administration, Association of Official Agricultural Chemists, and food microbiology organizations to establish uniformity in laboratory procedures for the examination of foods which may lead to Standard Methods for the Examination of Foods. Since the IAMFES is concerned with food sanitation as well as that of dairy products, it is natural that the Applied Laboratory Methods Committee should be concerned with the uniformity of food microbiology methods. Members of this committee have been requested by the chairman to participate with A.O.A.C. referee laboratories in collaborative studies on food microbiology methods. The Applied Laboratory Methods Committee has also been requested by the Food Hygiene Committee of the FAO/WHO of the U.N. to assist in the development of microbiological standards for foods.

Due to the increased interest in food microbiology methods and standards and the need for continued activities in laboratory methods related to the examination of dairy products, as well as water supplies and product-contact surfaces, the chairman subdivided the Applied Laboratory Methods Committee into three subcommittees with vice-chairman responsible to the Committee Chairman: *(1)* Subcommittee on Laboratory Methods for the Examination of Milk and Milk Products which would be responsible for laboratory activities concerned with microbiological and chemical method studies; *(2)* Subcommittee on Laboratory Methods for the Examination of Foods which would be responsible for laboratory activities concerned primarily with studies on microbiological and chemical methods applicable to foods other than milk and milk products; and *(3)* Subcommittee on Laboratory Methods for the Examination of Water and other Environmental samples.

One of the immediate responsibilities of this last subcommittee would be to study the use of membrane filtration for viable and coliform counts of rinse and/or swab solutions of product-contact surfaces which are required in item 12p of the Grade A Pasteurized Milk Ordinance recently published by The U. S. Public Health Service. Although some committee members may have responsibilities on all committees due to their background and/or motivation, it will be necessary to obtain additional qualified subcommittee members to fulfill the responsiblities of each subcommittee.

This Committee was also requested by the American Standards Association (ASA), U.S.A. Member Body of the International Standards Organization, to advise the ASA how to vote on apparatus (cheese triers and butter triers) for testing milk and milk products which have been recommended as International Standards. Due to the need for quick transmittal of reply, it was not possible to consult with fellow committee members and, as a result, the chairman voted approval of the recommended apparatus following consultation with a sampling expert.

RECOMMENDATIONS

It is recommended that additional IAMFES committees be formed with responsibilities applicable to food production, processing, and distribution sanitation problems. The Food Hygiene Committee of the FAO/WHO has also expressed interest in food sanitation problems and has solicited the Applied Laboratory Methods Committee for assistance in these problem areas. Because of the need for advisory assistance, due to the everincreasing technological changes in milk and food processing, the various committees within the IAMFES can contribute signifcant information towards answering potential sanitation problems.

The IAMFES should, in its official capacity, recommend that government agencies provide support, financial and otherwise, for ALM committee collaborative studies on laboratory methodology concerning dairy products, foods, air, water and other environmental fields. The committee solicits the comments of IAMFES members relative to any of the above described activities.

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Chairman
Milk Sanitation Research
Robt. A. Taft Sanitary
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Cincinnati, O.

Dr. David Levowitz
(New Jersey Association)
Director, New Jersey
Dairy Laboratories
P. O. Box 748
New Brunswick, N. J.

Mr. J. C. McCaffrey
(Illinois Association)
Chief, Bureau of Sanitary
Bacteriology
Illinois Department of
Public Health
1800 West Fillmore Street
Chicago, Ill.

Dr. Laurence G. Harmon
(Michigan Association)
Department of Food Science
Michigan State University
East Lansing, Mich.

Dr. J. J. Jezeski
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Industries
University of Minnesota
St. Paul, Minn.

Mr. Burdett Heinemann
(Missouri Association)
Chemist, Producers
Creamery Co.
Box 1427 South Side Station
Springfield, Mo.

Mr. Donald Thompson
(Wisconsin Association)
Wisconsin State Laboratory
of Hygiene
Madison, Wis.

Dr. F. E. Nelson
(Arizona Association)
Department of Dairy Science
University of Arizona
Tucson, Ariz.

Dr. J. E. Edmondson
(Missouri Association)
Department of Dairy
Industries
University of Missouri
Columbia, Mo.

Dr. Earl W. Cook
(Pennsylvania Association)
Quality Control Laboratory
Pine Road
Philadelphia, Pa.

REPORT OF THE COMMITTEE ON BAKING INDUSTRY EQUIPMENT, 1965

This Committee has had two meetings with the Baking Industry Sanitation Committee (BISSC) since our previous report. To date, twenty-three Standards have been formulated, adopted and published. It is the intent of BISSC to continue writing Standards for every major piece of equipment used in bakeries. In addition, many of the older Standards are being re-written and modernized.

A great amount of the Committee's time in the last year has been devoted to the formulation of standardized "boiler plate" definitions. When these definitions have been approved the result should be that future standards and revised standards will have a continuity of definitions, with each standardized definition being used in all revised and new standards. This will be of great value to manufacturers and sanitarians in their interpretation of these standards.

OFFICE OF EQUIPMENT CERTIFICATION

Applications have been filed to trademark and copyright the BISSC symbol. It is expected that favorable governmental action will be forthcoming on these applications. The symbol will be the property of the Office of Equipment Certification and will be available to all manufacturing companies whose equipment complies with the particular BISSC Standard.

Registration and Application Forms are to be available October 1, 1965. The actual issuance of the BISSC seal is expected to be after January 1, 1966. The issuance of seals to companies whose equipment complies wth BISSC Standards, plus the advertising by the manufacturers that their equipment meets BISSC Standards should be of great value in promoting the use of sanitary bakery equipment. It will now be brought to the attention of buyers of bakery equipment as well as sanitarians that BISSC approved equipment is available.

This constitutes another step forward in the progress of bakery sanitation. A step made possible through the cooperation of industry personnel and sanitarians working together to achieve a common goal.

Vincent T. Foley, *Chairman*,
(Missouri Association)
City Health Department,
21st floor, City Hall
Kansas City, Mo.

A. E. Abrahamson
(New York Association)
City Health Department,
125 Worth Street
New York, N. Y.

Louis A. King, Jr.,
(Illinois Association)
American Institute of Baking
400 E. Ontario Street
Chicago, Ill.

Armin A. Roth,
(Michgian Association)
421 N. Rosevere
Dearborn, Mich.

Harold Wainess,
(Illinois Association)
510 N. Dearborn Street
Chicago, Ill.

REPORT OF THE COMMITTEE ON COMMUNICABLE DISEASES AFFECTING MAN—1965

The job of revising the booklet "Procedure for the Investigation of Foodborne Disease Outbreaks" has been completed. The manuscript of the revised edition has been submitted to the President of the Association, Dr. W. C. Lawton. In preparing the revision, contracts were made by personal conferences and by correspondence with persons highly knowledgeable in specific areas of foodborne diesase. Comments and suggestions were received from twenty-five persons. In addition, the revised edition in draft form was reviewed by a representative of the Association of State and Territorial Health Officers and by an Ad-Hoc subcommittee of the Bacterial Infections Committee of the Conference of State and Territorial Epidemiologists. Suggestions were received from both groups.

The basic concept of the "Procedure" has not been changed in the revised edition. The narrative material in Parts I through III has been augmented to some degree and slightly rearranged. The Report Forms in Part IV have been modified slightly. Minor changes were made and material was added to Part V "Classification of Illnesses Attributable to Foods" to bring it up to date with present knowledge. A "List of Equipment and Supplies" has been added to the revised edition. This is a list of basic supplies and equipment which should be readily available for a sanitarian when investigating suspected food poisoning. The list of "References Pertaining to Foodborne Diseases" has been updated. While this list is considerably longer than the list in the first edition, it is limited to specially selected references believed to be of high value to the sanitarian.

With sadness the Committee reports the death of one of its members. Dwight L. Lichty, D.V.M., died April 24, 1965 following a heart attack. Dr. Lichty was Public Health Veterinarian, Palm Beach County Health Department, West Palm Beach, Florida, and had served as an active member of the Committee for many years.

Stanley L. Hendricks,
Chairman
State Department of Health
Des Moines, Ia.

Robert K. Anderson
School of Veterinary Medicine
University of Minnesota
St. Paul, Minn.

John Andrews
State Board of Health
Raleigh, N. C.

H. L. Bryson
Vancouver Health Department
Vancouver, B. C., Canada

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Milk and Food Branch
U. S. Pnblic Health Service
HEW
Washington, D. C.

Charles A. Hunter
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Tulsa, Okla.

E. R. Price
Missouri Division of Health
Jefferson City, Mo.

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National Institutes of Health
Bethesda, Md.

P. N. Travis
Jefferson County Health Department
Birmingham, Ala.

C. B. SHOGREN MEMORIAL FUND

In the obituary for C. B. Shogren appearing in the December, 1965, issue of the Journal mention was made of the probable establishment of a C. B. Shogren Memorial Fund. It was C. B.'s expressed desire before his death that money for flowers be utilized for some more permanent useful purpose to be administered by IAMFES.

Such a Fund has now been set up and a number of contributions already have been received and deposited in a special account by H. L. Thomasson, Executive Secretary, at Shelbyville. Many of C. B.'s old friends have manifested interest in the Fund and may wish to make further contributions. In such an event checks should be directed to the Executive Secretary.

The ultimate purpose and disposition of the Fund will be the decision of the IAMFES Board of Directors. Consideration is being given to a number of projects, including specific sanitarian awards, special research grants, establishment of a reference library or the initiating cost of a Sanitarian's Handbook. A determining factor, of course, will be the ultimate amount of the contributions and any continuing aspects probably will be administered by the Committee on Recognitions and Awards.

NEWS AND EVENTS

COMMEMORATES THE NATIONAL SHELLFISH SANITATION CONTROL PROGRAM

Forty years of health protection for consumers of oysters, clams and mussels was observed on January 15, 1966 in a special ceremony called by Dr. W. H. Stewart, Surgeon General of the Public Health Service. Guests included the Secretary of Health, Education, and Welfare, members of the U. S. Senate and House of Representatives form shellfish-producing States, officials of national professional associations, the shellfish industry, the governments of Japan and Canada, and other Federal agencies.

The National Shellfish Sanitation Control program dates back to a serious epidemic of typhoid fever in the winter of 1924-25 which was traced to the consumption of infected oysters. The program today operates on a voluntary basis through the cooperation of the shellfish industry, the States, and the Federal Government—primarily the Public Health Service.

The suitability of grounds for harvesting shellfish for human consumption is determined by sanitary survey, which includes bacteriological examination of the water. The industry cooperates by obtaining shellfish only from approved growing areas, by maintaining high sanitary conditions in their shucking and packing plants, and by placing certificate numbers on all packages of shellfish shipped.

Local and State health departments inspect and approve shellfish-growing areas and processing plants according to procedures and standards developed in cooperation with the Public Health Service and issue operating certificates to approved shippers.

NEW MILK INSPECTION REGULATIONS IN MICHIGAN

Fluid milk for bottling will be under a uniform Michigan standard and inspection after July 1, 1966, according to B. Dale Ball, Director of the Michigan Department of Agriculture. Standards for manufacturing milk, used in cheese, butter, and other processing, will be unchanged from 1965.

State-wide inspection under the new law is the culmination of continual upgrading of bottling milk standards since the original pasteurized milk law of 1929. Responsibility for inspection will for the first time rest with one agency, the dairy division of the Michigan Department of Agriculture. Inspection is presently carried out by various city and county agencies as well as the Michigan Department of Agriculture.

"Since 1929 bottling milk standards were set, optional Grade A standards were established in 1957. Thus, there are now two standards in use," said Director Ball. "Uniform bottling milk standards and inspection starting next July will assure consumers the equivalent of Grade A or better wherever they buy milk in Michigan."

The new law thus provides for a single standard of sanitation and a single standard of inspection for bottling milk, the responsibility of the Michigan Department of Agriculture. Manufacturing milk standards remain unchanged.

NEW FOOD TECHNOLOGY MAJOR AT PENN STATE

The Pennsylvania State University has a new major in food technology, starting with the opening of the Fall term 1965. The major is a scientific approach to processing, packaging, and development of foods, emphasis is given to basic chemical, biological, and physical principles.

The new major recognizes the trend among food processing companies not only for more scientifically trained personnel, but also considers the fact that food processors increasingly are diversifying their production operations. In addition to the usual undergraduate courses in the basic sciences, writing and speaking skills, social sciences, humanities and economics, a student has 18 free elective credits to permit him to pursue his major area of interest or a combination of various courses he may desire.

The historic concept of a food processor who concentrates his effort largely along a limited path has changed rapidly during the past several years. In addition, the expanding world population demands the concentrated efforts of highly trained people not only to increase food production, but also to process food in such a way that loss of nutrients will be avoided, food appeal enchanced, and processing costs kept to a minimum.

The new major recognizes the needs of industry, states Donald V. Josephson, chairman of an interdisciplinary committee administering the program. He says it can succeed only if industry supports it through scholarships to attract people of college caliber. Currently, there is a serious shortage of technically trained people in the food industry. Only by college and industry working together can the new leaders of the food industry be secured and trained to fulfill the great need in this area, Dr. Josephson points out.

Examples of Courses in the Food Technology major are:

General Food Technology—Food production and consumption trends; technology of the food industry; problems and methods of preserving various foods; additives and food regulations.

Fundamentals of Dairy Products—Composition, properties and physico-Chemical aspects of milk and milk products; legal and quality considerations relating to consumer acceptance.

Processing Dairy Products—Unit operations involved in processing dairy products and their effects on the properties of these products.

Poultry and Egg Products—Application of food science and technology to the handling, processing, preservation, and retailing of eggs, poultry meat, and special products.

Fruit and Vegetable Processing—Canning, freezing, dehydration, and other means of preserving of fruits, vegetables, and their products.

Effects of Processing on Foods—Physical and chemical changes in food caused by processing, packaging, storage, and distribution.

Sanitation and Quality Control—Principles of sanitation, public health, standards of identity, quality grades, adulteration, and labeling of processed foods.

The Thermal Process—Theory and application of heat to sterilization of food. Heat resistance of spores, rates of heat penetration, determining process times for food.

Departments cooperating in this new interdisciplinary major are Animal Industry and Nutrition, Agricultural Engineering, Dairy Science, Horticulture, and Poultry Science. Further information may be obtained from Dr. Josephson at 105 Borland Laboratory, University Park, Pa. 16802.

15TH SOUTHERN WATER RESOURCES AND POLLUTION CONTROL CONFERENCE

An April 6, 7 and 8, 1966 the Southern Water Resources and Pollution Control Conferences, initiated in 1952, will provide a forum where the contribution of the water environment to the health and prosperity of the Southeast will be discussed from political, economic, and technological view points. Outstanding spokesmen for the several areas of interest have been invited to share their thoughts and efforts with the participants of the Conference.

Development of water resources has long been recognized as a tool of national policy. It has not been well understood, however, that expenditures by municipalities, industries and other local interests account for about three quarters of the total investment in development projects in the Southeast. Expanding population and increasing production are reducing the per capita allotments of water. A goal of ample quantities of high quality water for all purposes at a reasonable price can be achieved only if widespread discussion and understanding of the associated problems is possible. North Carolina State University at Raleigh, Duke University at Durham, and the University of North Carolina at Chapel Hill have undertaken the sponsorship of the Conferences on a rotating basis in recognition of the need for an unbiased forum.

Participants in the Conferences are drawn from the policy setting echelons of government (Federal, State, and Municipal), consulting engineers, industry, and from the academic community. The host for the Fifteenth Conference is North Carolina State University located in Raleigh, North Carolina.

"SELLING" THE PUBLIC HEALTH SANITARIAN

Here is an item of interest from the Michigan Association of Sanitarians Newsletter.

"The MAS Board of Directors have embarked on a multi-pronged program for projecting the proper image of the professional sanitarian in our society.

Under the leadership of Bob Lyons, work has been completed on a short public relations film on the environmental health specialist in our community. This is in the form of a 60 second film, in color, which will be used by television stations for public service spot announcements. Through the efforts of Sam Stephenson and Winfred Ettesvold the film will be on the air in March through August on all Michigan stations.

The development of a series of longer live T.V. programs on the role of the sanitarian has begun in cooperation with the Michigan Health Council. To date, programs have been broadcast over Channel 13 (Grand Rapids) and Channel 9 (Cadillac). Sam Stephenson, Dave McMullen and John Fleming have participated in these programs. It is anticipated that program opportunities will occur elsewhere in the State, and other practicing sanitarians will be called upon to assist in this venture."

2ND INTERNATIONAL CONGRESS ON FOOD SCIENCE AND TECHNOLOGY

The Second International Congress on Food Science and Technology, arranged by the Polish Ministry of Food Industries, the Committee on Food Technology and Chemistry of the Polish Academy of Sciences, and the Association of Polish Food Technologists is to be held in Warsaw, Poland, during the week beginning Monday, August 22, 1966.

The program for August 23, 24 and 26 will cover eight general topics. Each topic has been selected to emphasize fundamental aspects of food science and technology not covered by congresses on individual commodity and process problems held by other international scientific unions. The eight general topics are: (1) Novel protein foods and their protein sources; (2) chemical and biological deteriorative changes in food; (3) technological advances in food processing; (4) advances in food engineering; (5) technical problems of safety and purity of foods; (6) advances in methods for assessment of food quality; (7) economic, sociological and nutritional aspects of food production, processing and consumption; and (8) special problems of food science and technology.

A comprehensive scientific program has been prepared to cover a wide variety of topics of current interest to those working on food production, manufacturing, processing, storage, distribution and consumption as well as in teaching and research.

X-RAY DIFFRACTION CHEMICAL IDENTIFICATION USED BY FDA SCIENTISTS[1]

One of many scientific techniques used by FDA scientists to enforce the Federal Food, Drug, and Cosmetic Act is X-ray Diffraction, a method of identifying chemicals in foods and drugs photographically.

The science of crystallography, or the recording of the structure and forms of crystals, has been used by FDA scientists to identify chemical substances for many years. X-ray Diffraction supplements the identification techniques currently in use. X-ray Diffraction is a "picture-taking" process. X-ray beams are shot through chemical crystals whose internal structure diffracts or "scatters" the rays at different angles or permits passage unheeded. These diffraction patterns are permanently recorded on a strip of film.

The machine used in this process is a metal console about four feet high, encasing a generator and electrical circuits in the base and an X-ray housing with four X-ray escape "ports" in the upper section. The sample to be tested is crushed into a fine powder, and a small amount is carefully packed into a 1-inch capillary, or fine glass tube, about the size of a pencil lead. The tube is fastened in the center of a sample chamber or "camera". On each side of the tube is a "collimator," a hollow device shaped like an eyedropper, which is inserted into the chamber from the outside. These two collimators, one of which guides the X-ray beams into the chamber, are aimed at the sample. The chamber is lined with a filmstrip.

Thirty thousand volts of electricity activate an X-ray tube shooting high speed electrons at a metal target plate, or anode, which in turn emits the X-ray radiation. Since the X-ray radiation is a mixture of different wave lengths, filters are used to strain out "undesirable" wave lengths, leaving only one to be funnelled through the collimator, where it is further reduced to a fine, pencil-thin beam. This beam hits the sample and is either bent or it passes through the sample and the collimator on the opposite side of the tube. During this process the sample is slowly rotated at the speed of one revolution per minute for a period of from 2 to 6 hours.

The molecular structures of some chemicals permit X-rays to simply pass through them with no path deviation. In other chemicals the rays are scattered at various angles and strike the film, leaving characteristic imprints or lines. FDA scientists use the patterns of darkness of these lines and the distances between them for chemical identification. The relative intensities and distances between these lines on the film are then compared with those on a filmstrip of a known substance for identification.

FDA's X-ray Diffraction machine is used by the Division of Microbiology to resolve such questions as the composition of a "cure-all" remedy and the difference between two apparently similar antibiotics. The machine revealed that the "cure-all" remedy contained barium sulfate, magnesium oxide, and starch—common substances with no panacean effects.

In the case of two seemingly similar antibiotics, the manufacturer stated both had been made from the same batch submitted to FDA for testing. One met the specifications for potency required by FDA; the other did not. The X-ray Diffraction machine proved that one of the drugs was "purer" than the other.

The machine has also been used to fix the identity of questionable substances submitted by a number of consumers. One woman claimed that she had been served a powder in her soup which she claimed was "poisoning" her. The machine showed the powder to be sodium bicarbonate or common baking soda.

X-rays emitted by the machine are not the same as those produced by machines used by doctors to take chest X-rays. The latter rays, "hard" or penetrating radiation, pass relatively harmlessly through the human body. The X-ray Diffraction machine produces radiation which can be absorbed by the skin and cause burns which do not heal readily. The machine is equipped with safety devices, however. When properly operated, no more radiation

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[1]From FDA Report on Enforcement and Compliance, December, 1965.

escapes from the machine than from a watch with a radium-coated dial.

An accessory to the machine, which makes its operation even more accurate and less time-consuming, is known as a diffractometer and measures results on a strip chart instead of film. Instead of using collimators, the diffractometer uses an extremely sensitive radiation detector device which rotates in an arc around the sample. The moving device picks up the X-ray beams (scattered by the sample), records them, and sends these impulses to the strip chart, where they are drawn as visible peaks of varying heights instead of hard-to-distinguish dark or light lines.

Research chemists using the machine say this auxiliary unit will enable them to make quantitative as well as qualitative measurements. They will be able, not only to tell whether a chemical is contaminated, but also how much contamination is present.

DICK PARRY CHAIRS COMMITTEE ON SINGLE SERVICE CONTAINER STUDY

The 1965 National Conference on Interstate Milk Shipments requested the Public Health Service to list manufacturers of single-service milk and milk products containers after criteria for such a listing had been prepared, assisted by a committee appointed by the Interstate Milk Shippers Conference.

Dr. R. M. Parry, Chief of the Dairy Division of the Connecticut State Department of Agriculture was appointed chairman. The committee had its first meeting on Thursday, January 27; a second committee meeting will be held in March. It is hoped that these standards will be prepared by July 1, 1966.

RESEARCH AND DEVELOPMENT ASSOCIATES ANNUAL MEETING

Research and Development Associates will hold its 20th Anniversary meeting, April 12-13-14, 1966, Pick-Congress Hotel, Chicago, Illinois, with a general theme of "Old Food Forms from New Food Sources." Registration information may be obtained from Harlan J. Wills, Lt. Col., AUS-Ret'd., Executive Secretary, R&D Associates, U. S. Army Natick Laboratories, Natick, Mass. 01762.

KLENZADE OFFERS MORE COMPLETE FARM SANITATION PROGRAM

A new complete dairy farm sanitation program based on new products and cleaning techniques is offered by Klenzade Products, division of Economics Laboratory, Inc. Three new formulations, Passiv-8 Acid Detergent, Aim Pipeline Cleaner, and HC-10 Bulk Tank and Utensil Cleaner, represent entirely new approaches in farm cleaning utilizing new chemical concepts, according to the manufacturer. Three products of long standing use, Iodophor Udder-Wash, Inflation-Kleen and Liquid Sanitizers round out the program.

Passiv-8 is an acid detergent which, when used in a final rinse, not only helps clean equipment but actually protects stainless steel from corrosion. The name comes from its ability to "passivate" stainless steel—to rebuild its protective oxide coating so the metal will not react with corrosive agents. Passive-8 also controls water hardness and milkstone deposits on all dairy farm equipment with no corrosive effects on such materials as nickel alloys, rubber, penton, plastic tubing aluminum and mild steel.

One of the two new chlorinated alkaline cleaners is designed for brush washing equipment and the other for pipeline recirculation. HC-10 Cleaner (Chlorinated Kleer-Mor), long familiar to Klenzade users, has been reformulated with a new organic chlorine source. In the brush cleaning of bulk tanks and milkers, the more active chlorine does a faster, more thorough job. Because it is more active, less chlorine is needed in the formula, reducing the tendency to skin irritation.

Aim Pipeline Cleaner is a defoamed product designed for use where excessive foaming and resultant air bubbles cut down the contact between the surface of the pipeline and the chemical cleaner. Foaming is reduced to a minimum even at low water temperatures. A new and more effective organic chlorine is incorporated in Aim to enhance its cleaning ability. Both cleaners have high levels of water conditioning agents to hold all water minerals in suspension. The result is a clean rinse with no water spots or milkstone.

Another new feature of these alkaline detergents is that they are available in two pound "control" packaging for convenience and for effective control of usage. Both are also packaged in plastic pails reusable in the manual cleaning procedure.

Use of Iodophor Udder-Wash prior to milking not only helps to control sediment in the milk but also is an aid in the prevention of mastitis. Washing the udders kills and removes bacteria and the massaging action lessons udder damage by promoting milk letdown.

For cleaning rubber parts of milking machines and vacuum systems Inflation-Kleen has long been recommended. It removes fats and residues absorbed by the rubber, thus greatly lengthening the life of the rubber.

To insure low bacterial counts Klenzade liquid chlorine sanitizers, X-4 and XY-12, are highly effective. These can be circulated through pipelines just before using, sprayed on bulk tanks with the Klenzade Sprayer unit, and used as a pre-milking rinse for the milking machine.

For promotion of the new farm sanitation program a new 10 minute color-sound movie has been developed, picturing each step of the recommended procedures. Literature on the farm sanitation program, and milkhouse cards outlining the simplified procedures, are available from Klenzade Products, Division of Economics Laboratory, Inc., Beloit, Wisconsin 53512.

NEW BOOK ON CHEESE AND FERMENTED MILK FOODS

A new book, *Cheese and Fermented Milk Foods,* by Professor Frank V. Kosikowski, New York State College of Agriculture, Cornell University, has just been published. It is distributed by Edwards Brothers, Inc., Ann Arbor, Michigan.

Containing 27 chapters, the 441-page volume was prepared in answer to the many requests for a comprehensive book on this important subject. It describes the origins and principles of more than sixty foods from milk fermentations and gives specific directions for their manufacture. Included are yoghurt, sour cream, buttermilk, and cheeses such as Mozzarella, Ricotta, cream, cottage, Cheddar and Swiss. Little known facts on Kefir and Koumiss, fermented milks produced in Russia, are presented as well as a commentary on the early theories and controversies dealing with fermented milk consumption and the prolongation of human life. In addition, the new volume contains information on the public health, safety, and nutritional aspects of cheese.

Approximately 200 illustrations are presented, showing some of the work of outstanding photographers in America and Europe.

The volume was written for students in technical schools and colleges, industrial workers, economists, and public health and regulatory officials. It is intended also for the non-technical reader who appreciates the lore of fermented milks and cheeses and wishes to understand more of their historical and technical background.

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.

FASTER PACKAGING SYSTEM

A complete packaging system, Auto-Fill III, which speeds the entire in-plant filling and handling operations and lowers the cost of Scholle bag-in-box containers has been marketed by the Scholle Container Corp., 200 West North Ave., Northlake, Ill. Filling speeds up to 150 quarts of milk per minute with two operators are guaranteed.

Auto-Fill III is completely automatic with liner bags and outer boxes delivered to operators as fast as they can be used. A new single-service spigot has been designed to be self-closing to prevent accidental leakage and the new system can also be used for fruit drinks and other beverages.

NEW CATALOG ON FLUID LINE ACCESSORIES, CONNECTORS AND FITTINGS

Spraying Systems Co. has published a new eight page bulletin describing all of the major accessories manufactured by the company for liquid and air lines. Most of these accessories were developed for installation in spray nozzle systems, but many of them have practical use in other liquid and gas handling installations. Most of the accessories are different in design or materials from conventional items, according to the manufacturer. Line strainers are made in a complete range for piping from ¼" to 2½" in size in stainless steel as well as cast iron and brass and other line strainers are offered for connection to piping up to 6" in size. Other accessories include a wide variety of components such as suction strainers, adjustable joints, patented split-eyelet connectors, stacking-type control valves, check valves and float box assemblies.

In addition, two pages of the bulletin are devoted to a unique series of fittings and adapters that offer the user an unusual opportunity to make various types of connections in ⅛" to ½" pipe lines and equivalent size tubing. Typical possible assemblies that can be made from these parts are flow regulators with or without check valves, strainer assemblies and a type of union connector. Most of these connectors and fittings are available in choice of brass or stainless steel and some in Nylon. For Accessories Bulletin 135 write to Spraying Systems Co., 3201 Randolph Street, Bellwood, Ill. 60104.

PENNSALT INTRODUCES TWO NEW PRODUCTS

Pennsalt Chemicals Corporation has introduced to the dairy and food industry a new heavy alkaline circulation cleaner and a new concentrated cleaner and sanitizer. The first compound designated H. D. Circulation Cleaner is useful on poultry, meat, canning, bottling and food and dairy processing equipment. It can be applied either by spray and circulation or with a pressurized steam gun.

New Pennsan XXX is a combination of an anionic wetting agent and an acid. While basically a sanitizer for farm, dairy and food processing plant equipment, it can be used effectively for the acid rinse following the cleaning operation.

For additional information on these products address B-K Dept., Pennsalt Chemicals Corp., 3 Penn Center, Philadelphia, Pa. 199102.

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MILK SANITARIAN: To work as a consultant on a statewide basis. Interesting position offering group life insurance, retirement benefits, liberal vacation, sick leave and merit system status. Salary $6144-8040. Requirements-graduation in dairy science and Masters Degree or one year of experience. For details write Director of Personnel, State Health Department, Richmond, Virginia 23219.

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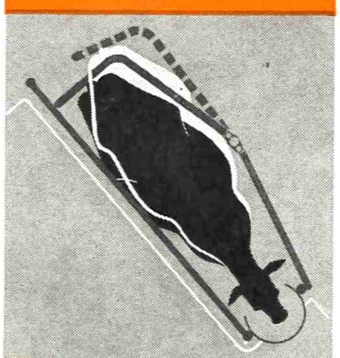

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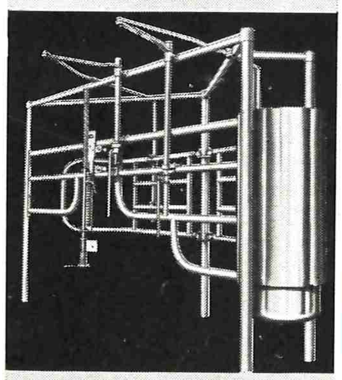

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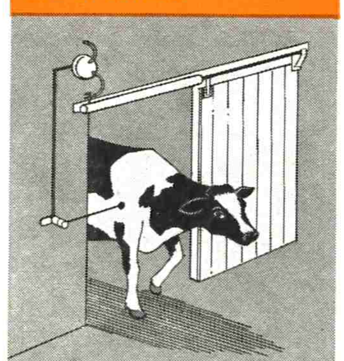

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