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Editorials

The opinions and ideas expressed in papers and editorials are those of the respective authors. The expressions of the Association are completely recorded in the transactions.

SANITARIANS—COMING OR GOING?

The sanitation-mindedness of the public did not just happen. It is a build-up by a long-continued process of applying cleanliness and orderliness and sanitation in general to our conditions of living—and doing it in such a way that the public likes it. It has been formulated from ideas which were developed by sanitarians, physicians, chemists, bacteriologists, engineers, veterinarians, and others. It has been made workable by personnel who have known how to apply abstract ideas to every-day living. The fieldmen—the inspectors, now sanitarians—did this.

These men have usually been either chief executive officials or men responsible directly to the health officers. A sanitarian has held a position of dignity and responsibility. Often he has risen to the directorship of his bureau or division in a health department. But there now seems to be a trend to place all of this work under the direction of an engineer. Perforce, such a move subordinates the sanitarian. He finds that he is forced (pushed back) to a lower level of organizational responsibility (and thus cut off from warranted recognition and the higher salary brackets). The increased recognition of the importance of applied sanitation, built up by a generation of sanitarians, is now being increasingly placed under the direction of a professionally limited class of specialists which has had only a part in the whole program.

Probably the reason for this is the fact that engineering is a well-recognized professional and educational entity. Everyone knows what an engineer is—the kind of training that he has received—the type of work that engages his attention—the technique he uses in going about his work. So, when the health officer sets up specifications for the position of head of the environmental hygiene work, he has the well-established field of engineering (increasingly now—sanitary engineering) to draw on.

We commend the recognition that the public is giving to the field of sanitation. We deplore the narrowing of the positional opportunity for men who are

sanitarians but who are not labeled as engineers. We maintain that the field of sanitation is broader than any one specialized professional class. Therefore, properly qualified men, regardless of label, should feel that they can reach the higher administrative levels. This increases the incentive for good work. On the other hand, nothing is more disheartening than to know that however well you do your work, the situation is stacked against you by fiat (meaning that the Civil Service rules define the incumbent as one who was educated years ago in a curriculum which you cannot go back to but which, *as a curriculum*, prepared him no better than yours did you).

The situation is that of our own making. We know that persons cannot be recognized as physicians, veterinarians, nurses, and engineers without formal education in curricula at accredited institutions of learning. These create real professions. Then on top of this type of education there is the acquisition of knowledge and experience that comes from years of application to environmental sanitation problems. A sanitarian is the final product. But many santiarians seek a short cut to such professional standing. They short-circuit the line of educational training. The result?—the present situation.

So we find that the sanitarian has no well-understood professional status. His training ranges from that of the Ph.D. to the politically-appointed "faithful." His duties range from working out pasteurization control to nuisance abatement, from supervision of water purification to the lowliest inspection jobs that a health department must embrace. All are "sanitarians."

In view of these considerations the appointing officials specify that the top sanitation positions are to be held by engineers—men who are fundamentally well trained and everybody knows it. We commend this ideal of public service. We suggest an amendment: that such positions be held by ". . . engineers or those whose training and experience are equivalent to that of a Fellow (in Sanitation)."

What is such a Fellow? See the following editorial.

We want to know: is the sanitarian coming or going? Is his opportunity for public service, professional recognition, and salary attainment increasing or decreasing? We maintain that if he continues "as is," he faces a decline in prestige and opportunity. But if he takes himself seriously and *qualifies*, he is in a position to expand greatly his field and his status. He can become a peer among peers.

Turning the field of sanitation over to the control of any one group is like trying to limit the earth to the production of only one fruit or vegetable; the sea and lakes, to any one species of fish; the air, to one type of birds. They are free. The survival of the fittest is still a law. The American way of free and fair competition is still in existence. So why make a totalitarian state out of sanitation? Why not the man who fills the position best be given the position, whether (years ago) he came up through the engineering, the veterinarian, the chemistry, or the bacteriology educational route? The only question that should be asked is: has he the educational background and the experiential knowledge to give a clean healthy community? Can he give us a safe milk and food and water supply? Can he properly protect us in the way that he is supposed to protect us? If so, the job should be his, irrespective of the degree after his name. The performance test is the only thing in which we are interested. This is the American way.

J. H. SHRADER

THE DEVELOPMENT OF A SANITARIAN

As we look over the personnel who constitute the professional sanitarian, we find men from many different fields: physicians, veterinarians, engineers, chemists, bacteriologists, and others. Not only the physical sciences and the biological sciences but also in many cases the social sciences have their application. The engineer is well trained in the physical sciences and is accustomed to think in terms of measurements and preciseness. The veterinarian has had more training in biology and microbiology and their relation to disease and many aspects of sanitation, but he may be short in the physical sciences, especially in the field of materials and their use. Likewise, the bacteriologists and the chemists who have graduated from first-class schools have had training in biology and biological chemistry, which gives good background for work in sanitation. In short, the engineer and the chemist have been trained more in the physical sciences whereas the physician, the veterinarian, and the bacteriologist have been trained primarily in the biological sciences.

Now sanitation may be likened to a gem of many facets. It utilizes knowledge from a wide variety of fields. Consequently, we find the engineer and chemist (who engage in sanitation work) learning biology as they advance through the years; and the physician, veterinarian, and the chemist-bacteriologist learning engineering and more chemistry; with both groups learning more and more about the social sciences—if they are smart and have progressive minds—until, lo and behold, some day we have a full-fledged SANITARIAN who is of some value to his community. This is not because he was an engineer, a veterinarian, a bacteriologist, or what have you, but because he has applied what little he learned in college and then added to that knowledge by everyday experience. He has added so much judgment and common sense and "knowledge of the eternal fitness of things" to his training and experience that after fifteen or twenty years you ask him whether he is an engineer, a veterinarian or any other such specialty, he will reply that "my college training was such-and-such but I soon found that I had to use my head and knowledge from various fields and much common sense, until now I am more than an engineer or a veterinarian or some other such professional. I am a sanitarian."

When a man attains this state of ability, he has reached the qualifications of a "Fellow". The American Public Health Association defines this classification as follows:

a. A graduate degree in public health or equivalent degrees and acceptable service for two years in responsible public health position;
b. An academic degree including training in public health and meritorious responsible service in public health for at least five years;
c. Notable original work in public health or preventive medicine giving recognized standing;
d. Employment in public health for at least five years, with special proficiency and recognized standing;
e. Teaching of public health or a constituent science for at least five years with attainment of distinction;
f. Substantial contributions to public health and attainment of recognized standing.

The appellation "sanitarian" is now generally understood to include any one who works in the field of sanitation. The use of the word "fellow" indicates that such high attainment of professional quality has been reached that a responsible organization sponsors the worker as being among the top-ranking persons in the field. It ignores the route but acknowledges the excellence of the performance. It rises above collegiate degrees and recognizes only the ability of the incumbent—degree or no degree.

J. H. SHRADER

A FEDERATED INSTITUTE OF SANITATION

AN INSTITUTE of Sanitation has been proposed in these columns [1] as a desirable means for coordinating and facilitating the work of applying sanitation to the many aspects of daily life. Already there are half a dozen organizations devoted in whole or in part to this subject. Although each operates in a more or less restricted aspect of the field, yet they overlap to one degree or another. More important still, the scatter of the several thousand sanitarians into these smaller groups weakens the effectiveness of the sanitarians as a class in developing their own professional standing. The increased strength that comes from the uniting of scattered groups is well known.

Much is said about professional recognition. Sanitarians have compared themselves with the professions of medicine, engineering, and nursing. However, sanitarians as a group do not so qualify. The development of the field has been so rapid that the accumulated experience of several generations has not been available for the working out of an adequate and generally acceptable educational program for the training of sanitarians as has been the case in medicine and engineering and chemistry. Hence, if anything is done to correct this, it will be done by someone else *for* sanitarians or it will be done *by* sanitarians themselves,—or else, sanitarians will find that the work that they have developed is taken over by other groups. So the whole country-wide force of sanitarians might very well set their own professional house in order themselves, rather than let other groups classify them and "put them in their place".

Professional recognition comes from quality of work done by men whose education and training are equivalent to those of the professions which have "arrived". Each separate sanitation group can do good acceptable work, without doubt, entirely on its own. However, a federated Institute of Sanitation can raise the whole field to a higher plane. Such an Institute would be a mouthpiece for all the affiliate groups; and its public relations would function in high gear. It could work out educational curricula that would be effective and authoritative. It could set up a classification of "Fellows" that would give the incumbents a standing commensurate with those of any other professional group. In a word, it would be able to foster and encourage such an intensive and effective program that recognition would come, not because of legal restrictions on the job or vocal claims of the workers but by virtue of the high type of personnel and performance.

Such an Institute could be a federated body, composed of representatives from each of the affiliated organizations. It would not usurp the opportunities or programs of any of its component units. Each of the present groups would continue to function as separate organizations as they do now, under their own names and officers and constitutions and fields of work and policies and objectives. It would be set up analogous to our federal union of states, to that of the British Commonwealth of Nations, to the American Institute of Physics (which is composed of a Council of delegates from the American Physical Society, the Optical Society of America, the Acoustical Society of America, the Society of Rheology, and the American Association of Physics Teachers). Each group controls its own affairs and yet benefits from the support and interest of the others.

"Your actions speak so loud that I cannot hear what you say." Let our program make our case for a place in the professional sun.

J. H. SHRADER

[1] This Journal 7, 128 (1944); 8, 127 (1945); 12, 129 (1949).

3A SANITARY STANDARDS FOR MILK AND MILK PRODUCTS USING DISPOSABLE FILTER MEDIA

Formulated by

INTERNATIONAL ASSOCIATION OF MILK AND FOOD SANITARIANS
UNITED STATES PUBLIC HEALTH SERVICE
THE DAIRY INDUSTRY COMMITTEE
AS OF JUNE 5, 1950

IT is the purpose of the IAMFS, USPHS and DIC, in connection with the development of the 3A Sanitary Standards program, to allow and encourage full freedom for inventive genius or new developments. Milk and Milk Products Filter specifications which are developed and which so differ in design, material, construction, or otherwise, so as not to conform with the following standards, but which, in the opinion of the manufacturer or fabricator are equivalent or better, may be submitted at any time for the joint consideration of IAMFS, USPHS and DIC.

3A SANITARY STANDARDS

A. Material

1. All metal filter parts having any surface in contact with the product shall be constructed of dairy metal consisting of stainless steel, nickel alloy, or equally corrosion-resistant material, that is nontoxic and non-absorbent.

a. All milk contact surfaces shall be finished to an equivalent of not less than 120 grit-finish properly applied.

b. All outside surfaces shall be smooth and easily cleanable.

2. Exteriors of structural parts not in contact with the product shall be of corrosion-resistant material with a smooth finish; or shall be rendered corrosion-resistant or painted, and be so constructed as to be easily cleanable.

a. If, to clean a milk contact part, an exterior or structural part not in contact with the product is normally immersed in cleaning solution, the corrosive-resistant treatment material used on the latter shall be non-toxic.

B. Construction

1. The outer shell or housing and all inner parts shall be of seamless silver alloy brazed, or welded construction.

2. The weld area and deposited weld metal shall be substantially as corrosion resistant as the parent metal.

3. All non-removable appurtances attached to the outer shell or housing shall be attached in a manner to produce smooth, crevice-free, easily-cleanable surfaces.

4. If legs are used, they shall be smooth, with rounded ends and no exposed threads. Legs made of hollow stock shall be sealed. On filters with legs designed to be fixed to the floor, the minimum clearance between the lowest part of the base and the floor shall be four inches.

a. Readily portable filters may have leg heights of two inches. Readily portable filters are defined as those having a base area of not more than two square feet, or, in the case of filters

mounted on legs, an area encompassed by the legs that does not exceed two square feet.

b. Bases when used shall be constructed without ribs or flanges, and shall have smooth top and bottom surfaces, and shall be self-draining.

5. All inner parts shall be easily disassembled from the outer shell or housing, and all surfaces in contact with the product shall have rounded and smooth inside corners as large as practical for proper operation, and shall be readily accessible for cleaning.

6. Perforations or slots in the filter medium supports shall be not less than 3/16" in the minimum diameter and the end radius of the perforations shall be not less than 3/32". After perforation the flat surface of the sheet from which the perforating punch emerges on the down stroke shall then be polished to the equivalent of not less than a No. 4 mill finish.

C. Openings

1. All inlets and outlets shall conform with the 3A Sanitary Standards for Fittings.

D. Gaskets

1. Single service gaskets of the sanitary type are preferred, or removable rubber or rubber-like gaskets that can be easily cleaned may be used.

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SANITARY STANDARDS AVAILABLE

Sanitary Standards heretofore adopted and published pertain to storage tanks, pumps, weigh cans, and receiving tanks, homogenizer and plunger-type pumps, can-type milk strainers, and automatic transportation tanks used to store, handle, or process milk or fluid milk products, and electric motors and motor attachments employed to drive dairy equipment. Reprints of these sanitary standards may be obtained from the Secretary of the Association (Mr. George A. West, Rochester Health Bureau, 44 Marshall Street, Rochester 2, N. Y.) at a cost of 10 cents each.

Drawings and dimensions of sanitary milk-pipe fittings and thermometer connections are available at a cost of 50 cents for the set.

The complete set of reprints and drawings, in an envelope, may be obtained for $1.25.

These may be secured from the Secretary-Treasurer of this Association: Mr. George A. West, Rochester Health Bureau, 44 Marshall Street, Rochester 2, N. Y.

Watch the columns of this Journal for new issues of standards for equipment not previously covered, as well as for amendments to existing standards.

3A STANDARD METHOD FOR DETERMINING THE HOLDING TIME OF HIGH-TEMPERATURE SHORT-TIME PASTEURIZERS BY MEANS OF THE SALT CONDUCTIVITY TEST

Formulated by

INTERNATIONAL ASSOCIATION OF MILK AND FOOD SANITARIANS
UNITED STATES PUBLIC HEALTH SERVICE
THE DAIRY INDUSTRY COMMITTEE
AS OF JUNE 6, 1950

It is the purpose of the IAMFS, USPHS and DIC, in connection with the development of the 3A Sanitary Standards program, to allow and encourage full freedom for inventive genius or new development. Methods and apparatus which are developed which so differ in technique, design, material, and construction, or otherwise, as not to conform with the following standards, but which in the opinion of the technician, manufacturer, or fabricator are equivalent or better, may be submitted at any time for the consideration of IAMFS, USPHS, and DIC.

This 3A standard salt test is suitable only for timing with water operation. Thermal tests may be used when operating with milk or milk products. However, there are variables specific for each set of conditions and each thermal instrument, and for these reasons thermal methods should be compared to the 3A standard salt test, and the necessary correction made.

A. Apparatus and Material

a. Electrical conductivity instrument. (Instrument)
b. Standard electrode with syringe connection. (Number 1)
c. Standard electrode. (Number 2)
d. Syringe—50 ml.
e. Stop watch.
f. Salt. (Sodium chloride)
(Details regarding the apparatus and materials are covered in the appendix.)

B. Methods of Performing the 3A Standard Salt Conductivity Test

1. Install the Number 1 electrode. A sanitary tee shall be provided with the pasteurizer for this purpose and temporarily installed at the upstream end of the holder to conduct this test.

2. Install the Number 2 electrode on the indicating thermometer fitting at the downstream end of the holder.

3. Connect the electrodes to the instrument and connect the instrument to suitable electrical supply. Close the circuit to the Number 1 electrode.

4. Operate the pasteurizer with water in a manner identical to the way it will be operated with milk at the normal pasteurizing temperature.

5. Prepare a quart or more of a saturated solution of salt in tap water.

6. Fill the syringe with 50 ml of the saturated salt solution.

7. Inject the salt solution with a forceful stroke of the syringe piston.

8. Start the stop watch at the instant the instrument registers the first change in conductivity.

9. Open the circuit to the Number 1 electrode and close the circuit to the Number 2 electrode.

10. Stop the watch at the instant the instrument registers the first change in conductivity.

11. Repeat this test six times. The variation between the minimum and the maximum readings should not be over 0.5 second. If the variation between

readings is greater than 0.5 second, the test shall be repeated until the variation of six successive readings is not greater than 0.5 second.

12. The holding time in the forward flow shall be considered the average of six successive readings. Similarly, the time in diverted flow shall be the average of six successive readings.

13. If either average holding time is found to be less than the legal holding time, the capacity of the timing pump may be reduced, the holder altered or other adjustments made, and the timing repeated until a satisfactory legal holding time is obtained.

14. Since pumps rarely deliver milk at exactly the same rate at which water is delivered, the holding time of a HTST unit, determined by the conductivity test of salt solution injected into water, must be transposed into the holding time for milk. This is done in the following manner:

(a) Determine the ratio between the water and milk capacities of the unit by ascertaining the times required to deliver equal volumes or weights of water and milk.

(b) If the capacity is determined by the times required to deliver equal volumes, compute the holding time for milk by inserting the time values obtained into the following formula:

$$\text{Holding time for milk} = \frac{T\ M_v}{W_v}$$

T = Holding time with water
M_v = Time required to deliver a measured volume of milk
W_v = Time required to deliver an identical volume of water

Example: The minimum holding time, determined by test with water, was found to be 16 seconds (T). The time required to deliver a measured volume of water (probably a 10-gallon canful) was found to be 68 seconds (W_v). An equal volume (10 gallons) of milk was delivered in 63 seconds (M_v). Milk was delivered more rapidly than water; therefore, the holding time for any particle of it was necessarily shorter, as computation with the formula discloses:

$$\text{Holding time for milk} = \frac{16 \times 63}{68} = 14.8 \text{ seconds.}$$

(c) If the capacity of the pasteurizer is determined by the times required to deliver equal weights (rather than volumes) of milk and water, the calculation of the holding time for milk should take into consideration the fact that milk is heavier than water. One hundred pounds of milk occupy less volume than 100 pounds of water; consequently, any particle of milk passes through the pasteurizer holding tube at a rate slightly slower than would appear from the ratio between the times to deliver equal weights of milk and water. The slight difference in rate of flow is a function of the specific gravity of milk, which normally is 1.032. Therefore, the holding time for milk, when determined by the relative times required to deliver equal weights of milk and water, is computed by the following formula:

$$\text{Holding time for milk} = \frac{T\ M_w \times 1.032}{W_w}$$

T = Holding time with water
M_w = Time required to deliver a weighed quantity of milk
W_w = Time required to deliver an identical weight of water

15. If the computed holding time for milk is shorter than the legally prescribed time, as in the example cited, the pump capacity is to be reduced to the extent that a holding time for milk, equivalent to that prescribed, is obtained.

16. Seal the timing pump drive.

C. Appendix

1. Apparatus and Material.

Apparatus in contact with the product shall be of sanitary design.

a. Electrical conductivity instrument.

The conductivity instrument shall have a sensitivity which will give readable response to 10 ppm of salt in water of not over 100 ppm total salts. The following instruments have been found on test to meet this specification:

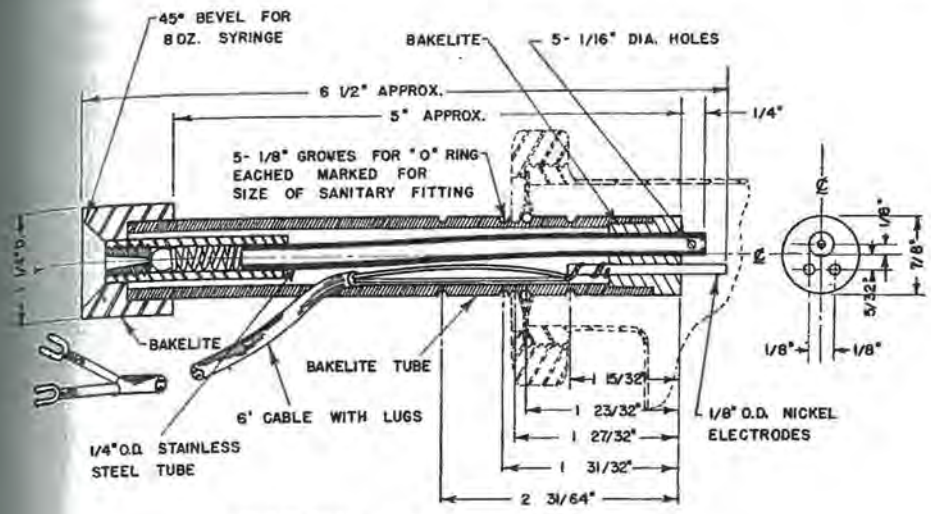
Solu-bridge Model RD-40—manual timer

Solu-bridge Model RT-3—automatic timer

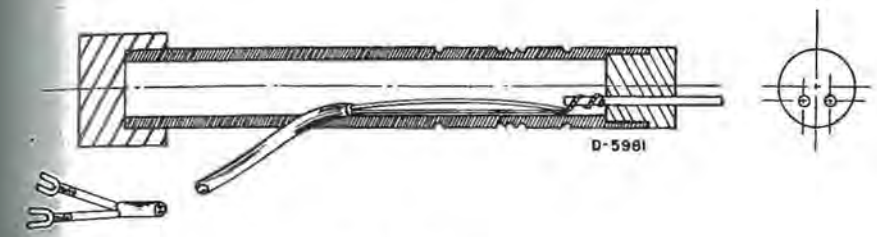
Industrial Instrument Co.
17 Pollock Avenue
Jersey City, N. J.

Galvanometer — taunt suspension — Model B—with proper shunt.

Fisher Scientific Company
711–723 Forbes Street
Pittsburgh, Pa.



ELECTRODE NO. 1
FIG. NO. 1



ELECTRODE NO. 2
FIG. NO. 2

This drawing is an example of an available electrode. Other electrodes are acceptable if they are of sanitary construction and meet sanitary requirements including location of the sensitive element in the center of the flow stream.

Milliameter—D.C. Model AEC 252, Type DO-41-FSIMA

General Electric Company
Schenectady, N. Y.

[The sensitivity of the holding time measurement decreases as the conductivity (salt content) of the water increases.]

b. An electrode with adaptors which fit all sizes of 3A Standard fittings is shown in Figure 1.

c. Syringe.

Any syringe with a capacity of 50 ml with connection to seal against electrode syringe connection is satisfactory, providing the discharge opening is not less than $\frac{1}{8}$ inch in diameter.

d. Stop watch.

The stop watch shall register 30 seconds or less for one revolution of the hand and shall read 0.1 second or less.

e. Salt. (Sodium chloride)

Any commercial brand of table salt is suitable for the purpose.

2. Complete Testers.

A complete tester containing all the necessary apparatus can be obtained from the following sources:

a. Industrial Instrument Co., 17 Pollock Ave., Jersey City, N. J.

b. Sidney P. Foster, 104 Schenck Blvd., Floral Park, N. Y.

3. Explanation of Method of Performing 3A Standard Test.

The specifications of this standard test are based on the results of the research work by Holland and Jordan[1] or previous studies by others reviewed by these authors.

a. An electrode at the upstream end of the holder is essential for obtaining accurate results. The sensitivity has been determined in relation to the movement of microorganisms. There is usually only one suitable port at the upstream end of the holder and, for this reason, the syringe connection is made an integral part of the electrode or designed for mounting in the same fitting.

b. The electrode for the downstream end of the holder is similar to the electrode for the upstream end of the holder but contains no syringe connection.

c. The electric current supply required for each make of electrical conductivity instrument is specified on the name plate of the instrument.

d. Operate the pasteurizer with water in a normal manner. The water in the constant level tank should be at normal maximum static head. Heating and cooling facilities should be at maximum volume capacities. The pasteurized milk discharge outlet should be at normal minimum static head. There should be no leaks on the suction or discharge sides of the timing pump. Any leakage on the suction side of the pump will lengthen holding time. Leakage of air is manifest by a fluctuation of the reading of the electrical conductivity instrument.

Homogenizer – When one or more homogenizers are attached to the pasteurizer, timing shall be repeated with the homogenizer operating at maximum capacity (without pressure applied to the homogenizer valve).

Clarifier or Separator–When a clarifier or separator is attached to the pasteurizer, timing shall be done when the bowls of such equipment are stationary. If such additional equipment may be by-passed, timing shall be done while the by-pass is in operation.

Filter–When a filter is attached to the pasteurizer, timing shall be made with all filter material and removable restrictions to flow removed. If the filter may be by-passed, timing shall be done while the by-pass is in operation.

e. Salt (sodium chloride) was chosen as the electrolyte because it is readily available and is fairly pure and of constant conductivity. A saturated solution is easy to prepare. About one-half pound of salt in a quart of water will make a saturated solution.

f. The volume of electrolyte used affects the accuracy of the test. When testing a pasteurizer of 8500 pounds per hour, volumes of 15 ml to 100 ml gave reproducible results within ± 0.1 second. The 50 ml volume falls within this range for all pasteurizers up to 28,300 pounds per hour capacity.

g. With the use of Number 1 electrode, the speed of injection is not critical but the entire volume shall be injected in 0.5 second or less.

h. If an automatic timer is used in place of manual timing, the human element of timing is eliminated. However, the automatic timer shall be set to respond to a change of 10 ppm of salt.

i. The electrical conductivity instrument is provided with a throw switch marked Number 1 and Number 2 electrode.

j. The watch should be stopped at the instant the instrument registers a change in conductivity as this is the minimum time that the instrument detects the salt solution.

k. At least six readings are necessary to assure correct timing. Under laboratory conditions, readings of not over 0.3 second maximum deviation can be obtained consistently.

l. If readings of 0.5 second or less maximum deviation cannot be obtained, it may be due to variations in the flow in the holder, and the minimum reading shall be considered the holding time.

m. When timing in diverted flow, care should be exercised to be sure the system is free from any salt solution from previous timing.

4. Accuracy of the 3A Standard Test.

Holland and Jordan[1] have determined that bacteria and saturated salt solution travel at practically the same velocity in water of 150 ppm hardness. Also the accuracy of the test decreases as the hardness (electrical conductivity) of the water increases. With water of 1000 ppm, the apparent holding time will be about one second longer than with water of 150 ppm or less.

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Dr. Giltner, Deceased

Dr. Ward Giltner, 68, dean-emeritus of the School of Veterinary Medicine at Michigan State College and one of the nation's pioneer leaders in the field, died July 14 following a heart attack at his summer cottage at Higgins Lake.

Dean Giltner, who retired in 1948 after 40 years of service at MSC, had directed the college's veterinary science program since 1923.

After joining the MSC staff in 1908 as a research assistant in bacteriology, Dean Giltner was appointed professor of bacteriology in 1912, and in 1923 took over the Division of Veterinary Science. In 1944, the curriculum was greatly expanded and the name changed to the School of Veterinary Medicine.

Born in Ithaca, N. Y., April 5, 1882, Dr. Giltner received his D.V.M. degree from Cornell University, his M.S. from Alabama Polytechnic Institute at Auburn, and his doctor of public health degree from the University of Michigan.

Examination for Milk and Food Inspectors Announced by Milwaukee City Service Commission

These examinations will be held October 20, 1950, for the position of Dairy Inspector, II, and on October 27, 1950, for Food Inspector II. The duties are those usually required of such positions, each of which starts with beginning salary of $3903.84 per annum, advancing in annual steps to $4083.84. Applications must be made on blanks supplied by the Commission, and must be filed not later than October 18 and October 25 respectively in the case of applicants to be examined in Milwaukee and sufficiently earlier than the said dates in those cases where the applicants must be examined elsewhere. Address The Milwaukee City Service Commission, Room 716, City Hall, Milwaukee, Wisconsin, for full information.

QUATERNARY AMMONIUM COMPOUNDS IN THE DAIRY INDUSTRY

A Report for the Applied Laboratory Methods Committee

FRANKLIN W. BARBER

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PART I. LITERATURE REVIEW

THE 1948 Committee Report on Quaternary Ammonium Compounds consisted of a list of references. Continuing the work of the past year another list has been prepared including articles of interest published between October 1948 and October 1949. Three groups of references have been accumulated: the first includes papers concerned with the bacteriological evaluation of quaternary ammonium compounds and detergent-sanitizers; the second, papers on the applications of detergent-sanitizers; and the third, papers of general interest concerning quaternary ammonium compounds.

These references undoubtedly do not include all the papers published on the subject, but it is hoped that at least the major ones have been included. It is of interest to note that in spite of the number of papers published on methods of evaluating quaternaries and detergent-sanitizers, there is still some question as to the most satisfactory method for evaluation. There are numerous groups working on these methods, and attempts are being made to develop a simple but accurate testing procedure. Some of the newer testing methods published during the past year are the following:

Weber and Black's Laboratory Test
Ridenour and Armbruster's Swab Rinse Test
Goetchius and Botwright's Rubber Strip Technique
Barber's Oval Tube Technique

Another phase of testing quaternary ammonium compounds which has been receiving considerable attention, is the development of a chemical test for quaternaries in milk. A recent communication from one member of this committee (P. R. Elliker,) states that a method is being developed which will permit the determination of concentrations as low as 5 ppm in milk. The method is in the experimental stage and minor details are being worked out before the method is submitted to other laboratories for examination. (It has since been published as "A Test for Quaternary Ammonium Compounds in Milk and Detergent-Sanitizers" by Miller & Elliker, *Oregon State College Circular of Information 472.*) The problem of a chemical test for quaternary ammonium compounds in milk is an important one. The success or failure of such a testing method may greatly influence the acceptance of detergent-sanitizers for use in the dairy industry.

PART II. FARM TESTS USING DETERGENT SANITIZERS

During the past three or four years a number of dairy companies, and their laboratories, in cooperation with manufacturers of quaternary ammonium compounds and detergent-sanitizers, have been conducting laboratory and farm field tests on these compounds. For the most part, the data collected from these studies were mainly for the information of the individual companies and were not originally intended for publication. However, at the request of this committee, these companies made available their data for inclusion in a committee report on farm tests where detergent-sanitizers were used for cleaning and sanitizing milking equipment.

The information assembled in this report is presented as the results of a number of field tests conducted on farms in different sections of the country with no identification as to the locality, participating companies, or trade names of the compounds used. The data represent studies on over 568 farms in 13 different areas. Twenty-one different sanitizing compounds were used, but these can be sub-divided into four chlorine compounds and 17 detergent-sanitizers. All the sanitizing compounds fall into four main groups, depending upon the active ingredient:

Group I	(Cl)	Chlorine compounds
Group II	(Q_R)	Detergent-sanitizers using alkyl dimethyl benzyl ammonium chlorides
Group III	(Q_E)	Detergent-sanitizers using alkyl dimethyl ethyl ammonium bromides
Group IV	(Q_H)	Detergent-sanitizers using di isobutyl phenoxy ethoxy ethyl dimethyl benzyl ammonium chlorides

Although these studies were conducted by different companies, the basic plan of action was about the same in each area. Farms were selected according to previous bacterial counts with probably more emphasis placed on thermoduric counts than on raw counts. Directions for use of the compounds were specified, and in most instances the farmer was actually shown how to use the compound by the company field man. So far as can be learned, the concentration of compounds were those recommended by the manufacturer.

Since in analyzing the data it was not possible to take into consideration the number of farms using each product or the number of bacteriological tests made on each producer's milk, the average figures presented are for *all* the farms on any particular test material in a specific area. In some cases, the pre-test data represented counts obtained during a two-week period immediately before the study, while in other instances the monthly average counts, over a period of several months to a year, were used. Usually an attempt was made to select farms with a record of high raw and pasteurized counts.

Unfortunately, the data available on many of these areas were insufficient to permit a detailed analysis or an explanation of some of the peculiar results observed. All the information gathered was tabulated and many graphs were prepared showing pre-test and test period raw and pasteurized counts, logarithmic and arithmetic averages for each product in each area, percentage reduction in raw and pasteurized counts, comparison of methods in certain areas, and selected data from producers whose raw milk counts were more than 100,000 and/or pasteurized counts of more than 5,000/ml during the pre-test period. Presentation of all this material would be confusing, consequently only a few summary tables and graphs are being included in this report.

A number of the detergent-sanitizers used in the various field studies were available for laboratory evaluation. These products were studied by the Oval Tube Method [1] in the laboratory of one committee member (F. W. Barber.) The results summarized in table 1 show the laboratory test results and the percent reduction in pasteurized counts in areas where these compounds were studied. Considering the fact that the simulated adverse conditions of the Oval Tube Method are extreme, and that the actual field test conditions were not uniform, there is an interesting correlation between laboratory and field test results. The greatest percent reduction in pasteurized count was obtained by the product giving the most satisfactory laboratory

TABLE 1

FIELD TEST PER CENT REDUCTION RESULTS AND LABORATORY EVALUATION OF SEVERAL DETERGENT-SANITIZERS BY THE OVAL TUBE METHOD

Sanitizer		Oval tube method end point % ice cream mix added				Field test reduction in pasteurized counts
Group	Type	0 min.	0.5 min.	1.0 min.	2.5 min.	%
Q_R	a	<¼	<¼	<¼	¾	97.3
Q_R	b	4	10	20	>30	82.7
Q_R	c	<1	1	2	2	80.7
Q_R	f	<1	9	30	30	78.8
Q_R	i	<1	>10	>30	>30	93.5
Q_R	j	<1	5	12	26	84.4
Q_R	m	<1	2	4–6	8–10	96.4
Q_R	n	<1	< 1	2	4	92.9
Q_R	p	<1	6	10	18	84.7
Q_R	q	<1	3	10	26	88.2

End point—time required for 99.9 percent destruction of test culture.

results. The two instances (Q_Re and Q_Ri) where farm and laboratory test results are not comparable can probably be explained by the uncontrollable variables of farm tests.

The percent reduction results for raw and pasteurized counts showing both selected and unselected data of all products studied are summarized in tables 2 and 3 and graphs I and II. A reduction in both raw and pasteurized counts was noted with all products and methods. In most instances there was a much greater reduction in pasteurized counts than in raw counts with any given product. The selected data results are much more impressive since these high-count producers showed marked improvement in most instances.

The foregoing analysis was made without regard to area conditions or an attempt to make any comparative evaluation of various products. A better means of evaluating sanitizing procedures is the comparison of a number of methods in the same area. The farms in an area were divided into groups, each group using a different product with a control group using standard cleaning methods followed by chlorine sanitizing procedures. In this set-up, weather conditions and the competitive spirit of being on a special study were more nearly uniform for all products. Six such farm studies were made in this manner. The percent reduction results obtained on these particular tests, summarized in tables 4 and 5 and graphs III and IV, present some interesting observations. In three of these comparative studies, on the basis of unselected data, the reduction in pasteurized counts was fairly uniform for all products, whether detergent-sanitizer, or cleaner followed by a chlorine sanitizer was used. In the other three studies the detergent-sanitizers all gave better reduction in pasteurized counts than the use of a cleaner followed by a chlorine sanitizer. However, on the basis of selected data all six studies showed good reduction for all methods.

One of the most striking observations in these studies is the importance of proper formulation of the detergent-sanitizer. The bactericidal effectiveness of the active ingredient alone may be excellent, but if the formulation of the subsequent compound is not proper the results obtained may fall far below expectations. For example, in the Q_R group of detergent-sanitizers types a and c are superior to types b, d, and e. The same difference is noted in the Q_R group of products, in which types k and m are superior to the others.

The general comments of participat-

TABLE 2

PER CENT REDUCTION IN RAW AND PASTEURIZED COUNTS FROM SELECTED DATA OF FARMS USING VARIOUS DETERGENT-SANITIZERS

		Raw			Pasteurized		
Group	Type	No. of farms	% red.	Ave. % red.	No. of farms	% red.	Ave. % red.
Cl	a	12	52.0		14	91.3	
	b	10	73.3		8	93.8	
	c	6	90.9		4	82.5	
	d	2	51.3	73.7	7	89.1	89.2
Q_R	a	23	83.4		22	97.3	
	b	19	45.8		35	82.7	
	c	15	80.97		51	94.4	
	d	10	66.2		23	83.3	
	e	2	90.9	73.5	8	80.7	87.3
Q_R	f	13	65.3	65.3	15	78.8	78.8
Q_R	i	12	71.5		14	93.5	
	j	6	74.3		10	84.4	
	k	4	81.9		7	96.5	
	m	7	87.3		6	96.4	
	n	21	54.6		33	92.9	
	o	2	80.9		10	92.4	
	p	6	72.5		8	84.7	
	q	5	79.4		16	88.2	
	r	4	——	75.3	13	86.4	90.6

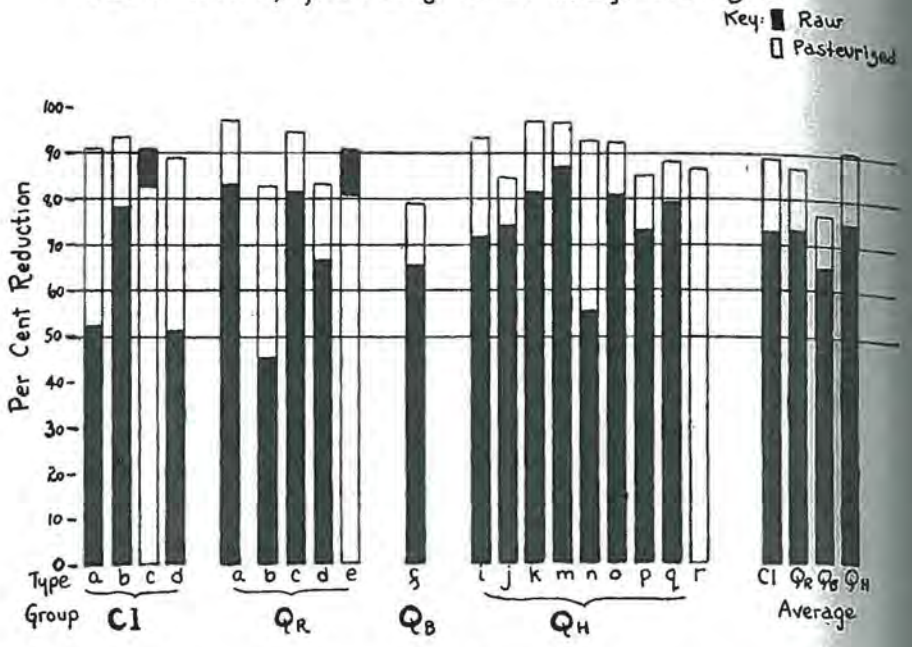
TABLE 3

PER CENT REDUCTION IN RAW AND PASTEURIZED COUNTS FROM UNSELECTED DATA OF FARMS USING VARIOUS DETERGENT-SANITIZERS

		Raw			Pasteurized		
Group	Type	No. of farms	% red.	Ave. % red.	No. of farms	% red.	Ave. % red.
Cl	a	46	41.7		46	72.6	
	b	15	71.8		15	83.3	
	c	30	23.4		30	17.8	
	d	8	64.2	50.3	8	90.0	65.9
Q_R	a	44	71.9		44	92.3	
	b	38	68.9		73	85.8	
	c	54	54.1		54	92.2	
	d	24	86.5		24	93.9	
	e	12	66.7	69.6	12	86.2	90.1
Q_R	f	16	61.1		16	80.2	
	g	23	——		23	80.0	
	h	20	——	61.1	20	72.0	77.8
Q_R	i	16	65.6		16	92.1	
	j	15	58.3		15	78.6	
	k	15	69.0		15	92.6	
	l	20	——		20	88.0	
	m	30	58.7		30	79.8	
	n	34	49.4		34	90.9	
	o	11	39.0		11	90.2	
	p	12	64.9		12	90.0	
	q	18	44.8		18	89.0	
	r	13	25.0	52.7	13	86.4	87.8

GRAPH I

Per cent reduction in raw and pasteurized counts from selected data of farms using various detergent-sanitizers.



GRAPH II

Per cent reduction in raw and pasteurized counts from unselected data of farms using various detergent-sanitizers.

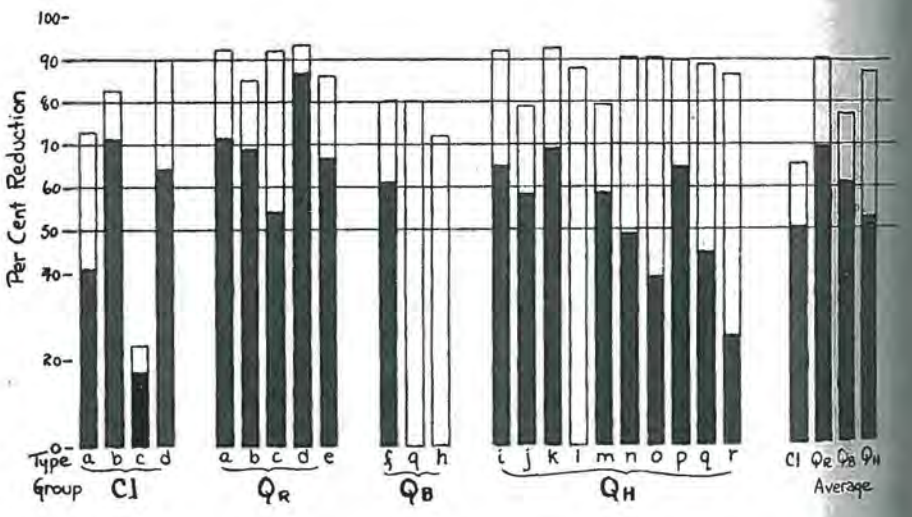


TABLE 4

COMPARISON OF SANITIZING METHODS: HYPOCHLORITES VS. DETERGENT SANITIZERS
PER CENT REDUCTION, UNSELECTED DATA

			Raw		*Pasteurized*	
Area	*Group*	*Type*	*No. of farms*	*% red.*	*No. of farms*	*% red.*
1	Cl	a	30	20	30	61.4
	Q_R	a	28	70	28	90
2	Cl	a	16	63.5	16	83.8
	Q_R	a	16	73.9	16	94.7
	Q_B	f	16	61.1	16	80.2
	Q_H	i	16	65.6	16	92.1
3	Cl	b	15	71.8	15	83.3
	Q_H	j	15	53.3	15	78.6
	Q_H	k	15	69	15	92.6
8	Cl	c	15	4.5	15	16.8
	Q_H	m	15	51.0	15	78.6
9	Cl	c	15	45.0	15	18.7
	Q_H	m	15	66.8	15	79.5
10	Cl	d	8	64.2	8	90.0
	Q_K	b	36	61.9	36	83.1
	Q_R	c	12	79.1	12	94.8
	Q_H	r	13	25.0	13	86.4
	Q_H	n	12	55.3	12	96.5

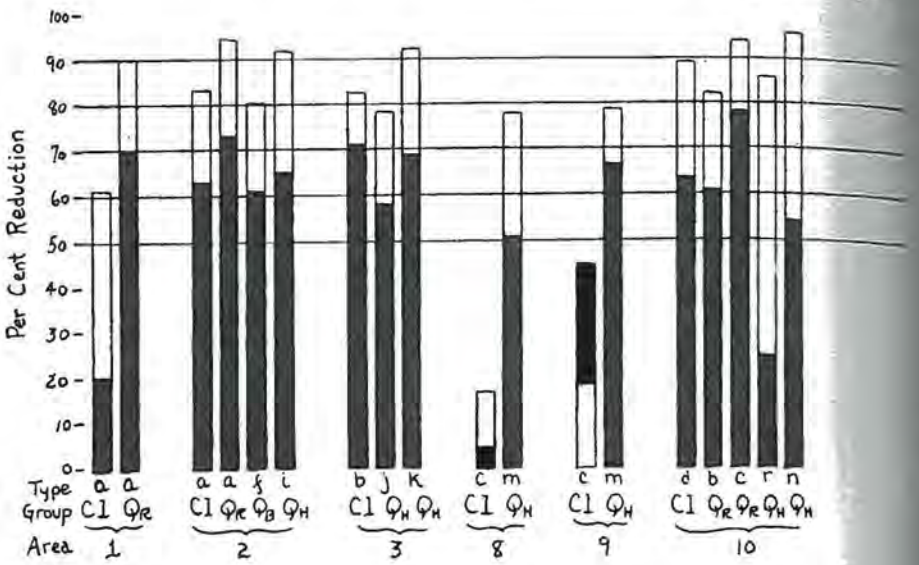
TABLE 5

COMPARISON OF SANITIZING METHODS: HYPOCHLORITES VS. DETERGENT SANITIZERS
PER CENT REDUCTION, SELECTED DATA

			Raw		*Pasteurized*	
Area	*Group*	*Type*	*No. of farms*	*% red.*	*No. of farms*	*% red.*
1	Cl	a	5	21	3	90.2
	Q_R	a	14	84.3	10	97.1
2	Cl	a	7	83.0	11	92.4
	Q_R	a	9	82.5	12	97.6
	Q_B	f	13	65.3	15	78.8
	Q_H	i	12	71.5	14	93.5
3	Cl	b	10	78.3	8	93.8
	Q_H	j	6	74.3	10	84.4
	Q_H	k	4	81.9	7	96.5
8	Cl	c	2	92.05	2	85.8
	Q_H	m	4	89.5	3	98.8
9	Cl	c	4	89.7	2	79.1
	Q_H	m	3	85.2	3	93.97
10	Cl	d	2	51.3	7	89.1
	Q_R	b	17	75.5	32	70.9
	Q_R	c	4	83.55	12	94.8
	Q_H	r	4	—	13	86.4
	Q_H	n	8	48.0	12	96.51

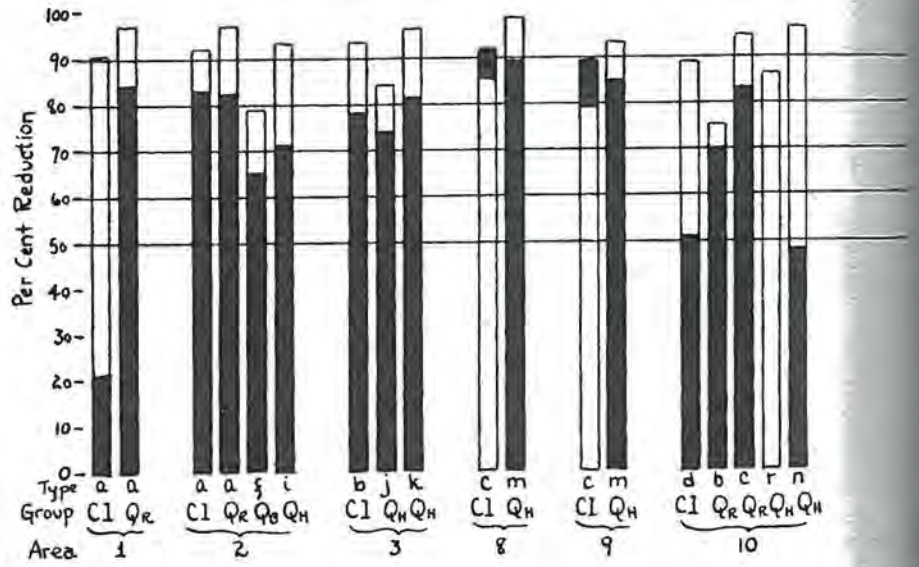
GRAPH III

Comparison of sanitizing methods: hypochlorites vs. detergent-sanitizers. Per cent reduction, unselected data. Key: ■ raw ▯ pasteurized



GRAPH IV

Comparison of sanitizing methods: hypochlorites vs. detergent-sanitizers. Per cent reduction, selected data. Key: ■ raw ▯ pasteurized



ing companies were fairly consistent and the conclusion seems to be that the composition of the detergent-sanitizer is extremely important since such factors as water hardness, organic matter, detergency, etc. must be taken into consideration. On the whole, when directions for use were followed religiously, satisfactory results were obtained when the farmer used either the standard procedure of a good cleaner followed by chlorine sanitization, or the new detergent-sanitizer.

One important value of a detergent-sanitizer may be in the fact that occasionally on a farm where there appears to be thermoduric trouble, it may be easier to convert to an entirely new principle of cleaning and sanitizing to clear up the difficulty, rather than to resort to requests for greater effort using the older procedure. In any case, it appears that periodic follow-ups by the field man are necessary, no matter what program of sanitization is used.

Information on two other studies, which could not be included in the foregoing summary, was submitted to the Committee. The conclusion reached with one of the studies was that in cold water, the detergent-sanitizer treatment was less effective than a lye treatment, but with hot water, the results were comparable. In the second study, the conclusions drawn by the investigators substantiated those already mentioned concerning proper formulations and careful attention to directions.

It is of interest to note in conclusion that in practically all instances the results of the farm field trials showed a good reduction in pasteurized counts both with the detergent-sanitizer and with the standard cleaning procedure followed by chlorine sanitization.

The committee wishes to thank the various dairy and chemical companies who so kindly submitted their data for analysis, and Miss Janet Curry for her assistance in the analysis of data, which made possible this report for the dairy industry.

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HIGH-TEMPERATURE SHORT-TIME PASTEURIZATION OF ICE CREAM MIX *

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THE desire of many ice cream manufacturers in recent years to use a HTST method for pasteurizing ice cream mix has presented public health officials with the problem of determining proper time and temperature standards for use in such a process. Such standards must not only insure the destruction of pathogenic bacteria which might be present, but should provide for the destruction of other bacteria present, to an extent comparable to that for the holder process. The standard for this process is 155°F for 30 minutes, as stipulated in the U. S. Public Health Service *Ordinance and Code for Frozen Desserts* (1940). The interest of the industry to use a HTST process for ice cream mix leaves little doubt of its probable adoption generally, particularly by larger companies. The absence of any standard for the HTST process until 1948 [3] has undoubtedly delayed the adoption of such processes in areas operating under the U. S. Public Health Service *Ordinance and Code for Frozen Desserts.*

PRESENT STATUS

In 1943 Dowd and Anderson [1] used an Electro-pure unit for the HTST pasteurization of ice cream mix. Portions of mixes were pasteurized at 180° F for 19 seconds in the HTST unit and at 160° F for 30 minutes in a vat pasteurizer. Averages of the standard plate count indicated that the HTST process was just as efficient as the holder process in reducing the total number of bacteria in the mix. Phosphatase determinations also showed that this HTST procedure adequately pasteurized the mix.

In discussing the dual use of the Vacreator for condensing milk and pasteurizing ice cream mix, Wilster [9] in 1945 reported the total counts of mix obtained by this process. In these studies the first chamber was controlled to heat the mix to 198–200° F, in the second chamber it was cooled to about 161° F, and to 100° F in the third. At one installation studied the mix from the Vacreator gave counts of bacteria per ml from 0 to 300, while at a second, counts from 200 to 1200 were obtained. Phosphatase tests on all mixes so pasteurized were negative. Unfortunately, there were no comparisons with pasteurization at 155° F for 30 minutes.

Speck [6] in 1946 conducted plant experiments to ascertain the destruction of the normal flora of bacteria in ice cream mix by HTST pasteurization. A plate heater normally used to preheat mix for holder pasteurization was fitted with a holding tube, the cold mix being heated directly to the pasteurization temperature without any preheating, such as is obtained in a regenerator. Although the pasteurizer was of 1000 gallon per hour capacity, the volumes processed, and thus the time of pasteurization, were varied by means of a Reeves Vari-Speed Moto drive connected to a Waukesha sanitary pump. The unit was timed for the various holding times by injecting saturated salt solution into water being pumped through the unit. The salt was injected at a valve located on the holding tube, 26 inches from the heater, and its appearance at a sampling valve located 5 inches from the flow diversion valve was detected by a Sol-u-bridge.

* Presented at the 36th Annual Meeting of the International Association of Milk and Food Sanitarians, Inc., held in Columbus, Ohio, October 20–22, 1949.

After sterilization of the equipment, usually two different mixes were pasteurized at varying temperatures for a given holding time. Pasteurization temperatures from 165° F to 180° F, at 5° F intervals, were used for holding times of 25, 26.5, 29.5, 32.5, and 37.5 seconds. Approximately 10-ml samples were collected from the sampling valve on the holding tube located just ahead of the flow diversion valve, and cooled in ice water. In addition samples of the unpasteurized mix were collected for determining the total and coliform counts. A 5-ml portion of each raw mix was laboratory pasteurized at 160° F for 30 minutes, this time and temperature being used as a basis of comparing the effectiveness of the HTST pasteurization experiments, since it is the usual pasteurization treatment used in the industry. The results showed that HTST pasteurization by this plant equipment using 175–180° F for 25 seconds gave bacterial destruction equivalent to laboratory pasteurization at 160° F for 30 minutes. Longer times at 175° F and 180° F did not increase the bacterial kill significantly. Although coliform bacteria were present in all the raw mixes, none survived any of the plant HTST pasteurization treatments or the laboratory pasteurization.

The foregoing study indicated quite definitely that HTST pasteurization of ice cream mix at 175–180° F for 25 seconds should kill any pathogenic bacteria present, as based on its effectiveness of bacterial kill equivalent to the holder process which has a wide margin of safety for such purposes. It was felt by a number of persons, however, that more direct information should be available on the minimum times and temperatures required to insure the destruction of pathogens in HTST pasteurization of ice cream mix. In order to obtain such information Speck [7] studied the times and temperatures required to kill *Micrococcus freudenreichii* (No. MS66) in mix. This organism was used after unsuccessful efforts were made to locate the heat-resistant *Escherichia coli* (No. 3U), a culture which had somewhat greater heat resistance than *Mycobacterium tuberculosis* and *Brucella abortus*, and which had been used by previous investigators as an index of safe pasteurization and sterilization procedures. Fortunately, *Micrococcus freudenreichii* (No. MS66) possessed practically the same degree of heat resistance in milk as reported for *Escherichia coli* (No. 3U), and in addition could be grown with the selective medium desoxycholate lactose agar (BBL) on which it formed small red colonies in 48 hours at 37° C. The technique used in the laboratory HTST pasteurization studies was modeled somewhat after the one used by Fuchs,[2] who eliminated the effect of heating-up times in similar studies on milk by inoculating a tube of tempered milk with a drop of test culture. The method developed consisted of placing 5 ml of mix, obtained by melting vanilla ice cream, in a sterile 120 x 20 mm glass vial plugged tightly with a rubber sleeve stopper. A series of tubes so prepared were tempered to the temperature under test. Then tubes were inoculated singly for given holding times with a suspension of the test culture, which had been grown on agar slants of a yeast extract-proteose peptone medium, suspended in sterile water, then shaken and filtered through sterile filter paper to eliminate clumps of cells. This suspension contained about 500 million cells per ml. Then 0.05 ml of the suspension was inoculated into the tempered mix through the rubber stopper by means of a 1-ml tuberculin syringe fitted with a 2-inch 20-gauge hypodermic needle. This permitted instantaneous inoculation and mixing of the test culture in the mix, and gave 1–2 million cells of the culture per ml of mix. After the desired holding period the tube was cooled rapidly in ice water. The pasteurized inoculated mix, as well as controls of unpasteurized inoculated mix and pasteurized uninoculated mix, were plated on desoxycholate lactose agar (BBL) and incubated at 37° C for 48 hours. The red colonies of *M. freudenreichii* (No. MS66) were then counted. The results showed that 99.99 percent destruction of the culture was effected in the ice cream mix at 150° F in 15 minutes, at 155° F in 2 minutes, at 160° F in 45 seconds, at 165° F in 12.5 seconds, and at 170° F in 1 second. Thus the U.S.P.H.S. standard of 155° F for 30 minutes and the suggested 180° F for 19 seconds or the 175° F–180° F for 25 seconds appeared to have quite large margins of safety for the destruction of pathogens in ice cream mix.

In 1948 Minthorn [4] described a commercial installation for the HTST pasteurization of ice cream mix, using a special heater for rapid heating and agitation of the mix during passage through the heater. In this operation the mix was pasteurized at 175° F for 23 seconds. By this treatment the author reported that the total count was low, coliform bacteria were destroyed, and phosphatase was inactivated.

The work of Sanders and Sager [5] on the heat inactivation of phosphatase in ice cream mix showed that 155° F for 30 minutes, or the 2 suggested HTST standards of 175–180° F for 25 seconds or 180° F for 19 seconds, would produce a safe product with a large margin of safety, based on the destruction of this enzyme as an index of safety. Thus in their studies phosphatase was destroyed at 155° F in 5 minutes, at 161° F in 60 seconds, or at 165° F in 21 seconds.

In view of the desire of a number of ice cream manufacturers to use HTST pasteurization, Mr. A. W. Fuchs,[3] of the U. S. Public Health Service, suggested that in areas operating under the *Ordinance and Code for Frozen Desserts*, a temporary standard of 175° F for 25 seconds be adopted until further research indicated any necessary change. This time and temperature combination appeared to be equivalent to 155° F for 30 minutes in bacterial destruction, based on the data available, but the need for further information regarding this proposed standard was recognized. Although there may be some question regarding its bactericidal equivalence to the standard for the holder process, there can be no doubt regarding the adequacy of the temporary HTST standard in eliminating pathogens.

QUESTIONS STILL CONFRONTING THE USE OF HTST PASTEURIZATION OF ICE CREAM MIX

The primary bacteriological problem remaining is the determination of time and temperature combinations equally as destructive to bacteria harbored in ice cream mix as is 155° F for 30 minutes. Although the present tentative standard presumably fulfills this requirement, more confirming data is desirable, and data should be available also on times required at higher temperatures. A process for which the latter data would be applicable, for instance, would be in plants where pasteurization is done by the Vacreator. Furthermore, as HTST pasteurization of ice cream mix becomes more generally adopted, it is very possible that pasteurizers different from the ones now available will be introduced. Such new equipment conceivably may be designed to operate at times and temperatures different from the present tentative HTST standard. Such developments could be expedited by having advance knowledge concerning the requirements of the times, at a series of temperatures, for the proper destruction of bacteria in ice cream mix.

Another problem of possible importance in the pasteurization of ice cream mix is the effect of varying concentrations of certain ingredients in different mix formulæ. This question has received no attention previously. Even though the total solids concentration of mix may not vary markedly, the fat and solids - not - fat components are varied. It is the latter that may be expected to have a measurable effect on the destruction of bacteria present. In the pasteurization of chocolate milk,

Speck *et al* [8] found that increasing the added sugar concentration from 5 percent to 8 percent, or the addition of 3 percent non-fat-milk-solids tended to prolong the time for the destruction of *Micrococcus freudenreichii* (No. MS66) at 143° F, 145° F, and 150° F. No effect was found by increasing the stabilizer from 0.0555 percent, the preferable concentration, to 0.07 percent the maximum usable without getting coagulation and wheying-off. In this connection, the work of Sanders and Sager [5] showed the probable effect of solids-not-fat on the destruction of phosphatase. Thus, skim milk required only 0.7° F less, and 20 percent or 40 percent cream required only 0.7° F more than the temperature required to inactivate phosphatase in 4.0 percent milk. However, ice cream mix required about 4.5° F more and sherbet 5.7° F more than the temperature required to inactivate phosphatase in milk. Butterfat concentration evidently had relatively small effect, but the solids other than fat had a very pronounced effect on phosphatase destruction. Studies are now in progress in the writer's laboratory to gain information on these and similar problems concerned with the HTST pasteurization of ice cream mix.

The determination of holding times in HTST pasteurization of ice cream mix presents another problem. When the difficulties encountered in timing milk in HTST pasteurizers are considered, it is obvious that ice cream mix presents greater ones. For example, the viscosity of mix offers more opportunity for "coring" effects in the conventional holding tubes, which makes the customary timing by water of questionable value for use in ice cream mix pasteurization. Timing is concerned primarily with the shortest time required for the fastest moving bacterium to pass through a holding tube or chamber, yet laminations of mix formed on the sides of the tube or chamber conceivably could cause faster movement of the mix at the center. It is essential, therefore, that timing measurements should be of the fastest moving portion. In establishing standards of holding times at different temperatures, however, it would be reasonable to expect that consideration be given to lethal temperatures present during the heating-up and cooling periods which are usually obtained in plant installations.

Aside from the bacteriological considerations of HTST pasteurization of ice cream mix, there are those concerned with the general operational program of manufacturing plants, the selection and use of stabilizers, and the effect of this type of pasteurization on the various characteristics of the finished ice cream. These manufacturing problems will undoubtedly receive more attention as the HTST methods are accepted from the public health viewpoint.

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THE CHICAGO TEST OF DETERGENT SANITIZERS FOR USE ON DAIRY FARMS *

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EARLY last summer, when the Chicago Health Department was invited to present a paper concerning the field tests being conducted on detergent sanitizers for use on dairy farms, it was thought that we would, by the time this convention was called to order, be able to discuss, "Some Factors Involved in the use of Detergent Sanitizers on the Dairy Farms." However, as in many like problems of investigation, we were confronted with a number of variables which were more than sufficient to retard our research to a degree that, for the present, this paper will instead confine itself to "A Report of the Chicago Test on the Use of Detergent Sanitizers on Dairy Farms."

The Chicago Health Department undertook to conduct a series of experiments to determine the efficiency of detergent sanitizers for use on dairy farms in the early part of 1949.

In January, with the approval of the United States Public Health Service, an experiment, limited in time and scope, was begun. Twenty farms, lying in an area of perhaps twenty square miles, participated in a one-week test. For one week prior to the test, the producers were permitted to use a designated detergent sanitizer. During the second week, one of our inspectors was assigned to each farm during the morning and evening milking periods. A complete inspection was made, and no milk passed through the units and equipment unless it was visibly clean.

Samples of wash and rinse water were collected twice daily from each farm to test residual of the detergent sanitizer. Samples of milk were collected daily at the receiving station, and raw counts as well as thermoduric counts were made.

The bacteriological results on the raw milk, as well as the thermoduric counts, were such as to open the way for the work just concluded to be done on a larger scale and possibly under not so closely controlled supervision.

This work was conducted in cooperation with the United States Public Health Service, and much of the plan of organization and conduct of the tests are due to the excellent cooperation and suggestions offered by Mr. Fuchs and Dr. Black. Their help is greatly appreciated.

The detergent manufacturers and the milk companies participating, of course, can only receive our heartiest gratitude for their spirit of willingness and helpfulness.

At a meeting of the Health Department personnel with Dr. Black, the Chicago test was born. It was decided that this experiment should involve a sufficient number of dairy farms scattered over a wide enough area so as to make the tests fairly representative of the prevailing supply of milk and water.

It was, therefore, decided that several manufacturers of the compounds should be invited to participate and, of the five who were asked, four responded.

It was clearly emphasized, at the first meeting of representatives of our Department and those of the milk industry and detergent manufacturers, that the fundamental idea of the Chicago test would be only to prove or disprove, at this time, the efficiency of typical detergent sanitizers for dairy

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farm use; that no particular compound would be rated in preference to any other; and that, except for whatever comparisons were to be made for purposes of the experiment, no comparisons would be publicized.

Two milk companies, the raw milk supplies of which are shipped directly from the farm to the pasteurizing plant located in Chicago, were selected.

The dairy farms used in the test are spread out over an area roughly corresponding to about 80 miles north of Chicago, over 100 miles west, and 50 miles south of the city. The supplies were easily accessible and yet were represented by virtue of differences in local conditions, water, and other features desirable for such a test as this.

The fieldmen of the two milk companies participating were required to get the farms in shape, all equipment to be thoroughly cleaned and defective equipment replaced. This was done well in advance of the start of the test.

It was decided, in contrast to the winter program, that the test be conducted along lines as practicable as possible and that the Health Department closely-controlled supervision be reduced materially. It was felt that, if the producers were allowed to work with the dairy plant fieldmen and the detergent manufacturer's representative, the results would more nearly approach normal, every-day results.

Ten days before the start of the program, samples of milk from each farm were collected by Chicago Health Department representatives at the pasteurizing plants and submitted to our laboratory for bacterial plate count. During this preliminary period, the producer used the conventional wash, rinse, and chlorine bactericidal treatment. Then, samples were collected for seven consecutive days, including a Sunday, and these results were to be used as a control by which comparisons of milk counts with those of the following period or Test Program, as it was called, could be made. There was a 4-day interim between the control period and the Test program and, during this time, the producers were instructed in the proper use of detergent sanitizers.

The actual Test Program started on August 1, and the producers had been using the product for four days previous.

Samples of milk of each producer were collected by our representatives on Monday, Tuesday, and Wednesday of each week for the entire month of August, and plate counts were made. Thermoduric counts were not made during this test. Our laboratory was already over-burdened for lack of personnel, as well as space, so it was decided to pass the tests on thermoduric counts.

Briefly, the results of the milk tests were disappointing. Many factors which tended, in our opinion, to be adverse to the best interests of the efficiency of detergent sanitizers, manifested themselves. For instance, the weather during the middle two weeks of the test was extremely warm. To attribute the possible attendant high bacteria counts to the inadequacy of the detergent sanitizers appeared to us to be an unfair assumption. Since then, samples were collected at the pasteurizing plant some 40 to 70 miles distant from the producing farms.

There were also a number of other conditions which interfered in the program. As a matter of fact, a survey conducted by our own representatives showed that a number of producers were not using the products. Also, some microscopic tests indicated that poor cooling was the cause of high counts; others showed utensil contamination.

It was then decided to approach the problem from the viewpoint of efficiency of these detergent sanitizers in representative waters. We had heard and read much about tests conducted on "artificial" water supplies and on "limited" water supplies. By an artificial water we mean one made in the laboratory, with certain specifications as to hardness, iron content, etc. By a limited supply we refer to a condition where the work was done on only one or a few types of water.

Another conference with Dr. Black showed we were leading up to something and it was decided to use the Weber-Black method for determining the bactericidal efficiency of the compounds.

The four detergent sanitizers were first tested against Lake Michigan raw water and Lake Michigan treated water, and the results showed on each of three compounds tested no growth after 30 seconds of exposure of the inoculum suspension to the detergent sanitizer solution, according to the Weber-Black method. The fourth product was eliminated from the test.

It may be well to inject several thoughts at this time.

The solutions of detergent sanitizers were made up, according to the manufacturers' directions on the label. The container of detergent compound was one taken from stock.

Water from each of the fifty farms was tested according to the prescribed Weber-Black method, using exposure periods of 15, 30, 60, 120 and 300 seconds. Since the tests were conducted over a period of time involving several weeks the inoculum suspension varied numerically from 45,000,000 to 400,000,000 per ml.

All three compounds used in the original test were investigated with respect to each water supply. The results of these bacteriological water tests were almost as varied as the number of samples. However, when the final computations were made it indicated that of the 50 waters, 9 were incompatible; that is, 9 waters showed a bacteriological deficiency with respect to all of the detergent sanitizers being used.

To show the results obtained on all 50 waters is a rather unhandy matter so, for that reason, the slides show results on only 15 waters. These are represented by 6 waters showing 100 per cent compatibility, with the detergent sanitizers used, and the 9 poor waters which were completely incompatible with any detergent sanitizers.

It must be remembered that the remainder of the waters, some 35 in number, were compatible with one or two of the compounds used.

It is interesting to note that the six compatible waters showed no growth after 2-minute exposure to all compounds and that, of the remaining nine which were considered poor waters, the lowest percentage of kill was recorded at 99 per cent plus. All of the

CHEMICAL ANALYSES OF WATER OF FIFTEEN FARMS IN CHICAGO TEST

Shown in parts per million.

Producer	pH	Soap hardness	Calc.	Mag.	Ferrous	Ferric	Free NH3	Organic N.
1	7.3	276	40	43	0.28	3.22	.85	.20
2	7.8	322	75	33	0.42	2.38	.80	.15
3	7.7	143	52	8	0.02	0.20	.28	.10
4	7.5	276	59	31	0.16	1.57	.05	.11
5	7.2	285	77	23	0.08	0.92	.03	.10
6	7.5	228	57	21	0.08	0.14	.01	.32
7	7.3	1200	324	95	0.02	0.68	0.05	0.10
8	7.2	179	61	7	0.02	0.11	T	.04
9	7.8	313	59	41	0.11	0.95	.4	.18
10	7.8	387	64	55	0.08	0.48	.01	.10
11	7.5	460	100	51	0.25	2.46	.75	.28
12	7.1	487	105	55	0.37	3.65	.25	.11
13	7.8	451	110	49	0.08	0.92	.34	.13
14	7.1	404	105	35	0.02	0.06	T	.16
15	7.7	368	57	55	0.12	1.23	.06	.10

November 3, 1949.

GERMICIDAL EFFECTIVENESS OF THREE DETERGENT-SANITIZERS

TOTAL SUSPENSIONS, RESIDUALS, AND PERCENTAGES OF RESIDUAL AT SPECIFIC INTERVALS

PRODUCER	Total Inoculum Suspension	15 Sec.	30 Sec.	1 Min.	2 Min.	5 Min.	15 Sec.	30 Sec.	1 Min.	2 Min.	5 Min.	15 Sec.	30 Sec.	1 Min.	2 Min.	5 Min.
1	153000000	12600	1500	850	60	0	150000	110000	20000	0	0	650000	520000	130000	40000	0
2	155000000	2000	180	30	0	0	180	0	0	0	0	390000	325000	227500	20	0
3	45000000	20	10	0	0	0	10	0	0	0	0	350	110	0	0	0
4	45000000	210	20	0	0	0	0	0	0	L.A.		97500	38000	620	0	0
5	42000000	130	100	90	0	0	360	0	0	0	0	2070	270	0	0	0
6	226000000	10	0	0	0	0	0	0	0	0	0	40	30	0	0	0
7	175000000	650000	520000	455000	195000	27000	605000	605000	605000	605000	292500	650000	650000	650000	650000	195000
8	186000000	390000	16000	L.A.	10700	2700	50000	28000	13400	5500	0	650000	650000	550000	1150	0
9	220000000	97500	9750	6500	2500	690	5200	4550	4600	3250	0	605000	325000	22500	4400	0
10	185000000	6500	5250	3600	2000	1800	13000	13000	13000	19500	20000	650000	650000	390000	3900	30
11	195000000	260000	29500	24200	44000	5400	52000	12600	8600	6000	120	780000	650000	605000	455000	630
12	197000000	19500	19000	7000	6200	350	24000	9500	16000	7000	400	650000	450000	L.A.	9200	90
13	165000000	6500	26000	3250	5200	1100	7800	3800	3600	2800	0	650000	455000	325000	13000	240
14	216000000	38000	27000	8500	2500	210	4000	990	2450	2000	20	650000	520000	295000	6500	880
15	177000000	54000	150000	20500	17500	1320	35000	33000	14300	12200	0	650000	605000	295000	17500	0

so-called poor waters were retested and the results on the second test confirmed the results of the first test.

A further phase of the experiment was inaugurated to test these 15 waters chemically, in order to plot, if possible, a curve with projections to indicate probable trends. The results of tests proved more or less inadequate and no representative end-point was discernible.

The Chicago Health Department submits this report for its worth, making no recommendations or development of conclusions. The test was conducted in the interest of progress. It was done in the same spirit as our Department, under the leadership of Dr. Herman N. Bundesen, president of the Board of Health, sponsored investigations in the development of high temperature, short-time pasteurization, development of the phosphatase test, and application of the tuberculin test program for dairy cattle. These and other activities brought about the inclusion of Chicago as the largest city in the country operating under the United States Public Health Service Milk Ordinance and Code.

It is our feeling that, while the detergent sanitizers, at least those products with which the Chicago test was made, may not meet the very rigid requirements of the Weber-Black Standards, the speed of germicidal activity of these products may be accelerated to such a degree that their efficiency will one day be recognized and accepted.

Meanwhile, the Chicago Health Department stands ready with its facilities and personnel to make any further investigation as may be determined necessary so as to expedite inclusion of detergent sanitizers as a satisfactory "one step" wash and bactericidal treatment for use on dairy farms.

The Chicago Health Department will be glad to supply a copy of our field tests to any one who will write requesting this information of Dr. Herman N. Bundesen, president, Board of Health, City of Chicago.

DDT AND RELATED INSECTICIDES IN MILK *

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DURING recent years several chlorinated hydrocarbon insecticides have been offered to the public. There has been a great demand by the dairy industry to employ them to increase the production of forage crops, to improve the health and production of milk cows, and to improve sanitation on the farm and in dairy plants. These new insecticides are DDT, methoxychlor, toxaphene, chlordane, lindane, and TDE.

The use of some of these new insecticides by the dairy industry has created an important residue problem. The full significance of this problem was first recognized soon after DDT came into extensive use for this purpose. Experiments have shown that DDT and some of the other materials are readily absorbed and stored in body fats, and they may appear in butterfat from animals exposed to them. These findings have justifiably focused special attention on insecticide residues in such important foods as milk and other dairy products.

Dairy products may be contaminated with insecticides in three principal ways. (1) The dairy cows may ingest residues on feed crops. (2) The cows may absorb insecticides applied to them for the control of external parasites. (3) The cows may ingest insecticides used in the treatment of dairy barns, or milk or milking utensils may become contaminated directly. The degree of contamination in the first two cases depends on the kind of insecticide that must be used and on the formulation and the manner in which it must be applied to obtain satisfactory control. In the third case contamination can be minimized or perhaps avoided entirely, if care is taken to see that no insecticide gets on the utensils, in the milk, or comes within reach of the animals.

The purpose of this paper is to review some of the available information on residues in milk after these insecticides have been applied on feed crops, on dairy cows, and in dairy barns.[1]

Attention is called to the fact, however, that other new insecticides, not chlorinated hydrocarbons, are useful in controlling insects affecting dairy animals. Piperonyl butoxide and *n*-propyl isome are used in combination with pyrethrum. Two organic phosphates, parathion and hexaethyl tetraphosphate, are also of interest for the control of insects affecting feed crops. Older insecticides, such as pyrethrum, rotenone, and certain organic thiocyanates, are well known to dairymen.

STATUS OF KNOWLEDGE REGARDING THE OCCURRENCE OF INSECTICIDES IN MILK

So many new insecticide preparations are now considered for use in connection with dairy management that it has not yet been possible to determine if and to what extent all of them may appear in the milk. Such studies have been handicapped also because specific methods for determining small amounts of the chemical in milk are not known for several of the insecticides. Nevertheless, progress is being made through research by various federal, state, and industrial organizations, and considerable information is being accumulated.

* Presented at the Thirty-Sixth Annual Meeting of the INTERNATIONAL ASSOCIATION OF MILK & FOOD SANITARIANS, INC., Columbus, Ohio, October 20, 21, 22, 1949.

[1] The investigations by the Department of Agriculture were carried out as part of the program initiated under the Research and Marketing Act.

DDT. Several investigators have shown that DDT will appear in milk of animals to which this insecticide is fed (Woodard *et al.* 1945, Telford 1945, Orr and Mott 1945, Wilson *et al.* 1946, Wingo *et al.* 1948). DDT may also appear in milk of cows fed DDT-treated forage crops. The amount of such residues can be expected to depend on the type of crop and the methods employed in curing it, on the kind and amount of preparation used, and on the time intervals between treatment, harvest, and feeding. Shephard *et al.* (1949) found that the milk of cows fed alfalfa treated with 0.6 pound of DDT per acre, about the minimum amount applied for insect control, contained as much as 0.9 p.p.m. of DDT; when the cows were fed alfalfa hay treated with the excessive amount of 2.4 pounds of DDT per acre, a maximum of 10.1 p.p.m. of DDT appeared in the milk. Biddulph *et al.* (1949) found that cows fed alfalfa treated with DDT at 0.5 pound per acre had as much as 2.2 p.p.m. of DDT in the milk. Carter *et al.* (1949-b) found less than 0.5 p.p.m. of DDT in the milk of cows fed silage made from pea vines to which DDT had been applied at the rate of 0.5 pound per acre. Wilson *et al.* (1946) failed to find any DDT in milk of cows fed DDT-treated pea vine silage.

The occurrence of DDT in milk of cows on which an insecticide had been used for insect control was unexpected. Toxicologists have known for some time that DDT in oily solution is readily absorbed through the skin of animals, but it was believed that DDT applied as suspensions or emulsions made with light solvents such as xylene would not be absorbed in sufficient amounts to contaminate milk. Howell *et al.* (1947), however, showed that up to 33 p.p.m. of DDT appeared in milk of cows treated repeatedly with high concentrations of DDT in emulsions made with xylene. These investigators also showed that from 0 to 2.5 p.p.m. of DDT appeared in milk of cows treated at two-week intervals with 0.25-percent DDT emulsion or wettable-powder sprays, a schedule followed for fly control in some areas. Carter *et al.* (1949-a) demonstrated that an average of about 0.6 p.p.m. and a maximum of about 2 p.p.m. of DDT appeared in milk of dairy cows treated once a month during the fly season with wettable-powder sprays containing 0.5 percent of DDT. There is apparently no difference between emulsions and wettable-powder sprays in the amount of DDT that appears in milk following their use.

Claborn *et al.* (1949) recently found that, when residual emulsion sprays containing 5 percent of DDT were applied in dairy barns for fly control, DDT sometimes appeared in the milk. Further studies were therefore undertaken at the Kerrville, Texas, laboratory of the Bureau of Entomology and Plant Quarantine and by the Bureau of Dairy Industry and the Bureau of Entomology and Plant Quarantine at the Agricultural Research Center, Beltsville, Maryland, to determine how milk becomes contaminated with DDT after it has been applied in dairy barns. These investigations have shown that such contamination is due primarily, if not entirely, to ingestion of DDT by the cows. The practice has been to treat thoroughly all surfaces inside the barns, with no particular precautions to avoid contamination of feed troughs, watering fountains, or other surfaces accessible to licking by the cattle.

The amount of DDT that may appear in milk during the first few days after indiscriminate treatment of barns may exceed 1 p.p.m. Most of the contamination can be avoided, however, if feed troughs and watering cups are covered while the spray is being applied, or if the troughs are washed with water from a pressure hose before the spray dries. However, in some cases measurable amounts of DDT, but less than 0.5 p.p.m., were found in milk even after these precautions had been taken.

Methoxychlor. Precise information on the extent to which methoxychlor appears as a residue in dairy products is not available, because until recently there has been no specific chemical method for determining small amounts of this insecticide in milk. Studies conducted at Kerrville, Texas, and organic chlorine analyses reported by Carter *et al.* (1949-a) indicate that very little methoxychlor appears in milk when the insecticide is used routinely for fly control on dairy cattle. Furthermore, this insecticide is less toxic than the other chlorinated hydrocarbon insecticides, both from the acute and the chronic viewpoints.

There is apparently no published information relative to the amount of methoxychlor that will appear in milk of cattle consuming residues of this insecticide on feeds.

Lindane. Lindane, as recently defined contains not less than 99 percent of gamma benzene hexachloride. The availability of this purified form of benzene hexachloride has provided a very useful insecticide to aid in controlling some of the pests important on livestock, especially house flies, mites, ticks, and lice.

During recent months studies have been undertaken by the U. S. Department of Agriculture, Cornell and Rutgers Universities, the U. S. Food and Drug Administration, and certain manufacturers and distributors of lindane to determine whether this insecticide can be used safely as a residual spray in dairy barns for fly control, and whether its application to dairy cows specifically for controlling mange will result in contamination of milk. Tests have shown that dairy barns can be sprayed without contaminating milk if reasonable precautions are taken.

During the first day after application to cows as a wettable-powder spray at concentrations from 0.05 to 0.1 percent, lindane may appear in milk in amounts between 1 to 2 p.p.m. However, the chemical is apparently soon eliminated from the animal's system, and generally after 3 to 5 days significant amounts cannot be detected in the milk. No adverse effect on the odor or flavor of the milk due to the lindane treatment has been demonstrated.

No information is available concerning milk contamination when dairy animals consume lindane residues on forage crops.

TDE. Studies show that TDE, an insecticide closely related to DDT, is readily absorbed through the skin and is secreted in milk of dairy cows, although the amount averages less than for DDT (Carter *et al.* 1949-a). It has also been found (Claborn *et al.* 1949) that spraying barns with TDE may contaminate milk to the same extent as spraying with DDT.

There is no published information available in regard to milk contamination with TDE when cows consume the insecticide as residues in feeds.

Toxaphene. Toxaphene is one of the more promising insecticides for controlling insects affecting livestock. However, its use by the dairy industry is not being recommended at present, primarily because information on milk contamination is lacking. Little progress in this respect can be made until chemical methods for analyzing small amounts of toxaphene in milk are known. Organic-chlorine determinations are not considered sufficiently sensitive to establish precisely the degree of contamination with toxaphene at the levels likely to be encountered. However, such analyses of milk from toxaphene-treated cows indicate that little, if any, of this insecticide will appear in milk when it is applied to dairy cattle as a 0.5-percent spray (Carter *et al.* 1949-a).

In feeding experiments the Bureau of Dairy Industry, in cooperation with the Bureau of Entomology and Plant Quarantine, found a slight increase in the amount of organic chlorine in milk when toxaphene-treated alfalfa hay was fed to milk cows. The insecticide was applied at the rate of 1½ pounds per acre about 1 week prior to harvest,

and the alfalfa contained about 80 p.p.m. of the insecticide based on organic-chlorine values.

Chlordane. As with toxaphene, little information is available as to the amount of chlordane that appears in milk when it is used for specific purposes, because of the absence of methods for analyzing specifically for chlordane. However, available data based on organic-chlorine analyses (Carter *et al.* 1949-a) indicate that chlordane is more likely to appear in milk of dairy cows than toxaphene when applied to the animals at equal concentrations. Feeding tests using treated alfalfa hay run parallel with those on toxaphene showed some increase over normal amounts of organic chlorine in the milk.

Other insecticides. Apparently no studies have been conducted to determine whether pyrethrum or some of the synergists used with pyrethrum, such as piperonyl butoxide and *n*-propyl isome, when applied as sprays are absorbed by cows and secreted in milk. However, these materials are less toxic, and there is no reason to believe that with ordinary precautions their use will create health hazards.

Likewise, so far as the writer is aware, no studies have been conducted to determine the presence of rotenone and organic thiocyanate insecticides in dairy products when these materials are applied to dairy cow or used for other purposes by the dairy farmer.

Parathion and hexaethyl tetraphosphate are highly toxic to warm-blooded animals. However, they do not persist as residues on plants for long periods. This is particularly true of hexaethyl tetraphosphate. For this reason they may prove useful for controlling certain insects on dairy feeds.

APPRAISAL OF DATA ON INSECTICIDE RESIDUES IN DAIRY PRODUCTS

The question naturally arises—what do the available data on insecticide residues in milk mean in terms of health hazards to consumers? In other words, which of the new insecticides are too hazardous for use and which one can be employed safely for specific purposes by the dairy industry? Insecticides are necessary for the efficient production of dairy products. However, it is recognized that materials and methods of application must be employed which will not impair the quality and suitability of these products for food.

Much research information is needed, and in the proper appraisal of available data many factors must be carefully considered. The primary factor is the inherent toxicity of a given compound to man and animals. The Food and Drug Administration and other agencies are investigating this problem extensively, and Lehman (1948 and 1949) has published data on the toxicity of a number of the insecticides. However, the inherent toxicity of a given chemical is by no means the only consideration in determining its hazard or degree of safety when used in actual control operations. The various materials differ in their tendency to appear in milk when ingested by animals or when applied to them. Other important factors are the amount and frequency of applications necessary, the persistence of the residues on or in plant and animal products, the extent to which the insecticide is used for other purposes, and the number and kind of food items likely to contain such residues.

Additional information on the toxicity of some of the chlorinated hydrocarbon insecticides and the extent to which their residues appear in dairy products will be required before they can be recommended for specific uses in the control of insects important to the dairy industry. However, following is a brief general statement of the position of the Bureau of Entomology and Plant Quarantine regarding their use.

None of the chlorinated hydrocarbon insecticides are recommended at present for controlling insects on feeds or forage crops that are to be fed to dairy animals. It is well established that residues of DDT on forage corps persist for long periods of time and that detectable amounts of this insecticide appear in milk of dairy animals consuming feeds containing DDT residues. The same may be true of some of the other chlorinated hydrocarbon insecticides.

Methoxychlor is at present the only chlorinated hydrocarbon insecticide recommended for direct application to dairy animals. Methoxychlor shows little tendency to be secreted in milk when applied to cows, and it is also reported to be of a low order of toxicity.

Recently lindane has been recommended for limited use on dairy cattle. Cornell University, the Bureau of Animal Industry, and other research organizations have found that it is a very useful and much needed treatment, especially for controlling mites on dairy cattle, and it is now approved for controlling these parasites. The Food and Drug Administration considers that the chronic toxicity of lindane at low levels of intake is not of a high order.

The small amount of lindane appearing in milk after its occasional use for controlling mange is not considered a health hazard.

Currently methoxychlor and lindane are the only chlorinated hydrocarbon insecticides recommended for use as residual treatments for the control of flies in dairy barns and in milk plants on the farm. Although it has been shown that contamination of milk with DDT can largely be avoided by careful application, the Bureau does not contemplate recommending the use of this insecticide in dairy barns, because the Food and Drug Administration has stated that milk should be kept free of DDT and there is no assurance that in practical control operations contamination of milk can be avoided entirely.

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THE EFFECT OF HYPOCHLORITE AND QUATERNARY AMMONIUM COMPOUNDS, USED IN UDDER WASHES, ON THE CHEMICAL COMPOSITION AND BACTERIAL FLORA OF THE MILK PRODUCED [1, 2]

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A NUMBER of bactericidal and cleansing agents have been recommended for use in solutions in the washing of the udders of dairy cows prior to milking. An Australian committee (1) recommended in 1943 that the cow's udder and teats be washed clean with warm soapy water and dried before milking. This was to be followed by a chlorine rinse. In 1939 McCulloch (4) reported that streptococci associated with mastitis were readily destroyed by soaps. In the presence of 5 percent added milk, dilutions of 1:250 of common brands of household soaps were sufficient to kill all streptococci in one minute at 40° C. Seeleman (7) reported that the use of germicidal ointments made from German raw materials did not cause any reduction in the number of new udder infections. Klein (3), in 1912, observed an "unusual cause of udder disease in which a herd of 48 cows suddenly developed mastitis owing to their udders having been washed with a cold disinfectant and water without subsequent drying."

In 1942 Bryan *et al.* (2) found soaps unsatisfactory for killing streptococci, *Staphylococcus aureus*, and *Escherichia coli*. They tested the effects of certain hypochlorite solutions on various streptococci of the alpha, beta, and gamma types associated with mastitis. All strains were susceptible to hypochlorites in concentrations of 1 p.p.m. in 30 seconds. Bryan and co-workers also made a study of washing udders with clean water and with water containing 200 p.p.m. available chlorine. When chlorine was used no viable streptococci appeared in the wash water and was in evidence only in milk from cows which were previously infected. When water alone was used it became polluted after the first infected cow was washed. Milk from three otherwise clean cows showed viable streptococci after being washed with this contaminated water.

Waugh *et al.* (8) presented data to show that *Streptococcus agalactiae* did not survive a 20-second exposure to a solution containing 5 p.p.m. available chlorine. When 1 percent skimmilk was added, 40 p.p.m. were required. *Staphylococcus aureus* showed 2.3 percent survival after 20 seconds in 600 p.p.m. water solution available chlorine. Dipping cow teats into a solution of 400 p.p.m. of available chlorine gave an incomplete kill of *Staphylococcus aureus*.

A study was designed to determine the value of these agents in preventing the spread of those types of organisms generally associated with mastitis, and to note the changes in chemical composition of the milk produced by cows whose udders and teats were washed with the different preparations. Consideration was thus given to the question of whether the use of hypochlorite and quaternary ammonium compounds in the water used for washing the udders of cows just prior to milking, constitutes an effective means of disease prevention.

EXPERIMENTAL PROCEDURE

This experiment was conducted in the Pennsylvania State College Instructional herd from October 6, 1946, to January 5, 1947. Forty cows, representing all five of the major dairy breeds, were used. They were divided into four similar groups on the basis of milk production, stage of lactation, and stage of gestation. Their average daily milk production was 38 pounds; the average stage of gestation was 59 days; and the mean days in lactation was 149. These groups received the following treatments:

I. Control group—Udders and teats were washed with clean water prior to attachment of milking machines.

II. Chlorine group — Udders and teats washed with water containing 200 p.p.m. available chlorine.

III. Chlorine group — Udders and teats washed with water containing 400 p.p.m. available chlorine.

IV. Quaternary ammonium group—Udders and teats washed with water containing 200 p.p.m. quaternary ammonium compound.

Just before attachment of the milking machine, each cow was washed thoroughly with a cloth and water containing the disinfectant for the particular group. Never more than six cows were washed from one pail. A commonly used commercial sodium hypochlorite powder was used for preparing the chlorine solutions. Similarly, a widely used commercial preparation containing 10 percent of high molecular alkyl-dimethyl-benzyl-ammonium chloride was used as a source of the quaternary compound. Two and one-half gallons of the solutions were prepared just prior to use, with amounts of the bactericides on the basis of the manufacturer's directions. A clean cloth was used in each pail. Two streams of milk were removed into a strip cup following washing. All cows were milked three times daily and machine stripped only. The teat cups were not rinsed between cows.

At the beginning of the experiment and monthly thereafter, quarter samples were collected for bacteriological analysis. Prior to this collection the udder was scrubbed with a chlorine solution, particular care being exercised to clean the ends of the teats. Strict foremilk was drawn, none being discarded into a strip cup. According to Murphy (5) the use of strict foremilk, in diagnosing mastitis, is justified. Ten milliliters of foremilk were drawn aseptically into small, sterile, rubber-stopper bottles. Sufficient sterile sodium azide-brilliant-green-glucose solution to favor the development of streptococci had been placed previously in each of these containers.

Upon arrival at the laboratory the samples were incubated at 37° C. for 16 hours, following which modified Breed smears were made and examined. Actual counts of bacteria were not made but information was recorded as follows: leucocyte count, presence and types of streptococci and whether many or few, presence of rods, and presence of staphylococcal clusters. All samples which showed abnormally high leucocyte count and/or the presence of bacteria other than micrococci were streaked on Edwards Medium. From 4 to 6 samples were streaked on one plate and the plate was incubated at 37° C. for 48 hours. After incubation the plates were examined for presence or absence of growth, type of growth if present, type of hemolysis, and esculin fermentation.

Further tests to identify the various streptococci found on the plates were performed as necessary. This included isolation and cultivation in veal infusion broth followed by physiological and serological studies. At the beginning of the experiment and each 15 days thereafter, 70 ml. of milk was collected from each quarter for chloride and pH analyses. Before sampling the udder was washed thoroughly and two streams of milk removed from the teat into a strip cup. Samples were refrigerated at 5° C. until analyzed. The hydrogen ion concentration was determined, in terms of pH, with a Beckman potentiometer using glass electrodes. Readings were made to the nearest even figure in the

[1] The experimental data in this paper are taken from a thesis presented by E. M. Kesler in partial fulfillment of the requirements for the degree of Master of Science in Dairy Husbandry, The Pennsylvania State College.

[2] Authorized for publication as paper no. *1600* in the Journal Series of the Pennsylvania Agricultural Experiment Station.

second decimal place. The chloride content of the samples was determined using the method of Sanders (6).

EXPERIMENTAL RESULTS

A classification was assigned to each sample, and thereby to the quarter from which it had been drawn on the basis of the bacteriological analysis. A classification of I denotes normal milk in every respect. Class IA is a condition where short chain streptococci, diplococci, and micrococci may be present but excessive leucocytes are not in evidence. Alpha hemolysis on esculin plates is usually present in class IA and sometimes a trace of beta hemolysis. Class II resembles IA but has, in addition, excessive leucocytes or shows definite hemolysis other than of the alpha type. Class IIA is characterized by long chain streptococci, excessive leucocytes, beta or gamma hemolysis, and often abnormal gross appearance of the milk. Class III indicates *Streptococcus agalactiae*.

A summary of the bacteriological reports for the experiment is presented in Table 1. In Group I (udders washed with water) were a total of 39 rather than 40 quarters. One cow (number 3050) had a blind quarter due to a previous accident. The table shows quite clearly that at the beginning of the experiment the majority of the quarters under all treatments were in classifications I and IA. As the experiment progressed there was a decided shift toward the other classifications, until at the end of three months, over half of the quarters were in classes IIA and III. At the end of two months it appeared that some beneficial effect might have been derived from the use of 200 p.p.m. Cl (Group II). There was no evidence of this, however, at the end of the experimental period.

On the basis of previous experience with the herd it was expected that certain of the animals used in the experiment might develop mastitis during the trial. There are cycles of light and heavy periods of incidence of mastitis in this herd, and the three months during which this experiment was conducted were at a time when the incidence was on the increase. However, the four udder washes seemed to be equally ineffective in preventing the changes in udder flora observed during this period.

The mean chloride values for the quarter samples are presented in Table 2. An increase in chlorides was found in all groups over the three month period, with the milks from animals in Group I showing the highest rise followed in order by Groups III, IV, and II. The chloride values were analyzed by an analysis of variance. No significant differences could be attributed to treatments. Variations between sampling days and the interaction treatment X cows were found to be highly significant.

TABLE 1

SUMMARY OF BACTERIOLOGICAL DATA [a]

Classification	Beginning				After 1 Month				After 2 Months				After 3 Months			
	I [b]	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV
I	23	25	16	23	..	1	1	3	..	3	..	..	..	1	..	..
IA	13	12	14	6	8	5	3	3	9	13	2	2	8	5	4	4
II	3	3	8	9	22	21	16	9	13	20	20	18	10	13	6	11
IIA	..	..	2	1	5	12	14	20	11	4	12	13	11	11	12	14
III	..	..	..	1	4	1	6	5	6	..	6	7	10	10	18	11
Total No. quarters	39	40	40	40	39	40	40	40	39	40	40	40	39	40	40	40

[a] Expressed as the number of quarters in each classification.
[b] I—Washed with water
II— " " Cl. 200 p.p.m.
III— " " Cl. 400 p.p.m.
IV— " " Quat. ammonium 200 p.p.m.

TABLE 2

MEAN CHLORIDE VALUES * OF QUARTER SAMPLES

Group	Washed with	Beginning	After 15 days	After 30 days	After 45 days	After 60 days	After 75 days	After 90 days	Mean
I	Water	87	100	104	110	107	106	108	103
II	Cl 200 p.p.m.	85	79	78	88	80	91	92	85
III	Cl 400 p.p.m.	94	99	104	107	105	104	108	103
IV	Quat. Ammonium 200 p.p.m.	96	99	105	116	109	109	105	106

* Expressed as milligrams per cent.

The pH values of the quarter samples from this experiment are presented in Table 3. For purposes of determining mean pH values, all of the pH readings were converted into their equivalent hydrogen ion concentrations, the mean obtained, and this reconverted to pH. Groups I and IV showed a slight increase in pH whereas the two groups washed with chlorine solution remained constant or decreased slightly. However, an analysis of variance of the hydrogen ion concentration indicated that differences between treatments were insignificant.

SUMMARY AND CONCLUSIONS

Two concentrations of chlorine and one of quaternary ammonium compound were compared with clean water for washing the udders of dairy cows prior to milking. They appeared to be equally ineffective under the conditions of this experiment in preventing the spread of organisms associated with mastitis throughout the udders of the cows used in this trial. As the experiment progressed there was a general degregation of the udder flora of the cows under all treatments. No significant differences between treatments could be noted for chloride content or for pH of the milk produced.

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TABLE 3

MEAN pH VALUES * OF QUARTER SAMPLES

Group	Washed with	Beginning	After 15 days	After 30 days	After 45 days	After 60 days	After 75 days	After 90 days	Mean
I	Water	6.60	6.68	6.63	6.67	6.66	6.66	6.66	6.65
II	Cl 200 p.p.m.	6.60	6.59	6.51	6.61	6.57	6.58	6.56	6.57
III	Cl 400 p.p.m.	6.62	6.61	6.62	6.62	6.62	6.63	6.60	6.62
IV	Quat. Ammonium 200 p.p.m.	6.60	6.65	6.60	6.67	6.65	6.66	6.62	6.63

* Beckman potentiometer readings. Mean obtained by conversion to equivalent hydrogen-ion concentrations.

PEST CONTROL AND FOOD SANITATION *

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FOR several years I was employed in Public Health work, and from this larger heading, and particularly the field of sanitation, I have drawn considerable experience which is of considerable assistance in my present capacity with the Commonwealth Sanitation Company. This organization is a pest control firm, so I guess you would have to call me, in slang parlance, "a bug man". It is like you sanitarians being called "snoopers".

I am not quite certain of the exact scope of your sanitation work, whether you specialize in one field or cover all phases. In any case, whatever your particular interest, I believe that pest control should be, and probably is, a vital link in your sanitation program.

Pest control in food sanitation implies the control of those insects and rodents living in close association with man and his food products.

MOST COMMON PESTS

The rodents most commonly found as pests are the rats and mice. The former group includes three major and one minor species, while the so-called house mouse is the chief mouse pest, although field and other types of mice can sometimes be troublesome. In urban areas, rats formerly outnumbered man two to one, but this ratio has been cut by pest control and rat eradication campaigns so that the estimated ratio is now one to each man. Rats are very prolific breeders, and the damage done by actual eating of human food, as well as the food spoiled by rodents costs the people of the United States somewhere between one-half to two billion dollars annually. At the same time, rodents may spread many diseases and are consequently a constant menace to public health.

The insect pests most common to the milk and food industries are the roaches and flies. There are several other species of roaches, but the German, American, and Oriental roaches are the most common. The common house fly is cosmopolitan in distribution and is a pest everywhere. Besides its annoying habits and markings, it is a disease carrier. Blue bottle and flesh flies are frequently present in large numbers around some food establishments.

These are the insect and rodent pests most frequently encountered in any type of milk or food establishment. They must always be included in any pest control program.

There is one other group of insect pests that is far more destructive than any of the pests already mentioned, with the probable exception of the rodents. These are the pests most frequently encountered in grain mills, bakeries, breweries, warehouses, packing plants, and farms. These are the so-called stored products pests, or industrial pests. Some of the more important of this group are the flour beetles, weevils, mealworms, flour moths, larder beetles, and cheese skippers. These insects live in stored products, and control is somewhat more difficult and more expensive than control of the earlier mentioned pests. Those of you who work with this type of material know the damage and spoilage caused by this group of insects even better than do I.

All of these insects and rodents, and some minor insects, are pests met with in food sanitation. Some of these pests can spread disease and are a health menace, while others merely destroy or contaminate food and render the product unwholesome. All of these pests, if not controlled, are detrimental to the food industry. Since lack of pest control in food sanitation is more readily detected by the public than lack of certain other sanitary practices, the food sanitarian often has the valuable assistance of the private citizen as an informer. After all, who wants to eat food with roaches or flies hovering about? or rats? Or who wants to use wormy flour or cereal?

We know what most of these pests are. We should know, too, that they breed rapidly, and that they live in close association with man and his food products. THESE PESTS WANT TO CONTINUE LIVING WITH US AND EATING OUR FOOD. DO WE WANT THEM TO CONTINUE LIVING WITH US AND OUR FOOD? My emphatic answer, like yours, is NO.

SANITATION PRACTICE

To accomplish this negative desire is not so simple as we might expect. We cannot send these pests into exile so easily. The only way to combat the problem is by increasing good sanitary practices. This must be done by you sanitarians. But you alone cannot do this. Employer and employees must cooperate with the sanitarians. Even then, some form of vigilant pest control service must be continually on guard, and the person delegated to pest control service must have the cooperation of all concerned. Good sanitation alone will eliminate a great part of the pest problem; proper pest control should eliminate the rest of the problem. In our work we frequently urge cooperation for the customer's benefit.

One account I might mention is in a rat-infested neighborhood. We have urged the owner to do some rat-proofing for better rat control. His answer, always the same, "It's cheaper to pay you fellows to kill rats than to rat-proof". As you might expect, he still has rats, and always will. Pest control can do only so much. With his cooperation, I am certain that we could eliminate his rat problem and prevent food damage. I say again, *There must be cooperation for success.*

Since sanitation alone can do much of the control of pests, but not all, there should be some form of pest control service as a complement. This type of service necessitates the use of insecticides and rodenticides, and sometimes mechanical devices for the control of pests that may continually be brought into a food plant, mill, restaurant, dairy, or other food establishment. Thanks to the scientists and the stimulus given their work by the late war, we now have the chemicals to do an excellent job in controlling insect and rodent pests. Most of you know something about these, so I shall not take time to talk about them at this time. I do want to mention briefly one of the lesser known agents which is very applicable to food processing plants.

FUMIGATION

When fumigation of mill, granary, warehouse, or box car is indicated, the fumigant in most cases should be methyl bromide. This fumigant gives an excellent kill of all pests and rodents. Its penetrating power allows it to reach even the innermost parts of grain bins, bags, and bales of stored products. At the same time, all evidence to date appears to show that the foodstuffs themselves are not affected by the gas. Acrylon is an excellent fumigant for spot treatment of equipment. It is our opinion that large mills should be periodically fumigated, and incoming shipments, particularly infested materials, should be fumigated before being brought into the plant. In an otherwise clean plant, this practice indicates that just about everything humanly possible is being done to prepare clean food.

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Pest Control Program

Thus far we have briefly mentioned the most frequently encountered pests to the food industry, pests that we must control if we are to have clean foods. We have also established that good pest control must be a cooperative part of good sanitation. We know there are chemicals and materials available to do good pest control. The next question is—How are we going to do the job of controlling these pests?

If there is to be some form of pest control, that control may be done in three ways.

The first way the job of pest control may be done is by purchasing some form of insecticides and other chemicals and having some handy-man employee do an occasional spraying or poisoning. This occasional control work will generally be done only when pests become apparent. The handy-man most frequently selected to be the "bug specialist" at least the boss thinks he will be, is a porter or janitor, who, in most cases, does not know where to look for the source of trouble. Consequently, the job will probably be poorly done and a false sense of pest control will result. This type of pest control (and I use the term very loosely) is economical as far as known expense is involved. The materials and spray equipment are the only cost. I do not think this type of pest control is the answer to good pest control.

The second approach to pest control is most applicable to a large food processing plant. In this type of organization, the management hires a well-trained sanitary engineer. A well-trained sanitarian will know where to look for pests. He will know how to eliminate the pests and then to prevent their ingress again. The well-trained sanitarian should be in charge of all sanitation and should have the necesary authority to enforce his program. He may be the person responsible for doing the actual pest control, or, he may think it advisable that a competent pest control firm do the actual pest control service. If the latter course is his recommendation, and the present trend seems to be in that direction, he should be sure that the pest control operator is doing his job properly. A good plant sanitarian, whether he does the work himself or hires it done, is still responsible for good pest control. I believe, that if it is at all possible, this approach to pest control in food sanitation is ideal. Smaller organizations might benefit in the same manner by pooling the services of a sanitarian. We of Commonwealth look upon this idea with enough interest to contemplate offering such services.

The third approach to pest control sometimes fits in with the first approach, that where they do their own occasional pest control. In some cases it fits in with the second or sanitarian approach. In many of the small food establishments, the management believes they are doing their general sanitation well, but call in a professional to do the pest control. This third approach to pest control is the use of a professional pest control operator.

The professional pest control man fits in with the occasional or handyman approach only after it is apparent that the "handy-man specialist" has failed and the place is badly infested. In some cases the professional is engaged only long enough to rid the plant of pests, after which the pest control reverts to the original handy-man. In some cases, however, the management learns that they cannot do the job properly and place the plant under routine professional service. In other words, there is more to pest control than the insecticide salesman claims.

When professional pest control service is utilized by a plant sanitarian, pest control results should be apparent by the absence of pests. Where the professional pest control operator routinely serves a food establishment (and this may be of any size), pest control results are generally good. But here again, there must be cooperation for excellent results. All the fly spray the pest control operator can apply is not too effective, if the building is not screened. The same logic applies to rodent control if the building has many openings for rats and mice to enter. Chemical and other controls can do only so much.

These three ways are the approaches to pest control as I see the problem. I trust you will agree that the second two approaches are preferred.

Precautions

Since you are trained in the protection of food supplies, a few precautions should be stated here. You all know that interstate food shipments are under the jurisdiction of the Federal Food and Drug Administration as well as under local and state health agencies. Since the toxic agents used for pest control are also toxic in most cases to humans, precautionary use of these materials is necessary to prevent contamination of foods. The previous speaker has given an interesting paper on insecticides in milk. Detection of these chemicals in foods can lead to their seizure and prosecution by the Federal government. In the case of 1080, the chemical does not have to be present in foods. Negligent use of this chemical is sufficient grounds for prosecution. May I urge, if you do your own pest control—BE CAREFUL.

The second precaution I would like to bring to your attention concerns pest control itself—the professional. If you are looking for, or have requests for recommended competent pest control firms, be careful whom you select. I regret to say that there is a very wide extreme in the work and ethics in this field. There are many excellent and ethical firms taking pride in their work, and who look upon themselves as men with a profession. There are, on the other hand a great number of shady, untrained operators whose main objective is a fast dollar, and their ethics have not been heard of. In my opinion, some of these shady charlatans should be barred from pest control and the handling of such toxic agents. A recent report by a pest control operator who left the employ of a firm because he was frightened at what might happen, tells of the use by his firm of 1080, poured into a pond to kill rats seen drinking at the pond. This sort of report, and many others, only hurts the entire pest control industry, but hurts worse those doing a conscientious job.

In general, if there is a big discrepancy in comparative prices for a pest control service, the low-priced job generally means the quality of the work is comparably low. I believe that a pest control firm should carry liability insurance of at least $1,000,000, and that does not include vehicles. This is for customer protection. Since pest control operators could be secondary pilferers, all pest control operators should be bonded. This, too, is for customer protection.

There are several ways to check the competency and type of work done by a certain pest control firm. Check their advertisements. Some of these are pretty deceptive and misleading. The local Better Business Bureau should be consulted to determine whether frequent complaints are registered against a certain pest control firm. Probably most important in determining the type of work done by a prospective pest control firm is to contact some of the accounts served by that pest control firm. This way you can check how their chemicals are applied as well as the results to the customer.

I have not gone into the actual work of controlling insect and rodent pests, since that is not the scope of this talk. Actually, our prospective operators receive a month of classwork on pest control before they ever as much as see one of our jobs and start their field training. Our last school of five was

(Continued on page 307)

THE LICENSING AND INSPECTION OF COLD STORAGE LOCKER PLANTS *

FRANK E. FISHER

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ONE of the newer industries that has come under the control of public health officials is the cold storage locker plant. Although this industry is a relatively new development, its history goes back at least as far as 1908. At that time, the Chico Ice and Cold Storage Company of Chico, California, began renting space for the storing of meat and other food in boxes. Each customer furnished his own box which was stacked with others in a cold room. Covered boxes provided with locks were installed about 1913. In 1917 a special refrigerated room equipped with wooden lockers arranged in tiers was provided.

LOCKER PLANT PRACTICE

Although the above is the first use of refrigerated lockers actually on record, the same pattern was followed in many other existing public cold storage warehouses. Since the only service provided consisted of furnishing a locker in a refrigerated room, the demand for these lockers was limited to farmers who slaughtered their own meat animals, and to those who were able to prepare and package fruits and vegetables in their own kitchens. However, when these plants began to offer other services, such as slaughtering, curing, cutting, wrapping, freezing, and fruit and vegetable preparation and packaging, many more people became interested in renting lockers; consequently, the number of lockers and locker plants increased rapidly. Plants designed primarily as locker plants began to be constructed, and, today, we have a preponderance of that type plant. Food rationing during the war years and the exemption of frozen foods from the rationing gave the entire frozen food industry a great boost, and the locker plant industry grew accordingly. When I went into the Army in 1942, there were only 6 plants in Indiana that were primarily locker plants. When I returned in 1946, 160 locker plants were licensed, and today, in Indiana, we have 350 licensed plants in operation, with about 10 more under construction. In our State, the industry has more or less stabilized. Very few large plants are being constructed, and present expansion is in the line of the smaller branch plants which are used only for food storage after preparation at the larger main plant. In smaller towns, small plants are being constructed to be operated in conjunction with grocery stores or other food industries.

LEGAL CONTROL

During the early period of the expansion of the locker plant industry, little means of control existed in Indiana. We had the basic Sanitary Food Law, and plants were licensed under the Cold Storage Law of 1911. The Cold Storage Law controls the public warehousing of foods, but has no definite temperature requirements and very few sanitary requirements. Consequently, during this period, the industry, like Topsy, "just growed." Many poorly designed and jerry built plants were constructed. Many of these plants had inadequate insulation; refrigeration equipment was too small to carry the load and a general impression seemed to exist that any temperature under freezing was adequate.

In 1943, the Cold Storage Locker Law was passed in Indiana. This law defines a locker plant, makes it illegal to operate a locker plant without a license from the Indiana State Board of Health, and provides that the Board of Health shall not issue a license unless the plant meets all of the requirements of the law. This law also provides that each locker plant shall be inspected at least once each six months, or oftener if necessary. General sanitation, toilet and washroom facilities for employees, and cleanliness and health of employees are covered in great detail in the law. Specific temperatures are required for the various rooms in the plant, and recording thermometers are required to record continuously the locker room temperatures. Specific procedures are set up for the handling of fish, fruits, and vegetables. Provision is made for the State Board of Health to make rules and regulations and to revoke licenses of violating plants. Penalties are provided for violations of any of the provisions of the Act or any lawful rule or regulation of the Board.

The licensing provision of the Indiana Cold Storage Locker Law, or of any other law, is a two-edged sword. On the one hand, the authority having the duty of issuing such license has almost complete control of that industry. A plant cannot operate legally unless a license has been obtained. If the law provides, as the Indiana law does, that a plant must meet certain requirements before a license is issued and that a license may be revoked for violations of any of the provisions of the law, the licensing authority has a mighty club to hold over the heads of the members of the industry. You can say, "If your plant does not comply with the law, no license will be issued. Period." Operation without a license is the easiest charge to prove in court that I have ever experienced. It does not depend on complicated chemical analyses or any question of judgment of the sanitarian. It is simply necessary to prove that the plant is being operated and that no license has been issued. It is as simple as in the old days when we took all of our cases to the nearest J P Court.* On the other hand, the issuance of a license to operate a locker plant places a great responsibility on the shoulders of the State Board of Health. In effect, this license is a form of guarantee to the people of the state that the licensed plant is constructed and operated in conformity with all of the provisions of the law and is maintained in a satisfactory condition at all times.

In enforcing the Cold Storage Locker Law in Indiana, we insist that the plant meet all of the structural requirements of the law and be maintained in a sanitary condition before a license is issued. By strict adherence to this policy, we have been able to improve the sanitation level in this industry to a higher point than exists in any other food industry that we control. This high standard was obtained by a great deal of hard work and by the co-operation of the locker plant industry itself. During the entire year of 1946 and the first half of 1947, we used the full-time services of six men in Indiana exclusively on locker plant inspections. Frequent visits were made, and complete inspections were made at each visit. Verbal recommendations of the sanitarian were confirmed by letter to violating operators. Licenses were withheld from unsatisfactory plants, and the poorly built and badly engineered plants were forced to rebuild to meet the requirements or go out of business. Today we are able to maintain a high sanitation level in this industry with approximately two and one-half man-years per year. Operators and prospective operators now submit their blueprints for our recommendations before any construction is started because, in the past, many plants have been forced to make expensive changes in their buildings to meet the requirements of the law.

* Presented at the Thirty-Sixth Annual Meeting of the INTERNATIONAL ASSOCIATION OF MILK & [illegible] Inc., Columbus, Ohio, October

* *Editorial Note:* Justice of the Peace Court. These are not courts of record, and the proceedings are very informal.

DESCRIPTION OF LOCKER PLANT

Since many of you may not come in daily contact with locker plants in your work, it may be well to define a locker plant and say a little about the services rendered in these plants. A locker plant is an establishment where individual compartments are rented to individuals for the storage of foods at a temperature below freezing and having one or more of the following facilities: a sharp freezing compartment; a chill room; facilities for cutting, wrapping and processing meats; and facilities for preparing and packaging fruits and vegetables. In addition, many plants provide facilities for smoking and curing meats, rendering lard, and some plants provide slaughtering facilities. Many plants also sell frozen foods and will purchase beef or pork carcasses at wholesale prices for their patrons.

In discussing the inspection of a locker plant, I will take the plant, room by room, and try to point out the high spots in each location.

The locker room is the room where the food is stored in individual lockers after it has been frozen. This room must be maintained at zero degrees or below. Therefore it is imperative that the floors, walls, and ceiling be of a smooth, impervious and easily cleanable finish. It is a rather hard job to scrub with soap and water at zero degree. All food stored in the locker room should be placed in the lockers and should not be allowed to be stored in baskets or crates in the aisles, or on top of lockers. We have found plants where overflow storage has been allowed to pile up on locker tops to a point where air circulation has been so hindered that a difference of four to five degrees in temperature existed in adjacent aisles in the room. The coils or blower used to refrigerate the room should be properly defrosted at sufficiently frequent intervals to hold down the ice formations on the coils or blowers to a minimum. Ice is an excellent insulator, and a large deposit of ice on the coils hinders the efficiency of the refrigeration system. During defrosting, care should be taken that it does not result in contamination of the foods stored.

The sharp freezing compartment is the section where the food is frozen after it has been processed and wrapped or packaged. The temperature of this compartment must be maintained at ten degrees below zero if freezing is done in still air, or at zero degree if a forced air system is used. Food should never be placed directly on the refrigeration plates or coils for freezing. This will result in dehydration or freezer burn. This is discussed in more detail below. If forced air circulation is used in the sharp freeze compartment and any unwrapped foods are frozen in the compartment, the air inlet to the sharp freeze compartment should be provided with an adequate and efficient air filter to remove the dust and dirt from the air to be circulated around the unwrapped foods.

The processing room is the room where meats are cut, processed, and wrapped prior to freezing. The walls and ceiling should be provided with a smooth, impervious washable surface. The floor should be of concrete and provided with a floor drain to facilitate clean-up. Tools and equipment used to process food must be maintained in good repair and be of such construction that they can be easily dismantled for proper cleaning. The power saw, present in most processing rooms, is an ideal place to find something wrong. The older model saws in particular are difficult to take apart; stale, decomposing meat particles can be found in back of the wheel guiding the saw blade and in the guide where the blade passes through the stationary platform of the saw. Underneath the sliding platform is another hard-to-clean spot which is frequently overlooked by the butcher during his clean-up period. Under the lower wheel of the saw is a small pan to collect bone dust, and, invariably, if there is any rodent infestation in the plant, evidence can be found at this point. It is surprising the number of butchers who have never learned that by loosening two thumbscrews, the knife guard on a meat slicer can be removed. I have examined a number of these guards that appeared to have been cleaned prior to shipment from the factory, but not since. Even the best of the meat grinders are difficult to clean, and if the operator of the plant is at all slipshod in his methods, evidence can be found here. The holes in the cutter plates will be partially or totally clogged with meat particles that have lost the battle with the bacteria. We require an adequate-size equipment washing sink, serviced with hot and cold running water, either in the processing room or in a location convenient to the processing room. Judicious coaching on the part of the sanitarian will eventually teach the operator the use of this valuable piece of equipment. Meat blocks and cutting tables should have smooth impervious tops or work surfaces. Many operators seemingly do not realize that their expensive laminated maple meat block is provided with draw bolts so that the cracks and crevices which fill up with meat particles and stale grease, can be eliminated.

Hand tools, such as knives, saws, and cleavers should be examined for evidence of poor cleaning. The handle blade slots are hard to clean, and if the operator is skimping on his clean-up, this slot will be found to be clogged with old grease and meat particles.

Wrapping and packaging foods prior to freezing are very important from the standpoint of preserving the quality of the food after freezing. Only vapor proof wrappings or packages should be used to prevent dehydration. After wrapping, packages should be marked with the correct locker number to prevent mix-ups in patrons' food. The packages should be marked or stamped with the date of wrapping so that the patron has an indication of the length of storage time of each individual package.

SANITARY REQUIREMENTS

Locker plants are required to provide chill room facilities to chill and hold meats prior to cutting and processing. Chill rooms should be provided with concrete floors and floor drains to facilitate clean-up. Walls and ceilings should have a smooth impervious surface that can be cleaned readily. Rust should not be permitted to form on rails, hooks, or other metal parts in the room. Shelves or tables should be provided to prevent the storage of food on the floor with a consequent danger of contamination from foot traffic dirt. A separate prechill room should be provided so that the moisture extracted from warm carcasses will not be deposited on already chilled carcasses, thereby promoting the formation of slime on the cooled carcass. Separate facilities should be provided for curing meats, and the practice of using a section of the chill room as a curing cellar should be discouraged. The high relative humidity consequent to such an operation will also promote the formation of slime on chilled carcasses.

Rails should be suspended from the ceiling, or if a framework is necessary, the framework should be built within the walls so that a smooth, unbroken wall surface is provided. In some of the older plants where a framework has been built within the chill room to support the rails, evidence of poor housekeeping can be found at the junction point of the framework and the walls of the chill rom.

The first evidence of a mold growth in the chill room will usually be found on the wooden framework supporting the rails. At the first sign of a mold growth in the chill room, steps must be taken to eliminate this growth to prevent penetration into the walls and insulation of the room. A plant in Indiana has just recently completed a complete remodeling job on the chill room. All of the insulation was torn out and replaced. The old insulation

was found to be almost completely interlaced with mold filaments.

The temperature in the chill room must be maintained between 32 and 36 degrees Fahrenheit. It has been demonstrated conclusively that unless meat is chilled to an internal temperature of 38° F. within 24 hours after slaughter, bone sour can be expected to develop in the carcass. In all refrigerated rooms, nothing should impede the flow of the convection currents that cool the room. Food should be placed or hung so that free circulation of air is possible around all parts of the food to promote more rapid chilling, and to reduce the internal temperature of the food more quickly.

Lard rendering, smoking and curing meats, and slaughtering operations are identical with such operations in meat packing establishments, and will not be discussed in this paper, other than to say that all of these operations are considered as part of the locker plant operation. Any insanitary conditions or unsatisfactory operations in these departments are, in our State, sufficient cause to withhold the issuance of a license for the locker plant.

Our law provides that only persons free from any infectious or contagious disease shall be employed in any capacity in a locker plant. Toilet and washroom facilities are required for the use of employees. All water used in locker plants, except compressor cooling water, must be uncontaminated and meet the standards for drinking water. Sewage disposal facilities must meet the standards of the State Board of Health and the Stream Pollution Board of Indiana. Cross connections and interconnections are prohibited, since all plumbing in the plant must comply with the plumbing code.

Enforcement Problems

There are a few special problems that are peculiar to locker plant inspectional work. The first of these is the peculiar relationship of the health department to the foods stored in a locker plant. This food is for individual consumption and does not enter the trade channels of commercial food, therefore we have no control over the food processed or stored in a locker plant. It belongs to the individual patron and is his to do with as he pleases. This places an even greater responsibility on the shoulders of the health department. If the sanitarian, in the course of an inspection of a restaurant or bakery or any other food establishment finds any adulterated or decomposed food, he will seize the food and force its destruction. This is a definite penalty against the operator of this establishment, because it is a financial loss to him. However, in the case of a locker plant, if the operator allows food to become contaminated or spoiled, the locker plant patron, an innocent person, is penalized. If a plant is allowed to operate with high temperatures which may cause spoilage of foods stored in the plant, we are not doing our job properly. If a plant is allowed to operate under insanitary conditions and foods being processed become contaminated, we have again been remiss in our duty. If, for either or both of the above reasons, we close the plant, we are depriving the patrons of the services of the plant. Therefore, we feel that plants should be inspected at frequent intervals, and immediate steps be taken to correct any unsatistory conditions found. We insist that our sanitarians make complete inspections and submit narrative reports on conditions found in the plant. If any serious violations are found, the operator is called in for a hearing to show cause why his license should not be revoked. By insisting that defects be remedied immediately, we have been able to prevent any serious cases of food spoilage from arising. We keep our fingers crossed—constantly.

Customer complaints from locker patrons usually concern off odors in meats stored in locker plants. Investigation of such complaints usually involves tracing down something that happened from six months to a year previous to the complaint. In most instances, the odor is caused from a bone sour or sour round condition. In many cases we find that the animal had been slaughtered on the farm and some time had elapsed between the time of slaughter and delivery to the locker plant. Of course it was always a "pretty cold day" when Farmer Jones slaughtered that hog, and it is rather hard to explain to Farmer Jones that too cold a temperature may be just as bad as too high a temperature. If animal carcasses are chilled at a low temperature, it is possible to freeze the outside of the carcass and seal the animal heat inside. This, of course, will tend to produce a bone sour condition. One customer's complaint that his meat had a "funny odor" was rather interesting. The animal involved was a 4-H Club calf that had received a blue ribbon. Investigation revealed that the animal had been treated for bloat. Medication given the animal included several commercial preparations, all of which contained as ingredients, camphor, salicylic acid, turpentine, and menthol. The animal was treated on Tuesday, sold on Wednesday, and slaughtered on Thursday. The meat had a definite medicinal odor which remained after cooking. Laboratory results indicated that traces of the above substances were present in the meat, which made the meat inedible because of the taste and odor.

Freezerburn

Probably the biggest bugaboo in the entire frozen food industry is dehydration. This condition is known in the industry as "freezerburn." The surface of the meat, poultry, fish, shellfish, or other food so affected has a dry, leathery appearance, and pock marks appear on the surface. Freezer-burned meat, poultry, and fish are objectionable for other reasons than appearance. The fats below the dehydrated area become oxidized and, to a certain extent, rancid. The proteins become irreversibly dehydrated, and consequently the tissues become dry and tough. The red pigment becomes oxidized and turns brown.

The first step in preventing freezerburn is proper wrapping or packaging. All foods to be frozen and stored should be wrapped or packed in a material that is moisture and vapor proof. Many operators have found that a special grade of Cellophane, produced specifically for this purpose, is an effective wrapping. The package, after wrapping in Cellophane, is then wrapped with butcher paper to protect the Cellophane from injury. Many special wrapping papers have been produced for use in the frozen food industry. All of these papers are of laminated construction and consist of a good grade of butcher paper to which has been bonded a vapor proof material. Aluminum foil has been found to be very effective in wrapping awkwardly shaped packages such as poultry. During the wrapping or packaging operation, care must be exercised to remove as much as possible of the air trapped in the package. Foil wrapping is effective in this operation because the foil can be moulded to the food being wrapped.

After wrapping, foods should be placed in the freezing compartment in such a manner that heat is extracted from all surfaces of the package at an equal rate. Placing packages directly on the coils or plates will many times result in freezerburn. This can be avoided by the use of wire trays or baskets which provide an air space between the package and the coil.

The third step in preventing or reducing freezerburn is maintaining a constant storage temperature. A fluctuating temperature promotes dehydration; a constant temperature minimizes it. A high temperature increases dehydration, and a low temperature decreases it. Research indicates that a constant storage temperature of zero degree gives very good results in the prevention of dehydration. Lower temperatures are slightly more effec-

tive, but not enough so to justify the added expense of extra refrigeration.

The subject of locker plants would require several days of discussion if we were to explore the subject fully. I have attempted to discuss a few of the general problems relating to the licensing and inspection of locker plants under the Indiana Cold Storage Locker Law, and a few of the special problems of this industry. I hope that I have been able to pass on a few ideas and add to your knowledge of this industry.

INDIANA STATE BOARD OF HEALTH—DIVISION FOOD AND DRUGS
INDIANAPOLIS

LOCKER PLANT INSPECTION FORM

Name of Establishment .....

Address ..... (Street) ..... (City) ..... County .....

Owner ..... Supt. .....

No. Lockers ..... No. Lockers Added ..... License Expires .....

Type of Establishment: Locker Service ( ), Custom Sl. ( ), Com. Sl. ( ), Packing ( ).

SIR: An inspection of your premises has this day been made and you are notified of the defects marked below with a cross (X):

BUILDINGS AND FACILITIES

Item No.

1. Structure: Wood, Brick, Concrete, Tile—Good Repair ..... ( )
2. Floors: Impervious ( ), Smooth ( ), Clean ( ) ..... ( )
3. Walls and Ceilings: Washable ( ), Well Painted ( ), Clean ( ) ..... ( )
4. Doors and Windows: Effectively Screened ( ), Self-Closing Screen Doors ( ), Open Outward ( ), Kept Closed ( ) ..... ( )
5. Lighting: Adequate ..... ( )
6. Ventilation: Adequate ..... ( )
7. Protection of Food from Contamination: Protected from Insects ( ), Vermin ( ), Free of Flies ( ), Rats ( ), Mice ( ), Domestic Animals ( ) ..... ( )
8. Toilets: Ventilated ( ), Self-Closing Doors ( ), Open Outward ( ), No Direct Opening Into Rooms Where Food Is Handled or Stored ( ) ..... ( )
9. Washroom: Adjacent to Toilets ( ), Running Water ( ), Individual Soap and Towels ( ) ..... ( )
10. Employees' Dressing Room: Provided ( ), Individual Lockers ( ) ..... ( )
11. Water Supply: Public, Private—Under Pressure ( ), Adequate ( ), Safe Quality ( ), Cross Connections ( ), Sanitary Drinking Fountain ( ), No Common Cup ( ) ..... ( )
12. Waste Disposal: Public, Private—No Accumulation Near Plant ( ), No Discharge Into Stream, Lake, Pond or Ditch ( ), Satisfactory Method of Treatment ( ), Inter Connections ( ) ..... ( )
13. General Sanitation and Cleanliness ..... ( )
14. Tobacco: None Used in Any Room Where Food Is Processed or Stored ..... ( )
15. Health Certificates: Provided For All Workers ..... ( )

CHILL ROOMS

16. Floors, Walls, and Ceilings: Clean ( ), Good Repair ( ), Well Painted ( ) ..... ( )
17. Rails: Good Condition ( ), Proper Height ( ) ..... ( )

Item No.

18. Refrigeration: Adequate ( ), Good Air Circulation ( ), No Excessive Condensation ( ) ..... ( )
19. Racks and Hooks: Clean ( ), No Rust ( ), No Contamination ( ) ..... ( )
20. Temperature: ..... ° F ..... ( )

PROCESSING ROOM

21. Cutting Blocks and Tables: Properly Constructed ( ), Good Repair ( ), Clean ( ) ..... ( )
22. Containers, Utensils, and Tools: No Contamination ( ), Clean ( ), Good Repair ( ), Cleaned Before Use ( ), Cleaned After Each Day's Use ( ), Properly Stored ( ) ..... ( )
23. Equipment Wash Sink: Adequate ( ), Hot Running Water ( ) ..... ( )
24. Method of Wrapping: Suitable Paper Used ..... ( )
25. Lighting: Adequate ..... ( )
26. Ventilation: Adequate ..... ( )
27. Temperature: ..... ° F. ..... ( )

SHARP FREEZING ROOM

28. Blower, Coils: In Good Condition ..... ( )
29. Arrangement of Packages: Not Overcrowded ( ), In Wire Trays or Wicker Baskets ( ), No Freezer Burns ( ) ..... ( )
30. Temperature ..... ° F ..... ( )

LOCKER ROOM

31. Blower, Coils: In Good Condition ( ), Properly Defrosted ( ), Proper Arrangement ( ) ..... ( )
32. Aisles and Locker Tops: Not Overcrowded ..... ( )
33. Condition of Food: No Evidence of Spoilage, Thawing, Etc. ( ), No Evidence of Not Having Been Sharp Frozen ( ) ..... ( )
34. Lockers: Paper, Wood, Steel—Clean ( ), Good Repair ( ) ..... ( )
35. Temperature: ..... ° F. ..... ( )

TEMPERATURE CONTROL

36. Recording Thermometers Provided ..... ( )
37. Temperature for Last 6 Months: Maximum ..... ° F.; Minimum ..... ° F.; Average ..... ° F
38. Defective Recording Thermometer Charts ..... ( )
39. Charts Retained for 12 Months ..... ( )

Satisfactory for License: New ..... ( ) Renewal ..... ( ) Six Months Inspection ..... ( )

Date: ..... Sanitarian: .....

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MILK and FOOD SANITATION

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WHAT TO LOOK FOR IN BAKERY SANITATION APPRAISAL *

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BAKERY sanitation appraisal involves the same inspection factors that are the concern of any sanitary inspector. Therefore, in speaking to you on the subject of the title of this paper namely "What to Look for in a Bakery Sanitation Appraisal" it is felt that the subject is essentially how to make a modern sanitation inspection of any food plant in the light of the appraisal factors to be discussed in detail.

What are the appraisal factors of any food plant sanitation inspection? They depend, of course, upon the objecjectives. Food plant sanitation in these days has come to mean two things: (1) regulation of personnel practices to prevent the spread of disease through consumption of the food produced in a plant, and (2) elimination of practices and conditions in a plant that might lead to *adulteration of the foods produced therein with aesthetically repulsive extraneous matter.* Today both of these factors are of primary importance.

While we do not wish to lose sight of the dominant role of food plant sanitation in aiding in the prevention of the spread of disease, we cannot ignore at any time the fact that the consuming public expects of all concerned with food plant manufacture, in their personal conduct, in their choice of ingredients, and in their handling of such to conduct themselves so that the finished products of the plant will be free from the debris of insect infestation, rodent infestation, fungus growth, and repulsive bacterial growths not associated with disease.

By far the greater majority of those listening to this paper are concerned with the enforcement of what might be called public health requirements in food plants. Because of this interest you have primarily been concerned with the regulation of human behavior factors within the plant in order to minimize the possibility of disease spreading. The principal mechanism through which this has been done has been the setting up of state and local regulations on total bacterial counts, and by the presence or absence of specific organisms such as *Escherichia coli* in the products at consumer level.

In making sanitary inspections you have been concerned with enforcement regulations drawn up with a view to minimizing the possibilities for the development of high bacterial counts in the finished products and in the possible contamination with *E. coli.*

From an industry viewpoint, however, we have found that interest in food plant sanitation must not only include these factors, but also that of the problems of adulteration with extraneous matter. The two factors are closely interrelated after all for in one respect a dirty plant is a dirty plant in all respects. One that contains many opportunities for development of bacterial contamination will undoubtedly contain sources for the development of insect and rodent infestation. But conversely it is quite possible to have a plant appearing outwardly to be bacteriologically sound and at the same time have conditions permitting a degree of insect or rodent infestation to

* Presented at the Thirty-sixth Annual Meeting of the INTERNATIONAL ASSOCIATION OF MILK & FOOD SANITARIANS, INC., Columbus, Ohio, October 20, 1949.

occur in a hidden way which will lead to adulteration with extraneous matter so that prosecution under food and drug laws might well result.

Many of those listening to this paper are also responsible for enforcing local food and drug laws and they will bear me out in this statement.

What is desirable, therefore, in making an industry sanitation appraisal or inspection for sanitation in food plant is a procedure which will supply the inspector with a sound basis for analysis as to how close the plant being inspected actually comes to compliance with both food and drug laws involving adulteration with extraneous matter and public health laws.

Within the baking industry we feel that we have worked out such an inspection appraisal system together with a program to meet it. When the remedial program falls down, we do not feel it is the fault of the program itself but of the personnel applying it who may be limited either by lack of knowledge or lack of sufficient funds to enable them to carry it out adequately. This feeling has been amply supported by revisits to firms after the program has been properly applied.

We try to view the problem on an overall level without making a sharp distinction between the two viewpoints. In so doing, we set up a bakery inspection into the following eight categories:

1. Evidences of insect infestation in equipment and ingredients.
2. Evidence of structural insect infestation.
3. Evidence of rodent infestation.
4. Analysis of storage practices in the light of insect and rodent infestation possibilities.
5. Occurrence of structural harborages for insects and rodents and maintenance faults both of building and equipment.
6. An analysis of the housekeeping practices.
7. Degree of cleanliness maintained normally of equipment and utensils.
8. Personnel hygiene practices.

It is our feeling that these categories cover the field quite well. Depending upon the objectives of the inspection each of them can be given different weighted value when presenting a total picture. In fact it is recognized by us that from time to time our objectives will change so that we ourselves will change the weight to be given each of these factors. At the present time the baking industry is tremendously concerned with compliance of all bakeries with adulteration laws insofar as their sanitation goes. This means, therefore, that we must give this phase at least equal consideration with compliance with public health regulations. Therefore, we have weighted those categories concerned with adulteration so as to equalize those concerned with public health practices within the plant.

Let us consider each of the categories individually. Going back to number one—*evidence of insect infestation in equipment and ingredients*—the inspector in order to detect evidence of insect infestation must not examine a piece of equipment nor a stack of ingredients casually, but actually be present when the equipment is taken apart and cleaned piece by piece. As a matter of fact many occasions have shown that even plant personnel may not know how to disassemble many pieces of equipment requiring inspection, so our inspector must, on his own, figure out how this can be done and show the plant the procedure they must follow in the future.

Bakeries have always endeavored to keep their plants as clean looking as possible. This means that the outsides of machinery have been polished and scrubbed wherever possible but all too often there has been a lack of understanding of what might be underneath the first layer of covering that is taken off when the machine is disassembled, and the further regions deep down underneath. Ingreditents are examined not by looking over the stack but by actually taking out material quantities of flour and sifting it. If there is a strong suspicion that stored flour may contain a certain small degree of insect infestation our inspectors require that as many as a square root of the bags be sifted by individual whole bags to determine how many live adult insects or larvae might be found. In all cases our men are equipped with hand sieves, hand lenses, and other equipment which will enable them to go as far as they can in the field, to determine the degree of infestation of ingredients. Experience in the past has shown that inspectors too often have gone by appearances on the outside of flour bags. Examination of the ears of the bag has represented the extent to which they went in getting into the interior.

Evidence of structural infestation means a thorough foot by foot examination of the structure of the plant itself to determine whether or not there is insect infestation living within the building. In a sense these two categories represent, first, inspection for evidence of insect infestation by ingredient infesting insects primarily; in the second case, evidence of infestation by structurally infesting insects. Examples of the first are the confused flour beetle, a true "bran bug," and of the second, are the cockroach and the silverfish which live hidden often in the cracks and crevices of the walls. A complicating factor, of course, is that structurally a plant can become thoroughly infested with ingredient type infestation with, say, the confused flour beetle as well as with the so called household type insects.

Evidence of rodent infestation means that the inspector at the time of surveying the plant for structural insect infestation also looks for signs of rodent infestation. In the case of bakeries, these are chiefly the avenues of entry, droppings, tracks, rodent run marks, and gnawings in the structure or the bags or of containers of ingredients.

Experience has shown that in fighting this evidence one can even gage the extent of infestation for in a very light infestation very little evidence is found except in the form of a few tracks in the flour dust that usually accumulates on the skids in which flour is stored or perhaps in the dust developed underneath the skids. Then as the infestation gets heavier pellets are found occasionally on the bags themselves or in adjacent places where mice may have been stopping to feed. They tend to leave droppings as they feed or stand before their holes looking for evidence of safety before traveling further into the room. One does not find gnawings or evidence of rodent runs unless the infestation is very heavy.

Storage Practices are surveyed carefully to see whether or not the firm understands how to store its ingredients, its unused equipment, and its unused supplies in such a way as to minimize the development of rodent and insect infestation. Here again thorough consideration is given to adequate storage under refrigeration of perishable products and also methods of removal of perishable products from storage. For example, it has been found that a common practice in some bakeries is to take out cans of frozen eggs and leave them to thaw for a long period of time in the open air. By the time the interior of the can is thawed some of the eggs adjacent to the can side may have spoiled. Other factors involved in the study of storage practices are whether or not proper rotation is followed with ingredients as they are received so that the oldest is used first and whether or not intermediate containers are kept covered, and whether or not the plant follows a thorough inspection program upon receipt of raw materials to make sure that no infestation is present when received to prevent it from being brought into the plant.

During the course of the search for evidences of structural insect and rodent infestation a survey is also made of the occurrence of *structural haborages and maintenance faults* that might lead to the development of insect infestation or rodent infestation. Coming under this category are a study of the adequacy of the rodent-proofing problem of the screening of the plant, the elimination of low walls and ceilings

wherever possible. Unless the plant is made thoroughly rodent-proof by the removal of all hollow spaces, these must be thoroughly sealed to make sure that they cannot be utilized. There are, of course, many interior practices such as methods of setting up equipment which may also develop insect and rodent harborages. These are not strictly structural but are given consideration in this category.

Good housekeeping practices are of primary consideration, for given a well rodent-proofed, well screened plant, if proper storage facilities are practiced there is no excuse for the development of insect or rodent infestation unless poor housekeeping is followed. In a bakery we are constantly faced with the problem of deposits of flour dust developing over a week or two weeks time everywhere within the plant. These must be routinely cleaned up. The only sure way of doing so is by use of an industrial-type vacuum cleaner.

Along with the flour dust it must be recognized that there may be deposited a small number of insect eggs which if left undisturbed will develop into an adult population within the course of a few weeks. This means that no matter how well a plant is insect-proofed, both by screening and by inspection of ingredients for evidence of live infestation, there is always a latent or potential infestation in every bakery due to the possibility of the hatching of these eggs. It is good housekeeping practices that keep this and casual interior harborages at a minimum.

Cleaning of equipment. This category is a very serious one to bakeries generally. In the past they have kept the outsides of their equipment thoroughly cleaned, at least to appearances. They have been handicapped in cleaning the interiors of their equipment by virtue of the fact that most bakery equipment has been so designed that it is impossible to disassemble it without extra effort for cleaning. At the present time bakers, bakery equipment manufacturers, and the industry sanitation advisors are working closely together to develop better sanitation design for bakery equipment. Our ideas are quite similar to yours in your 3A program. It is believed that we have very much in common, and in cooperation with Dr. Parfitt, who is chairman of your program, it is our thought that we can share much valuable information in this regard. Most of you are familiar with this program so there is no need for it to be discussed further here.

Personnel Practices. It cannot be denied that personal hygiene practices in the bakery are the keynote to prevention of disease by consumption of bakery products, in fact not only for disease but also in many food-poisoning outbreaks. It is necessary for an inspector to make sure that adequate facilities are provided for employees to keep themselves clean. Care must be taken to ascertain whether or not procedures are set up to keep employees informed as to their obligations in reporting individual sicknesses.

SUMMARY

In summarizing our appraisal of the bakery sanitation program the keystone is the concept that 80 percent of bakery sanitation is concerned with good housekeeping and adequate maintenance of the plant with a view to good sanitation as the final outcome. The remaining 20 percent of effort to be applied to bakery sanitation is applied to what we call the preventive program. This involves the use of rodent-trapping programs and the use of insecticides notably of the residual deposit type for the purpose of catching what we have termed often "casual invaders of a rodent or insect character".

It has been our experience that in the best of bakeries a noticable infestation of either rodents or insects will be built up by casual invaders multiplying in some hidden spot not disclosed by ordinary surveillance within the plant so that by the time it is so disclosed there is a heavy infestation requiring a great deal of effort to eliminate.

The preventive sanitation program properly applied automatically catches casual invaders as they attack the plant.

We feel that there must be maintained in every bakery a thorough educational program ranging from general management down to the lowliest porter. Each individual working in the bakery must be trained to understand the role of his job in the sanitation picture. This is necessary because it is our belief that if he understands the things that he can do to destroy good sanitation he will not be so prone to do them. No one likes to work in an insanitary plant. It has often been said that man fouls his own nest worst of all. If this is true, we believe that it is because of ignorance of the factors involved not because of an inate desire to do so. An educational program for every employee in the plant is a must to go along with the application of preventive measures involving infestation and the establishment of sound housekeeping.

Pest Control

(Continued from page 295)

carefully selected from over 200 applicants. You see, we no longer believe that any one can be a pest control operator.

In some cases regarding pest control, we do not have the answer. I am not sure wherein the responsibility lies. A few provocative thoughts might serve to illustrate. Have you ever thought of how beer and beverage cases spread roaches? What can be done about this situation? What happens to badly infested food that is fumigated? Sure, the insects are dead, but is the material usable as human food? Sometimes I wonder whether some phases of pest control and sanitation are not working backwards.

In closing, I want to emphasize the thought that competent pest control is a vital link in food sanitation. Good sanitation itself does a large part in pest control, but where food is involved, some form of good pest control is also necessary. I hope the day will not be too distant, when through the cooperation of all concerned, we can say PESTS ARE UNDER CONTROL IN THE FOOD INDUSTRY.

Vermont Dairy Plant Operators' Conference

Vermont's Twenty-ninth Annual Conference for Dairy Plant Operators and Milk Distributors, October 25 and 26, is offered by the Dairy Department of the University of Vermont and State Agricultural College, Burlington, Vermont, at which O. E. Reed, Chief, Bureau of Dairy Industry will discuss the "New Developments in Dairy Research".

The Milk Plant Operations section will have papers concerning "Maintenance and Operation of Boilers", "Maintenance and Operation of Refrigeration Systems", and a discussion of "Reflective Insulation".

Cleaning problems will be fully presented by talks on detergent sterilizers, the problem of water in washing dairy equipment, glass piping, and 3A Standards for dairy equipment, as well as a report on what is new at the dairy show.

Milk surplus will be discussed under the title "The Manufacture of Foreign Type Cheeses".

Milk quality will receive attention: "High Temperature Short Time Pasteurization" with full discussion. There will also be a three man panel discussion of "Milk Flavors".

NEW BOOKS AND OTHER PUBLICATIONS

Advances in Food Research, Vol. II, edited by E. M. Mrak and G. F. Stewart. Published by Academic Press, Inc., New York, N. Y. 1949. 558 pages.

This is the second volume of a series of annual reviews on the growing and complexity of food research. These reviews are not limited to advances during the past year but rather to a broad, up-to-date presentation of the knowledge now available in the particular field that is treated. Therefore the treatment is more along the line of reviews in selected fields and just the advances along the whole front of food research. The present volume deals with the following subjects:

Ion Exchange Application by the Food Industry, by G. E. Felton, *Hawaiian Pineapple Co.* 46 pages. The subject is dealt with theoretically, and then with the many applications to industry and laboratory, as per example the extension of ion exchange from the original water softening to many complex organic mixtures like the amino acids, milk, pectin solutions, sugar and syrup purification, analytical procedures, fruit juices, pharmaceuticals (alkaloids and streptomycin), and others.

Thermobacteriology as Applied to Food Processing, by C. R. Stumbo, *Food Machinery and Chemical Corporation.* 68 pages. A splendid review of studies on heat processing starts with the initial work of *Bigelow et al.* and shows the mathematical development of interpreting thermo process data. Attention is called to the areas of uncertainty still existing, and the need for more thermo-bacterial research in food processing.

The Quaternary Ammonium Compounds and Their Uses in the Food Industry, by C. G. Dunn, *Department of Food Technology, Massachusetts Institute of Technology.* 82 pages. After a full descriptive review of the general properties of this class of compounds as determined by structure, toxicity, compatibilities, activity, film formation, mechanism of reaction, commercial preparation, and economics, the reviewer takes up more detailed study of six commercial types, their methods for evaluation and determination, and finally their application, followed by about three hundred references.

The Pharmacology of DDT, by A. J. Lehman, *Food and Drug Administration.* 16 pages. The subject is dealt with under its chemistry, analytical procedures, stability, pharmacology, toxicity (to man), pathology, health hazard, and treatment. Emphasis is given to its selective solubility in the butterfat fractions of dairy products and its accumulation in fatty tissue.

Analysis of Foods by Sensory Difference Tests, by M. M. Boggs and H. L. Hanson, *Western Regional Research Laboratory.* 40 pages. The reviewers bring together information concerning methods of making tests, their accuracy, supplementary chemical and physical tests, and conclude with general comparisons and desirable precautions.

The Chemistry of Fruit and Vegetable Flavors, by J. G. Kirchner, *U. S. Dept. of Agri. Laboratory of Fruit and Vegetable Chemistry.* 38 pages. After a detailed review of the known work in ten common fruits, twelve common vegetables, coffee, tea, and cocoa, the author points out that "the majority of the work on fruits and vegetables is incomplete—scarcely any of the more common vegetables have been investigated for their flavoring components", and call for fundamental research on food flavors "to assist procedurers and processers obtain and retain the original fresh flavor in food products."

Histological Changes Induced in Fruits and Vegetables by Processing, by T. E. Weier and C. R. Stocking, *University of California.* 46 pages. This paper deals predominantly with the effect of moist heat on fruits and vegetables, and is illustrated with 56 figures. Inasmuch as food technologists usually have only a minimum of training in the fields of histology and plant breeding, there is need to understand the colloidal nature of the products handled and processed.

The Spoilage of Fish and Its Preservation by Chilling, by G. A. Reay and J. M. Shewan, *Torry Research Station, Aberdeen, Scotland.* 156 pages. This subject is discussed under the bacteriology of fresh and spoiling fish, the bacteriology of spoilage, the estimation of quality, and the practicality of the quality of "wet" fish. The need for more research is indicated concerning the level of spoilage as affected by pH, and the extent of struggling, crushing, suffocation, and pressure changes. "and the natural condition of the fish as influenced by season, feeding, reproduction, and possibly age and rate of growth."

Spray Drying of Foods, by E. Seltzer and J. T. Settelmeyer. *Continental Foods, Inc. and General Foods Corp., respectively.* 122 pages, 47 figures, and 9 photomicrographs. The section headings read: introduction, commercial spray dryers, atomizing devices, product recovery and handling, product cooling devices, heat supply, materials of construction, economics of spray drying, control of product accumulation, spray dryer instrumentation, humidity problems, and evaporating capacity and thermal efficiency.

Federal Food, Drug, and Cosmetic Act—Judicial and Administrative Record 1938–1949, by Vincent A. Kleinfeld and Charles Wesley Dunn. Published by Commerce Clearing House, Inc., 214 N. Michigan Ave., Chicago 1, Ill. xxvi + 895 pages. 1949. $17.50.

In the Introduction the senior author reviews the increasing strength and effectiveness of the Federal Food, Drug, and Cosmetic Act, particularly as augmented by decisions of the Supreme Court. The authors have furnished "a useful guide and source book not only for the attorney, both expert and non-expert, in the field, but also for the administrative official who would like to have on his desk something for needy reference".

The first part of the book, pages 1–560, contains digests of "every opinion rendered under the .... Act which appears in the jurisdictional law reporters, and in addition, various so-called 'unpublished' decisions, which cannot be found except perhaps in notices of judgment published by the Food and Drug Administration and in the CCH Food Drug Cosmetic Law Reports."

Then follows on pages 561–762 "Trade Correspondence" and "Statements of General Policy or Interpretation" issued by the Food and Drug Administration—a compilation of 431 excerpts from and summaries of announcements and answers by the Administration in trade correspondence regarding current problems, and statements on general policy.

Chemical Inventions and Chemical Patents, by Edward Thomas. Published by Matthew Bender and Co., Inc., 109 State Street, Albany 1, N. Y. 881 pages. 1950.

"This book represents an endeavor to bring into easily readable form and to bring up to date the substance of the author's prior Law of Chemical Patents, and also to point out and describe the many hazards surrounding the work of an attorney who tries to put into words the abstraction called a chemical patent." The author does this very well. In clear readable style, fully documented, the subject of patentability is discussed from a wide field of practical experience. Many useful hints, summaries of cases and digests, changing emphasis by the courts, pitfalls to be avoided, and a General Appendix of Typical Patents (pages 623–689) are followed with an index of cases (pages 691–810) and an index of subject matter (pages 811–881).

JOURNAL of MILK and FOOD TECHNOLOGY

(including MILK AND FOOD SANITATION)

Official Publication of the

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At the May meeting, a Publicity Committee was appointed by President A. J. Powers, consisting of the following members:
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ASSOCIATION NEWS

Tiedeman Leaves State Service

Mr. Walter D. Tiedeman will retire from service in the State of New York effective October 31. He has accepted an appointment as resident lecturer in the School of Public Health of the University of Michigan, and as director of the recently established Testing Laboratory of the National Sanitation Foundation.

Mr. Tiedeman was graduated from Union College in 1914 with the degrees of Bachelor of Engineering and Master of Civil Engineering. During the following year he served as resident engineer with the Water Department of the City of Schenectady. He then served for two years as sanitary bacteriologist in the U. S. Public Health Service, on the Ohio River Pollution Investigation project. The following year Mr. Tiedeman operated a testing station in the City of Cleveland for the then new activated sludge process.

During 1918–1919 he was assistant sanitary engineer for the U. S. Public Health Service in charge of extracantonment sanitation at Souther Aviation Field in Americus, Georgia, with special emphasis on malaria control. He continued malaria control work for the State of Georgia during the first year following the war. In 1920–1921 Mr. Tiedeman acted as city engineer and superintendent of the water supply for

In the years 1922–1924 he served in the Philippines as a special staff member of the International Health Board of the Rockefeller Foundation, in charge of malaria control studies and demonstrations.

He joined the staff of the New York State Department of Health in February, 1925, as assistant sanitarian and was assigned to the investigation of pollution of oyster beds in connection with a nationwide outbreak of typhoid fever. He made extensive studies of the chlorination of sewage effluents at Huntington, Long Island, during the following year. The results of these studies were published in the *Engineering News Record* and have been adopted by standard text books on sewage treatment.

Subsequently Mr. Tiedeman was designated to direct the Department's milk sanitation program, later becoming chief of the Milk and Restaurant Sanitation Section, the position he now holds.

He has been active in the American Public Health Association, is a member of its Governing Council and chairman of the Subcommittee on Food Utensil Sanitation of the Committee on Research and Standards. He is also a member of the Committee on Sanitary Engineering and Environment of the National Research Council.

Mr. Tiedeman is the author of many technical articles reporting special

INTERNATIONAL ASSOCIATION OF MILK AND FOOD SANITARIANS

37th Annual Meeting, October 13–16

Hotel Dennis — Atlantic City, New Jersey

Thursday, October 12

7:30 P.M. **Meeting of Officers of the Association** — Report of the Editor and of the Manager of The Journal of Milk and Food Technology.

Friday, October 13

7:30 A.M. **Breakfast** — Officers of the Association.

8:00 A.M. **Registration** — George West, Rochester Health Bureau, Secretary-Treasurer, International Association of Milk and Food Sanitarians Assn.

Morning Session

Chairman—P. Edward Riley, Illinois Department of Public Health, and Secretary-Treasurer, Associated Illinois Milk Sanitarians.

8:40 A.M. **For All Sanitarians—Colored Movie "The Power of Pennies."**
Courtesy, American Dairy Association of Wisconsin, Madison.

9:10 A.M. **For All Sanitarians—Colored Movie "Better Labels."**
Courtesy, National Canners Association.

9:30 A.M. **The Place of the Commercial Laboratory in Milk Sanitation Work**—W. K. Moseley, Director, Moseley Laboratories, Indianapolis.

10:00 A.M. **Sanitation Requirements for Construction and Installation of Soda Fountains and Luncheonette Equipment** — C. J. Palmer, Executive Sectary, Soda Fountain Manufacturers Association, Chicago.

10:40 A.M. **Milk Cooling—As You Find It**—C. S. Springstead, Sanitarian, County of Erie Health Department, Buffalo, N. Y.

11:15 A.M. **New Developments in Sanitation Practices in the Frozen Foods Industry**—K. G. Dykstra, Director, Birds Eye-Snyder Laboratories, General Foods Corp., Albion, N. Y.

Afternoon Session

Chairman—J. E. Dolan, Department of Public Health, Colorado. Member, Committee on Dairy Farm Methods.

1:15 P.M. **On the Professional Status of Sanitarians—A Report by the Committee on Professional Status of Sanitarians**—Harold B. Robinson, U. S. Public Health Service, New York

1:35 P.M. **Safe Food Institutes, Their Purpose and one Method of Preserving Them**—Dr. Meredith H. Thompson, Director Environmental Hygiene, Rensselaer County Health Dept., Troy, N. Y.

2:05 P.M. **On the Coordination of Responsibilities of the Dairy Industry and Control Agencies in Successfully Meeting The Denver Market Problem** — Harold J. Barnum, Chief, Milk Section, Bureau of Health and Hospitals, Denver.

2:35 P.M. **New Developments in Sanitation in Paper Materials Used for Food Products**—Dr. Lloyd Arnold, Director of Sanitation, Sealright Co., Fulton, N. Y.

3:10 P.M. **Association Business Meeting**—Dr. Milton Fisher, *Chairman.*
Reports of the following committees:
(a) Committee on Communicable Diseases Affecting Man—Dr. I. A. Merchant, Chairman.
(b) Committee on Food Handling Equipment—C. W. Weber, Chairman.
(c) Committee on Sanitary Procedure — Dr. C. A. Abele.

Saturday, October 14, 1950

7:30 A.M. **Breakfast—All members of committees of the Association, and of officers of the Association. Committees as follows:**

Committees On:
Applied Laboratory Methods.
Communicible Diseases Affecting Man.
Dairy Farm Methods.
Food Handling Equipment.
Frozen Desserts Sanitation.
Ordinances and Regulations.
Professional Status of Sanitarians.
Sanitary Procedure.
Resolutions.

Morning Session

Chairman—Ivan Van Nortwick, Kansas State Board of Health, Secretary-Treasurer, Kansas Association of Milk Sanitarians.

8:30 A.M. **For All Sanitarians—Colored Movie "Appleland."**
Courtesy, Duffy-Mott Co.,

9:00 A.M. **Ultra Violet and Its Use in Sanitation**—Dr. W. H. Haskell, Klenzade Products, Inc.

9:20 A.M. **Exigent Problems in the Use of Quality Appraisal Standards in the Procurement of Dairy Products for Military Requirements**—Major Robert J. Miller, Office of Depot Veterinarian, Chicago Quartermaster Depot.

9:55 A.M. **Bacteriological Aspects of the Evaluation of Adequacy of Pasteurization**—Dr. Franklin W. Barber, National Dairy Research Laboratories, Inc., Oakdale, Long Island, N. Y.

10:30 A.M. **The Ring Test for Brucellosis in Herd Management**—John S. Bryan, Laboratory Director, Walker-Gordon Laboratory Co., Plainsboro, N. J.

11:00 A.M. **The Brucella Ring Test, Its Use and Effectiveness in the Control and Eradication of Brucellosis in Minnesota**—Dr. Fred C. Driver, Veterinarian in Charge, Bureau of Animal Industry, U.S.D.A., St. Paul, Minnesota.

Afternoon Session

Chairman—J. L. Rowland, Missouri State Division of Health, Secretary-Treasurer, Missouri Association of Milk and Food Sanitarians.

1:00 P.M. **For All Sanitarians—Colored Movie "Springtime Is Egg-Time."**
Courtesy, The Fleischmann Div., Standard Brands, Inc.

1:30 P.M. **Sanitary Procedures and Products Control in the Cheese Industry**—Dr. B. E. Horrall, Products Control, Kraft Foods Co., Chicago.

2:00 P.M. **The Status of Vaccines in Dairy Animal Disease Control**—Dr. S. F. Scheidy, Veterinary Medical Director, Medical Research Division, Sharpe & Dohme, Inc., Glenolden, Pennsylvania.

2:30 P.M. **Whipped Cream Dispensers Their Public Health Significance**—Harold Wainess, U. S. Public Health Service, Chicago.

3:00–4:30 P.M. **Association Business Meeting**—Dr. Milton Fisher, *Chairman.*
Report of the following committees:
(a) Committee on Ordinances and Regulations—C. J. Babcock, Chairman.
(b) Committee on Frozen Desserts Sanitation—Dr. F. W. Fabian, Chairman.
(c) Committee on Dairy Farm Methods—Dr. R. G. Ross, Chairman.

Sunday, October 15, 1950

7:30 A.M. (a) **Breakfast—Officers of the Association.**

7:30 A.M. (b) **Breakfast—Officers and Editors of the Journal of Milk and Food Technology.**

Morning Session

Chairman—P. D. Shirley, President, Florida Milk Sanitarians Association.

8:30 A.M. **For All Sanitarians—Colored Movie "Treasure Islands."**
Courtesy, Dole Sales Co., San Francisco.

9:00 A.M. **A Comparative Study of Six Agars Proposed for Bacterial Plate Counts of Milk—A Report of the Committee of Applied Laboratory Methods**—Miss Vivian Pessin, Dept. of Health, New York, N. Y., and Dr. L. A. Black, U. S. Public Health Service, Cincinnati, O.

9:25 A.M. **Bacteriostatic Activity of Quaternary Ammonium Compounds in Milk**—Dr. W. L. Mallman, E. S. Churchill and C. A. Davenport, Dept. of Bacteriology and Public Health, Michigan State College.

10:05 A.M. **A Synopsis of the National Conference in Interstate Milk Shipments**—J. L. Rowland, Director, Bureau of Food and Drugs, Division of Health of Missouri, Jefferson City.

10:30 A.M. **Milk Dispensers**—Paul Corash, Chief, Milk Division, Bureau of Food and Drugs, New York City Dept. of Health.

12:00 M.

Noon Luncheon

Chairman—Dr. Milton Fisher, President, I.A.M.F.S.

Speaker

Dr. Robert S. Harris, Professor of Nutritional Biochemistry, Massachusetts Institute of Technology

on

"Recent Developments in Nutrition with Emphasis on Dairy Products"

Afternoon Session

Chairman—C. S. Leete, New York State Board of Health, Vice-President, International Association of Milk and Food Sanitarians.

2:00 P.M. **A New Method for Measuring Quaternary in Milk and in Detergent Sanitizers**—Dr. Paul Elliker, Professor of Bacteriology, University of Oregon, Corvallis.

2:30 P.M. **Milk Quality and Milk Regulations—The Project, and Some of Its Problems—A Study Being Made by the National Reseach Council.** Dr. A. C. Dahlberg, Project Director, Professor of Dairy Industry, Cornell University, and H. S. Adams, Minnesota Department of Agriculture.

3:10 P.M. **Problems of Midwest Producers in Interstate Shipment of Milk**—Dr. Joseph C. Olson, Jr., Professor of Bacteriology, University of Minnesota.

3:45 P.M. **Short Business Meeting**—Dr. Milton Fisher, *Chairman.*
(a) Installation of Officers.

4:00 P.M. **For All Sanitarians—Colored Movie "It's the Maine Sardine."**
Courtesy, U. S. Dept. Interior, Fish and Wildlife Service, Washington, D. C.

Monday, October 16, 1950

7:30 A.M. **Breakfast—Designated Representatives of All Affiliate Organizations and the Officers of the Association.**

Morning Session

Chairman—R. Kay Matthews, Seminole County Health Department, Oklahoma. Secretary-Treasurer, Oklahoma Association Milk and Food Sanitarians.

8:30 A.M. **For All Sanitarians—Colored Movie "Cheese Making in Dairyland."**
Courtesy, Damrow Brothers Co., Fond du Lac, Wisconsin.

9:00 A.M. **Business Meeting—**
(a) Report of Committee on Resolutions—W. D. Tiedeman, Chairman.
(b) Other business.

9:30 A.M. **A Comparative Study of Stains Proposed for the Direct Microscopic Examination of Milk—A Report of the Committee of Applied Laboratory Methods**—Dr. J. C. Olson, Jr., University of Minnesota, and Dr. L. A. Black, U. S. Public Health Service, Cincinnati, Ohio.

10:00 A.M. **Milking Machines—Boon or Bane**—I. E. Parkin, Dairy Extension Division, Pennsylvania State College.

10:30 A.M. **Milk Handling in the Plant Through Glass Piping**—Dr. John Sheuring, Dairy Department, University of Georgia.

11:00 A.M. **Milk Handling on the Farm Through Glass and Stainless Steel Pipe**—M. H. Alexander, Dept. of Dairy Science, University of Illinois.

11:30 A.M. **Insulating Glass—Studies in Its Use in Milk Houses and Dairy Barns**—W. Everett Eakin, Director of Farm Research, Libby-Owens-Ford Glass Co., Toledo, Ohio.

RESERVATIONS

Cards for the making of hotel reservations will be mailed to all members prior to the meetings. It is advisable to make your reservations well in advance of the meetings.

Milk Industry Foundation Invites Milk Sanitarians

The Milk Industry Foundation cordially invites all milk sanitarians employed by health departments to their convention and sessions to be held in Haddon Hall, Atlantic City, N. J., on October 16, 17, and 18. Full-time employees of health departments may obtain their admittance by writing in advance to Mr. E. B. Kellogg, Convention Manager, Milk Industry Foundation, 1001 Fifteenth Street, N. W., Washington 5, D. C., or by registration at the registration desk in Haddon Hall which will open on Sunday, October 15, 1950. No registration fee is required.

Laboratory Control Conference to be held at University of Illinois

A conference for those interested in dairy plant laboratory operations will be held October 31st at the University of Illinois under the sponsorship of the Division of University Extension and the Division of Dairy Technology according to Professor P. H. Tracey, general program chairman. The program opens Tuesday evening, October 31 with a series of demonstrations of laboratory tests involving recent developments in equipment and laboratory techniques. On Wednesday, November 1 the following topics will be discussed.

How the Control Laboratory can effectively Serve Management.
The Significance of the Coliform Test.
Public Health Aspects of the Control Laboratory.
Advantages of Check Testing.
Important Modifications of the Babcock Test.
How to Secure Representative Sampling.
Random Sampling Compared with Complete Fresh Daily Sampling.
Relation of Weigh Can Construction to Accuracy of Milk Sampling.

Experts from industry and technical fields have been invited to discuss these topics.

For information regarding housing and advance registration, write R. K. Newton, Division of University Extension, 205 Arcade Bldg., 713½ South Wright Street, University of Illinois, Urbana, Illinois.

Food Technology Courses This Year at the Polytechnic Institute of Brooklyn

Three of the six courses comprising the only comprehensive round-up in the field of food technology and manufacturing presented by an engineering college in the metropolitan area will be included in the offerings for the 1950–51 academic year at the Polytechnic Institute of Brooklyn, according to an announcement made by Dr. Raymond E. Kirk, dean of the graduate school.

Under this series, the courses this year will be the "Technology and Chemistry of Economic Poisons," "Food Technology" and "Industrial Fermentation."

The alternate year courses which will be given in 1951–52 include the "Technology of Dairy Products," "Technology of Food Flavors, Colors and Synthetic Additives," and the "Technology of Alcoholic Beverages."

The fall semester begins Monday, September 25.

North Carolina State College Dairy Manufacturing Short Courses

Dr. W. M. Roberts, Head, Dairy Manufacturing Section, announces the dates for the Fall and Winter short courses to be offered by the Dairy Manufacturing Section, North Carolina State College.

Milk Sanitarians Short Course—November 6–17, 1950. A cooperative short course with Field Service Training, U. S. Public Health, University of North Carolina, and North Carolina State Board of Health. Attendance is by special invitation from cooperating agencies.

Market Milk Short Course—February 12–23, 1951. The two weeks' course will be concluded with a full day conference, February 23, with prominent state and out-of-state speakers presenting topics which are of particular interest to the industry at this time.

Ice Cream Short Course—February 26–March 9, 1951. The two weeks' course will be concluded with a full day conference, March 9, with prominent state and out-of-state speakers presenting topics which are of particular interest to the industry at this time.

For further details write: Dr. W. M. Roberts, Head, Dairy Manufacturing Section, North Carolina State College, Raleigh, North Carolina.

NEW MEMBERS

ACTIVE

Agee, C. B., Box 217, Centralia, Ill.
Bailes, Jerry, 2323 E. 5th St., Tulsa, Okla.
Barlow, Jesse H., Pulaski County, Waynesville, Mo.
Baker, J. H., P. O. Box 674, Ft. Pierce, Fla.
Beardslee, C. E., 16 Miramar Drive, Box 1388, Delray Beach, Fla.
Browne, Edwin H., 585 Cleveland Ave., Columbus, Ohio.
Bryant, J. E., RR Box No. 380, Lake Worth, Fla.
Carpenter, Robert M., Box 576, Lafayette, La.
Chapman, T. M., General Delivery, Cabool, Mo.
Childs, W. E., 1340 S. Knoxville St., Tulsa, Okla.
Clark, John Leroy, 1425 So. Cincinnati, Tulsa, Okla.
Cuppe, Vernon R., P. O. Box 491, Lebanon, Mo.
Davidson, John W., American Can Company, 11th Ave. and St. Charles Rd., Maywood, Ill.
DeLaney, J. C., 909 So. Williams, Moberly, Mo.
Eberwein, Elroy A., 443 E. Padon St., Blackwell, Okla.
Evans, Thomas A., State Dept. of Health, Pierre, So. Dakota.
Fritz, John R., Kansas City Health Dept., 21st Floor, City Hall, Kansas City, Mo.
Gabriel, C. E., 3228 E. 4th St., Tulsa, Okla.
Gammel, W. B., 5904 E. Ute, Tulsa, Okla.
Glass, A. D., DeFuniak Springs, Fla.
Grandpierre, E. L. J., 3620 Valley Vista Rd., Nashville, Tenn.
Henricks, E. G., Route No. 2, Hannibal, Mo.
Jackson, A. B., P. O. Box 1382, Ft. Pierce, Fla.
Jordan, W. H., 5745 N. W. 3rd St., Miami, Fla.
Keele, H. D., 4728 E. 5th St., Tulsa, Okla.
Korff, Ferdinand A., 1204 Roundhill Rd., Baltimore, Md.
Kuhn, Fred W., Jackson County Health Dept., Murphysville, Ill.
Lamberton, Robert W., St. Louis Co. Health Dept., Clayton, Mo.
Larrimer, William H., Columbia Health Dept., Columbia, Mo.
Lotspeich, Glenn, Division of Health, Warrensburg, Mo.
Mauller, Harold L., Route No. 6, Columbia, Mo.
McCutchen, John, Division of Health, Jefferson City, Mo.
Michael, Sumner L., P. O. Box 20, Nashville, Ill.
Mills, Kenneth, Box 172, Benton, Ill.
Moellenhoff, F. H., Newton Company, Neosho, Mo.
Moore, R. E., Division of Health, Hannibal, Mo.
Niswonger, O. D., Division of Health, Lebanon, Mo.
Ohren, Del, Trenton, Ill.
Parks, Kenneth D., Route 1, Box 359, Tulsa, Okla.
Payton, Louis S., Division of Health, Higginsville, Mo.
Perkins, Roy H., Sanitary Inspector II, Potosi, Mo.
Phillips, C. E., 1420 Tampa St., Tampa, Fla.
Pollock, C. J., Milk Inspector, Jefferson City, Mo.
Renie, L. F., Box 82, Columbia, Mo.
Rodely, William E., DeLaval Representative, Brookfield, Mo.
Rosewitz, E. F., 1344 So. Knoxville, Tulsa, Okla.
Sadowski, John L., St. Louis Health Div., St. Louis, Mo.
Sims, Lee T., Re Pel Mar Dairy, Versailles, Mo.
Smith, Warren, 5018 South Benton, Kansas City, Mo.
Smittle, Vester J., 1224 East Page, Springfield, Mo.
Stone, Hary F., St. Louis Health Dept., Sullivan, Mo.
Thornton, R. W., Health Dept., West Unity, Ohio.
Tuepker, J. L., Jr., Division of Health, Kirksville, Mo.
Wilkinson, Mrs. Lillian, 142 North Bemiston, Clayton, Mo.
Wilkowske, H. H., Dairy Products Laboratory, Gainesville, Fla.
Worton, Harold, Box 793, Peterboro, Ontario, Canada.

ASSOCIATE

Ahlefeldt, H. E., 521 Gilmore, Jacksonville, Fla.
Arendt, W. A., c/o City Health Dept., Richmond, Va.
Arnold, Harold D., Route No. 1, Carbondale, Ill.
Bridewell, Ross O., Health Dept., Williamsburg, Va.
Brown, George, City Hall, Iowa City, Iowa.
Coltson, Russell, 15 W. Huron, Pontiac, Mich.
Copenhaver, J. A., Montgomery Co. Health Dept., Christiansburg, Va.
Decker, W. M., D.V.M., Michigan Dept. of Health, Lansing 4, Mich.
DesErma, Hugh, St. Joseph County H. D., Centreville, Mich.
Donhowe, David B., District Health Office, Centerville, Iowa.
Dwight, R. E., Fouquier Co. Health Dept., Warrenton, Va.
Emerson, Philip S., Health Dept., Alexandria, Va.
Ettesvold, W. L., Grand Rapids City Health Dept., Grand Rapids, Mich.
Everett, M. R., Health Dept., So. Norfolk, Va.
Farley, Dr. Linwood, Health Dept., Williamsburg, Va.
Finnegan, Geo. W., 410 N. Michigan Ave., Chicago 11, Ill.
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Hill, R. T., State Health Dept., Richmond, Va.
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Holmes, Wayne, 203 Boone Nat. Bldg., Boone, Iowa.
Houghton, Howard, District No. 3 H.D., Charlevoix, Mich.
Hutcherson, S. R., Petersburg Health Dept., Petersburg, Va.
Jackson, J. N., Staunton, Va.
Keppler, Richard, 608 E. Milwaukee, Detroit 2, Mich.
Koele, E. M., State Health Dept., Des Moines, Iowa.
Kronick, David, Pontiac City Health Dept., Pontiac, Mich.
Lawrence, W. F., Health Dept., Portsmouth, Va.
McDonald, Harry, Beatrice Foods Co., Centerville, Iowa.
Mendonca, Frank, Mendonca Dairy, McLoud, Okla.
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Morton, Hugh, Jr., Box 602, Ormond Beach, Fla.
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Pillsbury, Wiliam James, Station Hospital, APO 856, c/o P.M., New York, N. Y.
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Rinkenberger, Burl E., Elpaso, Ill.
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Shields, Oliver D., Roberts Dairy Co., Sioux City, Iowa.
Shoemaker, Frank, Amboy Milk Products Co., Amboy, Ill.
Sommerer, H. E., Pine Grove Dairy, Portsmouth, Va.
Southern, Ira W., Health Dept., Buena Vista, Va.
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