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March - April, 1953

*Journal of*

MILK and FOOD  
TECHNOLOGY

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*Official Publication*

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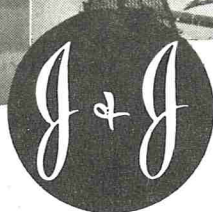
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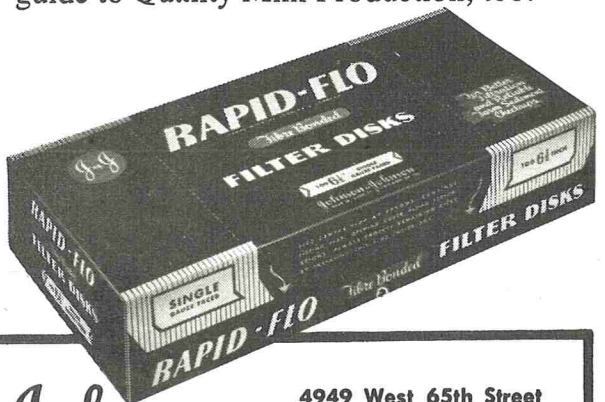
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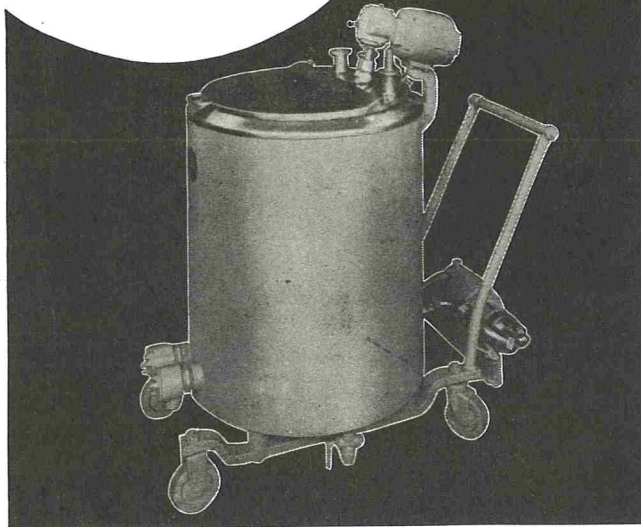
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INCLUDING MILK AND FOOD SANITATION

*Official Publication*

International Association of Milk and Food Sanitarians, Inc.

VOL. 16	MARCH - APRIL	NO. 2
<i>Editorials</i>	CONTENTS	Page
Sanitation Developing .....		53
Integration of Federal and Local Food Sanitation - An Opportunity .....		54
Status of Food Sanitation Knowledge Among Food Service Workers .....	H. S. Adams	55
Field Experience with Antibac, A New Type of Chlorine Sanitizer ..	Leslie R. Bacon, Alfred L. Sotier, and Armin Roth	61
The Effects of Heat on Bacteria in Milk With Particular Reference to Thermal Death Rates as Influenced by Various Factors .....	C. C. Prouty	66
Principles of Food Microbiology .....	H. O. Halverson	73
3A Suggested Method for the Installation and Cleaning of Cleaned-In-Place Sanitary Milk Pipe Lines for use in Milk and Milk Products Plants .....		77
Apparatus to Remove Agar from Petri Plates .....	T. J. Claydon	79
Some Aids In The Mathematics of Milk Control ....	Evan Wright	81
Defense Against Biological Warfare .....	Richard S. Green	83
Scharer Modified Phosphatase Methods .....	Dr. Luther A. Black	86
National Conference on Interstate Milk Shipments .....	J. L. Rowland, Chairman	89
Association News .....		102
Index to Advertisers .....		IX

ders for single copies, etc., should be addressed to H. L. Thomasson (address above).

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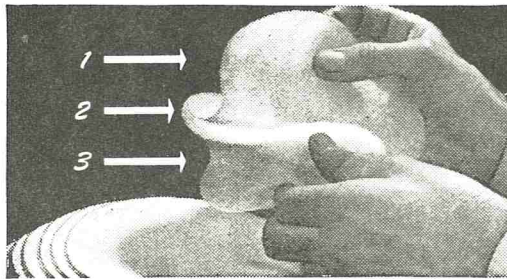
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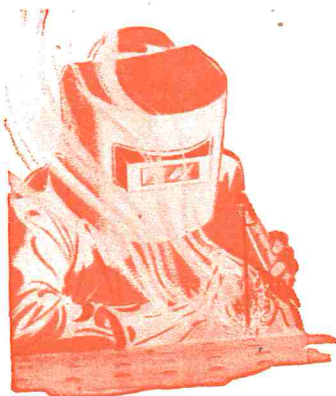
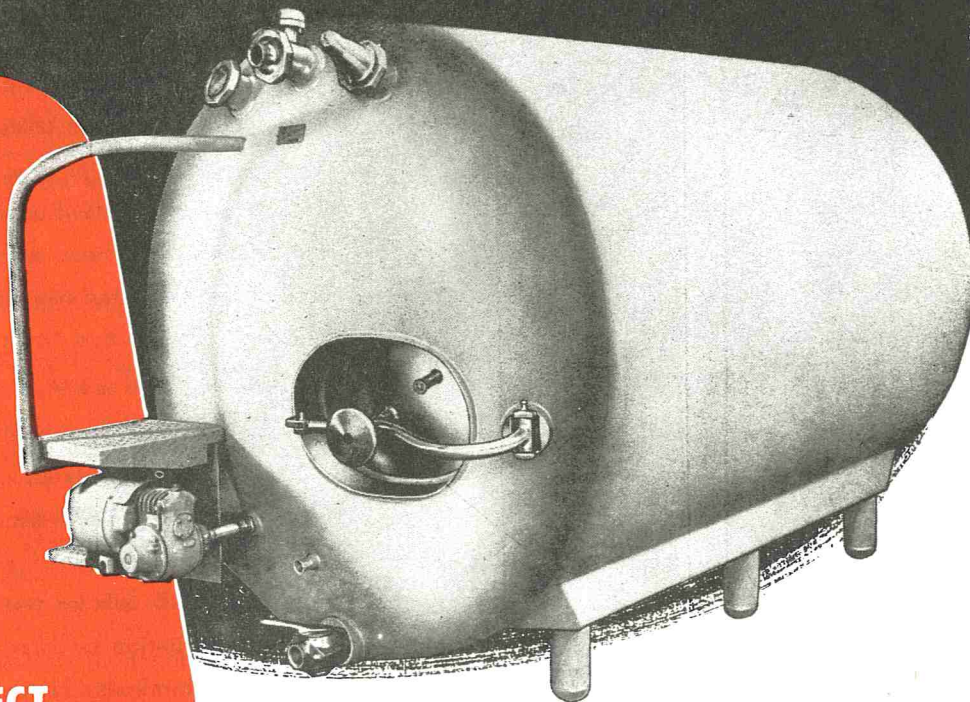
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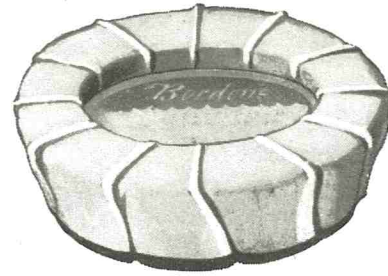
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his hair and beard were white. His clothes were  
threadbare. He was penniless and being sued for  
debt besides. He had tried many things and had known  
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## Editorial Notes

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### SANITATION DEVELOPING

Some of the old-timers in milk sanitation recall how we used to wish that the milk industry could become as sanitary-minded as the brewing industry. There comes to mind an address made a few years ago by a leading brewing technologists who exhorted his associates to practice what the milk industry had so successfully done in the field of sanitation. Our lead now in such matters is no cause for any smug complacency. Unless we strive to develop the fields already won, we risk their loss.

Three areas of new emphasis beckon.

Immediately, we note the interest in sanitation that is being manifested by several branches of the great food industry. For several years the baking industry has been on the march. Then, thanks to the prodding of food sanitarians (especially in the U. S. Public Health Service) the restaurant people got to moving — and are now “going places.” The canning industry has an organization of sanitarians. The food equipment and supply industry, observing the success of our 3-A program, have caught the idea and are now well along in integrating sanitation in general food equipment design. The recent engineering conferences at Michigan State College shows that sanitary technology has been taken seriously.

The poultry industry has now started. A fact-finding conference is scheduled to correlate information particularly from the standpoint of official sanitation and regulatory control. Some other industries need to wake up or risk being roughly handled.

Another area in the food field that is receiving increasing attention is that of the law. We all know only too well the confusion that has been thrust into the milk industry by the multitudinous state and municipal regulatory enactments. Their frequent contradiction, their heterogeneity of form, their varietal recognition as to what is really essential in sanitary milk production and handling—all attest two ideas: (1) the regulatory people themselves were not too sure of their facts as to what is basic sanitation technology, and (2) the regulatory people jumped in and promulgated laws and ordinances which were written by persons with more zeal than knowledge.

This writer holds no brief for the verbal abstruseness of the usual law. In fact, we wonder why on earth

anybody should promulgate directions for the public's compliance and then obfuscate them in rhetorical red-tape. Now we hope that some of the leading schools of public health are introducing courses on the food laws. High time! Here is a field declared to be of primary economic and public health importance. President John Wesley Dunn of the Food Law Institute states that the Federal Food and Drug Law is next to the Sherman Anti-trust Law in its far-reaching applications to our economy. The recent action of the U. S. Supreme Court in invalidating re-emphasizes the need for our facing up to the importance of establishing a sound forensic foundation in sanitation practice and development. State and municipal food control officials need some training along legal lines, in addition to their technical training and public interests. This need will increase when, as, and if a closer collaboration can be effected between federal interstate and local intra-state sanitary food control.

The third area that is beginning to make itself felt is that of community aesthetics (this word is used for lack of a better one that is not quite so fancy). Many violations of public good taste are perpetrated increasingly so. We presented this subject editorially\* last summer but have not heard a single reaction either good, bad or indifferent (presumably, everyone feels the latter). Recently, the glaring abuses perpetrated during the last election have left bill-posters everywhere, slowly peeling off — eye sores, street litter, public nuisances. On the offensive side are blatant and raucous noises, beach and atmospheric pollution, food-handling practises. On the constructive side are the support of efforts of communities, commercial concerns, and public officials to improve the physical aspects of our environment.

A noted biologist writes: “It is somehow very reassuring that an advertising campaign of paint manufacturers based on the appeal of utility—protect your house — was much less successful than one based on the appeal of aesthetics—make your house beautiful.”

In other words, we seek recognition of the importance of mental peace and enhancement of psychic or spiritual values. A person is more than mere body. The sanitarian should be his champion.

J. H. SHRADER

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\*See this Journal July-August 1952 issue, page 147.

## INTEGRATION OF FEDERAL AND LOCAL FOOD SANITATION — AN OPPORTUNITY

The recent decision of the U. S. Supreme Court in invalidating certain factory inspection provisions of the Food, Drug and Cosmetic Act (see page ....., this issue) has certainly weakened an important aspect of sanitary food and drug control. The Commissioner of Food and Drugs, Mr. C. W. Crawford, has announced that he will submit a proposal which will correct this unfortunate weakness discovered in the present law. Until this is done, factory inspection will continue on a voluntary basis.

It seems to us that an opportunity presents itself here for a great advance in sanitary food control. There are two areas that need attention: (1) the growing dichotomy in federal sanitation control, namely, that of the Public Health Service and that of the Food and Drug Administration, and (2) that of the irregular, heterogeneous, and ill-defined sanitary inspection that exists all over this country in our various states and cities.

Under the first category, we applaud the salutary results that have occurred from the entry into food control of the Public Health Service, initially in its milk work and then in restaurant and other lines. Good as was the effect of raising the level of milk sanitary practices, something additional was achieved, namely, the coordination of milk control all over our country. Qualified, competent leadership inspired a program of milk control that has paid rich dividends in decreasing the many conflicting requirements, in coordinating diverse practices, and in stimulating investigation.

Through the admirable development of the clean restaurant program, supported by the food-handler conferences, this country is being made increasingly sanitary-conscious. The poultry industry observing the confusion into which the milk industry fell through its uncoordinated diverse practices, seeks to forestall any such predicament by posting a fact-finding conference for February (see this issue, page .....

Our point here is that experience has revealed the need for coordination. Increase in sanitary consciousness would indicate that this need will increase when new industries that are not now awakened, and new areas that are not now contemplated, will get under sanitary inspection.

Yet in all this development, we see the Food and Drug Administration engaged in local food plant inspection. True, this is now in abeyance but probably this situation will be remedied by revision of the statute. We shall then have two separate federal agencies developing food plant inspection. Insofar as we know there has been nothing but friendly cooperation among the PHS, the FDA, and the local inspectors. But we can see where the two federal services are sooner or later going to entangle — as earlier happened

in milk work. In addition, federal activity locally may be expected to dull the feeling of local official regarding their responsibility in local food plant sanitation.

Under the second category, we all know that the sanitary supervision of local food plants by local inspection is in as heterogeneous a situation as has occurred in milk control. No agency with commending vision and authoritativeness has done in this field what the Public Health Service did in the milk field then in the restaurant field, then in food-handler training. There is much sanitary food technology now current officially in the meat-packing industry, the restaurant industry, and the milk industry, plus the industrially sponsored sanitary codes of the bakery, seafood, canning, and confectionery industries. All of this could be correlated into a single, comprehensive food plant sanitation code, applicable uniformly country-wide.

And now for the advance —

Municipalities have the authority under their police powers to require proper sanitation. But they are limited practically by the absence of a clearly defined code of food plant sanitary practice, and also by local influences of various kinds. Experienced food control administrators know the powerful aid rendered to their persuasive pressures by invoking nationally accepted standards. Where is there such a code?

The INTERNATIONAL ASSOCIATION OF MILK AND FOOD SANITARIANS, INC., is uniquely qualified and situated to give this service. Its experience over the years, the know-how of its personnel, the official status of its membership, all combine to give it the perspective and the interest to inaugurate such an undertaking.

The use of such a code would increase food plant sanitation in two counts. First, it would give the local men the necessary information and legal instrument (as interpretative regulations). Second, it would release federal inspectors from most local plant inspection work because of dependable cooperation locally. The experience of the Public Health Service in getting local certification of oyster shipments and cream shipments show the extent to which the federal coverage can be immensely increased — and at the same time, greatly stimulating local action.

We suggest that as a Public Member of the Food Law Institute (see this issue, page 101) the INTERNATIONAL ASSOCIATION OF MILK AND FOOD SANITARIANS, INC., might initiate a group-sponsored code that would serve as expert expression of what the present state of the subject of food plant sanitation comprises.

J. H. SHRADER

## STATUS OF FOOD SANITATION KNOWLEDGE AMONG FOOD SERVICE WORKERS\*

H. S. ADAMS

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Indiana University Medical Center  
Indianapolis, Indiana

This article reports upon an investigation carried on by the author and his staff among restaurant owners and food workers in Minnesota. The object of this investigation was to determine how much food service personnel knew about, and understood, the basic principles of safe food handling. Owners and their employees were questioned in a casual manner during the course of routine inspections, and in addition some two hundred others were tested through the use of multiple choice questions prior to the operation of food handler classes. The data presented demonstrates the need for more emphasis by sanitarians upon basic principles of food hygiene and a constant program of explanation and instruction of personnel within the restaurant industry.

THE INSTRUCTION AND EDIFICATION of food service personnel in the fundamentals of good sanitary practice should be a basic objective in every program intended to insure the safety of food. With the mechanization of the food business there is a tendency to become so concerned with apparatus and equipment that the personnel who use and operate it may be overlooked. To bring about maximum public health protection the necessity of getting to the people who work in the industry is a matter of vital significance.

A review of the latest published reports on food-borne outbreaks reveals that by far the majority of them were caused by failure to appreciate and to practice basic san-

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itary principles. Had elementary food protection methods been understood and practiced many of the outbreaks would not have occurred.

To substantiate this premise, table 1 has been prepared which lists the alleged causes of food-borne outbreaks reported in 1950.

TABLE 1

### ALLEGED CAUSES OF OUTBREAKS REPORTED IN 1950

1. Failure to use refrigeration....	68
2. Contamination or infection by persons.....	31
3. Insanitary handling - faulty methods.....	27
4. Chemicals introduced.....	4
5. Indefinite, miscellaneous causes .....	4
6. Insanitary equipment.....	2
7. Insects and rodents.....	1
8. Causes unknown or undetermined .....	204
Total	341

From table 1, it will be noted that the causes, through item 6 at least, demonstrate a lack of understanding of good sanitary practice. In fact, of the 341 outbreaks reported, 156 or slightly better than 40 percent were attributable to persons either through their acts of omission or commission. In addition it is undoubtedly safe to assume that at least 40 percent of the cases listed as "causes unknown or undetermined" had their origin in ignorance of good food-handling methods or a failure to carry out protective procedures.

With facts of this nature in mind, the writer, with the assistance of



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his staff and that of several of the city health departments in Minnesota, drew up a series of questions which could be used in the field to determine how much or how little food service personnel know concerning some of the basic sanitary principles of restaurant operation and food sanitation. As is well known to those working in the field of food sanitation, one constantly encounters persons in the industry who demonstrate, time after time, a lack of knowledge of good sanitary practice. On the other hand, to the writer's knowledge, no precise figures have been assembled to verify what the level of understanding is among food workers. This brief study is an attempt to reach some tangible conclusion so that strengths as well as weaknesses can be demonstrated.

In planning this survey, instructions were issued to food sanitarians to ask, during the course of routine inspections, certain pertinent but elementary questions of owners, cooks, waitresses, dish-machine operators, and bartenders. The questions were asked in a casual manner so the person interrogated would not feel he was being tested or quizzed. The instructions were to engage the person in conversation and attempt to have him express his opinions freely and without any prompting. A study of the answers revealed that the method was quite successful, and in many instances the question served to raise other points upon which the subject volunteered additional information, even though irrelevant.

#### OWNERS AND PROPRIETORS

The first questions were directed to owners and proprietors. The first of this series attempted to elicit information from owners or proprietors concerning the training of a waitress in food-handling techniques. The question was asked, "When you hire a new waitress what points about sanitary food handling do you teach her?" The results derived from using this question among forty-four owner-proprietors is shown in table 2.

Credit was given under major points if such items as hand washing, clean uniforms, hairnets, and handling of food and utensils in a satisfactory manner were mentioned. Under minor points, credits were given if general cleanliness, clean dishes, and serving techniques were covered. Such statements as "We hire only experienced help", or "Our older waitresses show the new ones how to wait on customers", accounted for the number credited with "no instruction".

From table 2 it appears that only 22.7 percent of proprietors gave adequate instruction in important food service procedures to new waitresses, that 36.4 percent did give some consideration to these

points, but nearly 41 percent made no attempt to cover fundamentals.

#### WAITRESS AND SERVICE PERSONNEL

The next question used was designed to ascertain first, from waitresses, how much and what kind of instruction they received in sanitary food handling, and second, to serve somewhat as a cross-check against answers contributed by proprietors in regard to the training or instruction of a new waitress. Consequently, this question was asked of waitresses and similar service people.

"How much instruction or training in food handling did you get from the boss when you first took this job?" An analysis of responses to this question is given in table 3.

The results shown in table 3 compare favorably with those shown in table 2. In both cases the percentage of waitresses and service personnel receiving adequate instruction was less than 25 percent, 22.7 in table 2 and 20.6 in table 3. In the case of no instruction given, the percentages were 40.9 and 53.0 respectively.

#### QUESTIONS TO OWNERS AND PROPRIETORS

Next a question aimed at determining some general knowledge

concerning food poisoning was asked of owners and proprietors. This was the question used: "what kinds of food do you think are most likely to cause food poisoning?" The results obtained from this question are shown in table 4.

Credit as a correct answer was given if the subject mentioned such foods as meat and meat products, poultry, custard-filled pastries, meat and fish salad, or certain creamed foods. Partial credit was given if left-overs, unrefrigerated foods, ground meat, or food kept too long were mentioned. Some typical answers in the "wrong" category were: food left in open cans, spoiled food, fish, and the use of aluminum utensils. As a further interesting fact it was determined that the average estimated age of the forty-two persons interviewed was forty-five years and the length of time in business averaged ten. Yet with ten years average experience the facts reveal that over one-third of those interviewed did not know or did not name the kinds of food most likely to cause outbreaks of food poisoning.

Two other questions were asked of proprietors. The first attempted to determine whether the owner or proprietor knew the brand name of the dish washing compound used in his place of business. The second

TABLE 2 — OWNER-PROPRIETORS INTERVIEWED — 44  
INSTRUCTIONS TO A NEW WAITRESS

A. Major points		B. Minor points		C. No instruction	
No.	percent	No.	percent	No.	percent
10	22.7	16	36.4	18	40.9

TABLE 3 — WAITRESSES OR SERVICE PERSONNEL INTERVIEWED — 34  
WAITRESS STATEMENT ON INSTRUCTION

A. Major points		B. Minor points		C. No instruction	
No.	percent	No.	percent	No.	percent
7	20.6	9	26.4	18	53.0

TABLE 4 — OWNERS AND PROPRIETORS INTERVIEWED — 42  
CAUSE OF FOOD POISONING

A. Correct		B. Partly correct		C. Wrong or did not know	
No.	percent	No.	percent	No.	percent
16	38.1	10	23.8	16	38.1

TABLE 5 — COOKS AND CHEFS INTERVIEWED — 20  
TEMPERATURE FOR REFRIGERATED FRESH MEAT

Didn't know		Below 32°F		34 - 38°F		38 - 40°F		40 - 50°F	
No.	percent	No.	percent	No.	percent	No.	percent	No.	percent
3	15.0	4	20.0	6	30.0	5	25.0	2	10.0

question was general in nature and attempted to elicit reaction to the question, "What do you figure is the toughest sanitation job you have in running this business?"

In regard to the question about dish-washing compounds it was found that only one-half of those questioned knew the brand name of the compound in use and in the majority of instances the familiar and highly advertised detergents were the ones mentioned. In no case could these proprietors name any of the constituents that would generally be present in commercial dish washing powders.

In response to the second question, that is, the one involving the "toughest sanitation job", the answers varied depending upon the viewpoint of the proprietor. General cleanliness, floor cleanliness, and equipment were mentioned most frequently. Such items as insect control, toilets, garbage, and waste disposal were not frequently mentioned. Cleaning to most proprietors seemed to involve the maintenance of appearance and such things as dismantling equipment, cleaning under and behind equipment, or rodent and fly control were not mentioned. However, the wording of the question was general, and as might be expected the answers were given in that vein.

COOKS AND CHEFS

The next series of questions was directed to cooks and chefs. The first of the series was, "How cold should your refrigerator be for storing fresh meat?" The answers to this question are given in table 5.

A study of these results indicate that 30 percent stated that the preferred temperature range was 34 - 38 degrees F which generally is considered satisfactory. In 15 percent of the cases, the subject did not know, and 20 percent mentioned below 32 degrees F. These last two percentages combined showed that 35 percent did not mention a temperature for fresh meat storage which is commonly accepted in the "trade" as satisfactory.

The next question asked the chef-cook group had to do with the serving of pork. The question was stated as follows: "Do you serve much pork here? Do you think it is all right to serve pink pork?" The

first part of this question was used only as a lead to the next portion and the answers are not of particular significance. Interestingly enough however, every cook or chef interviewed condemned the serving of pink pork. Two typical answers were, "It is all right to serve beef rare, but pork must be well done," or "Pork doesn't look right unless it is well done; mother was very fussy and saw to it that the pork she cooked was well done." In not one instance was there any hesitancy or indecisiveness about the undesirability of serving insufficiently cooked pork. The consistently correct answers to this question prompts the query, "Why was a correct answer to this question given every time". Somewhere in the early training or experience of these people they learned that pork must be well done and that fact had remained steadfastly with them. Perhaps if we knew the answer to this question many of our food-handling difficulties could be more readily solved.

DISH-WASHERS

The next question of this series was directed to persons in the dish-washing section. Both hand and machine dishwashing were being done by those interviewed. The question asked was this: (a) "How hot is the water here?" and, (b) "How hot should the rinse water be to disinfect dishes and utensils?" The results are expressed in tables 6 and 7.

From a study of tables 6 and 7 it is apparent that the generally acceptable sanitizing temperature of 170 degrees F is a figure which had not been adequately impressed

TABLE 6 — DISHWASHERS INTERVIEWED — 42  
Question — (a) How hot is the water here?

Gussed Temperature F at:									
Did not know		140 - 149		150 - 165		170 - 180		Over 180	
No.	percent	No.	percent	No.	percent	No.	percent	No.	percent
32	76.3	2	4.7	2	4.7	4	9.6	2	4.7

TABLE 7 — DISHWASHERS INTERVIEWED — 42  
Question — (b) How hot should rinse water be?

Did not know	Temperature in degrees F			
	140 — 159	160 — 169	170	Over 170
No. percent	No. percent	No. percent	No. percent	No. percent
16 38.1	5 11.9	5 11.9	2. 4.8	14 33.3

TABLE 8 — WAITERS, WAITRESSES, SERVICE PERSONNEL INTERVIEWED — 27  
(a) Place of hand washing

Rest room		At kitchen sink	
No.	percent	No.	percent
20	74.0	7	26.0

(b) Time of washing

Start work	Toilet	Soiled articles	Food	Other
No. percent	No. percent	No. percent	No. percent	No. percent
1 3.7	8 29.6	8 29.6	3 11.1	7 26.0

upon the minds of persons who work at dishwashing. Table 6 reveals that 76.3 percent of those interviewed did not know what the temperature of hot water was in their establishment. Table 7 shows that 38.1 percent did not know what the temperature should be. Only 4.8 percent stated 170 degrees F while 33.3 percent felt the rinse water should be over 170 degrees. While there would be no dissatisfaction on the part of control officials of the temperature was above 170 degrees, the fact remains that the significance of water temperature does not appear to be understood by persons whose everyday duties involve the washing and sanitizing of dishes.

Next among the questions used was one pertaining to hand washing. This question was asked of waiters, waitresses, and similar service people. The question was divided into two parts as follows: (a) "Where is the place you wash your hands around here", and (b) "How often should you wash your hands?" The replies are given in table 8.

While part (a) of table 8 reveals that hand washing is done in the kitchen sink by 26 percent of persons interviewed, a study of the answers to this question demonstrates that the necessity for frequent hand washing is well understood. Answers were positive and emphatic on this point.

Part (b) of the table shows that hand washing after using the toilet, after handling soiled articles, and within the scope of the item given as "other" accounted for a combined total percentage of 85.2. Only 14.8 percent mentioned hand washing before beginning work or after soiling the hands with food. It does seem apparent, however, that the importance of hand cleanliness is very generally appreciated and this

is further borne out by the facts that in many instances the person interviewed made a statement about as follows: "I wash my hands twenty times a day, in fact I don't keep track of the number".

#### BARTENDERS AND TAVERN OPERATORS

The final question used was directed to bartenders and tavern operators. The question used was designed to determine if the subject knew "why" a chemical sanitizer was required for the disinfection of bar glasses. The question asked was this: "I notice you are (or, are not) using a disinfectant on your glasses; why do you think the department requires one to be used?" The results obtained through the use of this question are set forth in table 9.

The tabulation of these results indicates that 72 percent understood that germicidal action was the underlying reason. In all but five establishments where this question was used a sanitizer was found present in the bar sink and the operators at these five places were included in the group that stated that they did not know why a sanitizer was required.

#### FOOD HANDLERS

To further determine the status of sanitation knowledge among food workers a series of questions was drawn up and distributed to persons attending food handlers' institutes in three medium-size Minnesota cities. After the food worker registered and while waiting for the instruction period to start, he was asked to select the correct answer to a series of nine questions. The question sheet is reproduced

TABLE 9 — BARTENDERS AND TAVERN OPERATORS INTERVIEWED — 57  
Question — Why is a disinfectant required?

To clean the glass		To kill germs		Did not know	
No.	percent	No.	percent	No.	percent
5	8.8	41	72.0	11	19.2



TABLE 10 – HOW WELL DO YOU KNOW YOUR JOB?  
(A few questions to check on your knowledge)

Please put a cross (x) in the space before the right answer.

EXAMPLE: The safest kind of meat to serve is that which has been:

- Killed fresh on the farm
- Aged for 30 days
- Government inspected

THESE ARE THE QUESTIONS.

TOTAL FOOD WORKERS QUESTIONED - 207

1. The <i>most</i> important time to wash your hands is:				
<input type="checkbox"/> After peeling vegetables		Right	Wrong	
<input type="checkbox"/> After handling money		No. Percent	No. Percent	
<input checked="" type="checkbox"/> After using the toilet	170	82	37	18
2. The kind of food most likely to cause food poisoning is:				
<input type="checkbox"/> Catsup, spices and seasoning		Right	Wrong	
<input checked="" type="checkbox"/> Meat and meat products		No. Percent	No. Percent	
<input type="checkbox"/> Fresh raw vegetables	198	96	9	4
3. The best temperature for storing fresh meat is:				
<input type="checkbox"/> 54 – 60 degrees F		Right	Wrong	
<input type="checkbox"/> 41 – 48 degrees F		No. Percent	No. Percent	
<input checked="" type="checkbox"/> 34 – 38 degrees F	151	73	56	27
4. Which one of these chemicals must be used in place of hot water for disinfecting dishes and eating utensils:				
<input type="checkbox"/> Tartaric acid		Right	Wrong	
<input checked="" type="checkbox"/> Chlorine		No. Percent	No. Percent	
<input type="checkbox"/> Sodium bicarbonate	168	81	39	19
5. The <i>main</i> reason for keeping displayed food covered is:				
<input type="checkbox"/> To protect it from odors and smoke		Right	Wrong	
<input type="checkbox"/> To keep it from going sour		No. Percent	No. Percent	
<input checked="" type="checkbox"/> To protect it from cough and sneeze droplets	137	66	70	34
6. The best way to store fresh ground meat in a refrigerator is:				
<input type="checkbox"/> In a deep container with a tight cover		Right	Wrong	
<input checked="" type="checkbox"/> In thin layers in a shallow pan		No. Percent	No. Percent	
<input type="checkbox"/> Wrapped tightly in waxed paper	88	43	119	57
7. Minnesota regulations require water to be at a certain temperature for disinfecting dishes. Which one is the temperature required?				
<input checked="" type="checkbox"/> 170 degrees F		Right	Wrong	
<input type="checkbox"/> 215 degrees F		No. Percent	No. Percent	
<input type="checkbox"/> 155 degrees F	108	52	99	48
8. The most important item in clean restaurant operation is:				
<input type="checkbox"/> Stainless steel equipment		Right	Wrong	
<input checked="" type="checkbox"/> Careful methods		No. Percent	No. Percent	
<input type="checkbox"/> Air-conditioned premises	151	73	56	27
9. The most common cause for complaint by restaurant customers is:				
<input type="checkbox"/> Lack of ventilation		Right	Wrong	
<input checked="" type="checkbox"/> Careless food handling methods		No. Percent	No. Percent	
<input type="checkbox"/> Floors not kept clean	153	74	54	26

What is your job where you work

(owner, waitress, cook, dishwasher, etc.)

herewith and the results for each question are shown giving the number of correct and incorrect answers and their respective percentages. (See Table 10).

A number of conclusions can be drawn from these data. Tables 2 and 3 prove beyond question of doubt that among proprietors and workers interviewed, relatively little time and attention is directed toward the training of a new worker in fundamentals of personal hygiene and sanitary food handling methods. It is too often taken for granted that because an employee has worked at some other food establishment no additional training by the next employer is necessary. The regulatory agency does not have the means or personnel to assume responsibility for the training of all food workers, but it is felt that the regulatory agency should train the employer and urge him to establish "house rules" and then train his employees to follow them. Numerous instances are on record where in-service training courses for employees are given by restaurant management. This is a policy that should be actively encouraged by the regulatory agency.

#### SUMMARY AND DISCUSSION

A brief review of these data point to certain definite facts. In connection with causes of food-borne outbreaks, thirty-eight percent of owners and proprietors could not or did not name types of foods most generally involved and nearly twenty-four percent gave answers which were only partially correct. In terms of public health protection this is serious. It demonstrates that the food sanitarian must devote more time to those features of food control which will

alert proprietors to inherent dangers which arise when sound food handling principles are violated.

From table 5 results indicate that cooks and chefs lack precise knowledge concerning the preferred temperature for fresh meat storage. Only thirty percent of those interviewed gave the range 34-38 degrees F. Considerable confusion seems to exist in this category and it again demonstrates the need for personal instruction among these workers.

The minimum temperature for hot water used in sanitizing dishes was a figure not generally well known by those interviewed in this study. Seventy-six percent did not know what the hot water temperature was in their place of business (table 6) and thirty-eight percent (table 7) did not know what it should be. A total of thirty-eight percent of those answering gave the correct temperature, namely, 170 degrees F, or over 170 degrees F. Obviously it will be difficult to obtain sanitized dishes if correct temperatures are not known.

Concerning the matter of hand-washing (table 8) it appears that the importance of this is quite well recognized. The answers as to time of washing were somewhat mixed in that washing after the toilet, after handling soiled articles, and at other times when necessary were always mentioned. The one weakness appeared to be that few admitted the need for washing prior to starting work or when first coming on duty.

The reason for using a chemical sanitizer for the disinfection of glasses at bars and taverns was known by seventy-two percent of

those questioned. This was a higher percentage than had been anticipated. It is presumed that this result may be attributable to the fact that regulatory agencies have stressed sanitized bar glasses repeatedly. In addition bartenders are frequently visited by representatives of detergent manufacturers who stress clean and sanitary glasses as a business as well as a public health asset.

In connection with the questions used at food-handler institutes, a study of the question sheet indicates the greatest lack of knowledge involved questions 5, 6, and 7, where incorrect answers were the most frequent. While this type of study was confined to Minnesota alone it does reveal and emphasize again the important fact that regulatory agencies must get to the people who prepare and serve food at public places. A continuous program of counseling and education must be carried on. While the physical properties of a public cafe are definitely important, food sanitarians must be constantly mindful of the fact that personnel are of even more significance.

Space does not permit a detailed discussion of the manner in which this instruction can best be accomplished, but suffice it to say that every device available will be needed to impress upon the minds of all food service workers that public health may be impaired if basic sanitary principles are neglected.

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**FORTIETH ANNUAL MEETING  
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## FIELD EXPERIENCE WITH ANTIBAC, A NEW TYPE OF CHLORINE SANITIZER

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A new type of chlorine-liberating germicide designed to provide sanitizing solutions in the pH range of 5.8 to 7.0 has been introduced under the name of Wyandotte Antibac. This new germicide is a white, low-density powder based on 1,3-dichloro-5,5-dimethylhydantoin as the active agent and contains 16 percent available chlorine.

Data obtained from performance tests in food and beverage serving establishments in several cities show that Antibac is an outstanding sanitizer for eating and drinking utensils. In germicidal performance it is comparable to sodium hypochlorite but its action on the skin is much milder. The material is rapidly and completely soluble in hot or cold water and shows excellent wetting and rinsing behavior. Other favorable characteristics found are a lesser retention of chlorous odor by sanitized vessels and no adverse effects on the foaming of beverages. After the introduction of Antibac for the sanitization of farm dairy utensils in unsupervised tests a considerable reduction in total bacteria counts in the milk and a very notable reduction in heat-resistant bacteria counts were found.

### INTRODUCTION

Another paper from this laboratory has described Wyandotte Antibac,\* a new commercial germicide and sanitizing agent, at some length, and presented data on its germicidal activity, corrosion effects and stability both in dry form and in solution.<sup>1</sup> Briefly, Antibac is a formulation containing 1,3-dichloro-5,5-dimethylhydantoin in a proportion to yield 16 percent of available chlorine. In addition, the product contains neutral salts, a wetting agent, and an acidic agent so as to provide working solutions within the pH range of 5.8 to 7.0, depending upon the alkalinity of the water supply. Since this ap-

proximates the normal pH level of the skin it is less irritating to the skin than the alkaline hypochlorites. In providing a final acidic sanitizing rinse the deposition of hard water residues is minimized and assistance rendered in the removal of existing scales and milkstone. The surface active agent content assists in wetting out dry surfaces and in more rapid and more uniform drainage from sanitized surfaces.

Antibac is a white, free-flowing powder of low density. Its dry storage characteristics are excellent at temperatures up to 120°F, beyond which the material loses chlorine very slowly. Antibac is very quickly and completely soluble in cold or warm water in concentrations up to about 0.85 oz. per gallon or 1000 ppm of available chlorine, but for the most practical uses, solutions of from 50 to 200 ppm are recommended. Such solutions are clear and free from sediment. For sanitizing purposes they may be used in exactly the same way as other chlorine-type sanitizing solutions. The solutions display only a moderately strong odor of chlorine and they show some bleaching activity toward colored fabrics.

Having extensively demonstrated in the laboratory that Antibac possessed the characteristics of an outstanding germicide,<sup>1</sup> there remained the problems of determining field performance and consumer acceptance of the product. Some of the work done to answer these questions will now be described.

### FIELD TESTS

The field tests to be reported here were conducted in Michigan, with the permission and cooperation of the personnel of several



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local health departments, and were of both the supervised and unsupervised kinds. The supervised tests will be considered first.

### Test A—Beverage Bar—Supervised

For this test a large and busy beverage bar having four serving stations was selected. Beer glasses from the stations were washed and sanitized at one section, in a 3-compartment sink. In the first compartment the glasses were washed in a detergent solution made up at 120°F, but which soon cooled to room temperature. The second compartment contained tap water at room

\*A product of Wyandotte Chemicals Corporation.

TABLE 1 — SANITIZING PERFORMANCE OF ANTIBAC SOLUTIONS ON BEER GLASSES  
Supervised Test Showing Rate of Depreciation of Sanitizing Action

Time ppm	Wash water count per ml	Ppm available chlorine	Swab Count per Glass, After Sanitizing Exposures of							
			15 sec.		30 sec.		1 min.		2 min.	
1:00	—	100	—	—	—	—	—	—	—	—
2:00	8,800,000	100	21	24	3	18	3	84	4	510
3:00	12,000,000	70	150	15	6	0	6	3	3	12
4:00	12,000,000	50	320	42	140	21	66	15	670	51
5:00	17,000,000	30	9,100	3,900	2,800	4,900	480	2,000	60	240
6:00	13,000,000	30	41,000	9,800	41,000	18,000	18,000	2,900	17,000	1,500

temperature which was not changed or replenished during the test. The third compartment contained a solution of Antibac made up at 100 ppm available chlorine with cold tap water. The test began at 1 pm and continued through 6 pm, during which time over 500 beer glasses were processed.

Exposure to the germicidal solution was timed with the sweep second hand of a large electric clock. Two glasses were selected for each swabbing test, and after removal from the sanitizing solution they were drained for a few seconds in the inverted position, and then swabbed. Sodium thiosulfate neutralizer was used in the swab vials. Tests were made at hourly intervals after various periods of exposure to the sanitizing solution, and in addition, wash water samples were taken. The data are presented in table 1.

The data indicate that under a very heavy load, a 100 ppm-available chlorine solution of Antibac began to fail only after the chlorine level had dropped to 50 ppm after 3 hours of use at room temperature. At 30 ppm, after 4 hours of use, the solution was clearly below the stand of effectiveness (count of 100 or less after 30 sec. exposure to the sanitizing solution). The local health department, appreciating the severity of this test, looked on the performance of Antibac with much favor.

#### Test B — Tavern — Supervised

This test was conducted in a well managed, clean establishment, serv-

TABLE 2 — SANITIZING PERFORMANCE OF ANTIBAC SOLUTIONS  
ON BEER GLASSES

#### Supervised Test in a High Class Tavern

Time	Wash water* plate count per ml	Sanitizing Tank*		Washed Only		Washed and Sanitized	
		Plate count	Available chlorine, ppm	Glass no.	Plate count	Glass no.	Plate count
6:15 pm	7,300	0	200	Start		Start/#	20
				10	1,160	20	20
				30	70	40	0
				50	1,130	60	0
				70	130	80	170
7:45	10,600	0	—	90	80	100 /	30
				110	510	120	10
				130	680	140	0
				150	1,280	160	20
				170	1,060	180	30
9:40	18,100	0	—	190	140	200 /	0
				210	110	220	0
				230	1,960	240	30
				250 #	2,310	260	10
				270	1,900	280	10
11:00	29,400	0	—	290	210	300 /	160
				310	710	320	250
				330	260	340	0
				350	570	360	0
				370	1,460	380	0
1:30 am	20,600	0	150	390	110	400/#	20
Average					792		38

\* Initial temperatures: Wash tank 115°F; Sanitizing tank 60°F.

# Available chlorine of sanitizing tank determined at this point.

/ Bacteriological samples taken from wash and sanitizing tanks at this point.

ing both food and alcoholic beverages. Beer glasses only were used in the test, and were washed in a 3-compartment sink. In this test the middle compartment was used as a still rinse tank, and no additions or changes were made during

the test. The glasses were hand-washed in the first compartment with an alkaline detergent of the operator's choice, rinsed by a hand dip in the second compartment, and then sanitized by hand dipping for a few seconds in the third compart-

ment, which contained a solution of Antibac at 200 ppm available chlorine. The beer glasses were removed from the sanitizing solution, inverted for a few seconds to drain, and then swabbed. Every tenth glass of 400 was sampled. On alternate sample glasses swabbing was done before rinsing and sanitizing, thus affording a side by side comparison of the effect of the complete cycle, and the effect of washing only. No replenishment of Antibac was made throughout the test. The data are given in table 2. Comments by the sanitarian who performed the tests follow:

"Compound reduced counts on glasses to below 100 organisms in 17 out of 20 samples of sanitized glasses. Eighteen out of 20 of the washed-only group had counts in excess of the standard."

"In concentration of 200 ppm causes only slight spotting of glass, and this is not apparent until glass is completely dry."

"Does not spoil head on beverage."

"Has odor, but this disappears from glass rapidly."

"There were no complaints when beverage was served in freshly sanitized (still wet), glass."

*Test C - Dairy Bar - Supervised*

This test was conducted in a dairy bar serving sandwiches, coffee, pie, and ice cream. On successive days the sanitarian washed, sanitized, and then swabbed four each of plates, cups, forks, and knives, and six metal malted milk, mixing jars. On the first day he used a sodium hypochlorite solution at 200 ppm, and on the next day Antibac at 200 ppm available chlorine. Both products gave excellent results since none of the plate counts exceeded 100 per utensil.

This establishment continued the use of Antibac, and when visited a week later the operators reported that they much preferred Antibac because it was less harsh than liquid hypochlorites, and left less odor on their hands at the close of the day.

*Test D - Restaurants and Bars - Unsupervised*

In this test the Chief Sanitarian of the Health Department visited four establishments, explained that a test of a new product was desired, satisfied himself that the sanitizing compartment of the sink was reasonably clean, and prepared a 100 ppm of available chlorine solution of Antibac. The operators in these establishments were told to go about their work, but not to change the sanitizing solution until after

an inspector had been around to swab utensils later in the day. No supervision of the washing and sanitizing of utensils was given. The data for these four establishments are given in table 3. All establishments used two compartment sinks. The Health Department of this city requires that the average bacteria count of four washed and sanitized utensils shall be no more than 100. Antibac easily met this standard at all four establishments when used at a concentration to provide 100 ppm of available chlorine.

*Test E - Dairy Farms - Unsupervised*

In Test E Antibac was put into actual use on dairy farms by 13 farmers. Other than requesting that it be used between 100 and 200 ppm available chlorine strength, no instructions were offered. Preceding the use of the sanitizer by the farmers, a round of raw milk samples was obtained at the receiving dairy plant, and plate counts were made to serve as background data. It was agreed by all concerned that these January 1951 plate counts were normal and reasonable in relation to direct microscopic count data on record in the Health Department files.

After the farmers started to use Antibac two collections of samples were made for the purpose of obtaining plate counts, and midway between these collections the Health Department took samples for a direct microscopic count (DMC). In addition, the Health Department released earlier DMC data on these producers including the January 1950 bacteria counts (corresponding month one year earlier), the averages for the entire year, and the counts for November and December 1950, the months immediately preceding this study. The DMC data available from the Health Department appear in table 4, and the data obtained by us using the plate count method are given in table 5.

TABLE 3 - SANITIZING PERFORMANCE OF ANTIBAC SOLUTIONS ON CUPS AND GLASSES

*Unsupervised Tests. Initial Solutions Prepared at 100 Available Chlorine*

	Swab Count per Utensil			
	Bar cold water	Restaurant 160° F water	Bar cold water	Soda Fountain cold water
Solution made at	10:30 am	11:00 am	11:30 am	Time not noted
Tested at	1:55 pm	2:00 pm	2:10 am	Time not noted
Ppm available Cl <sub>2</sub>	100	40	70	80
Bacteria count	Beer glass 0 91 21 234	Cup 3 0 0 0	Beer glass 3 15 0 6	Soda glass 0 6 0 0
Average	87	1	6	2

Table 4 shows that a general clean-up of the milk supply had been brought about during the year by increased attention to sanitation practices under the supervision of the local milk inspector. During January 1950, 7 of 12 producers had counts over 30,000; for the yearly average, 7 of 13 producers; for November, 4 of 13 producers, and for December not one producer exceeded the 30,000 level. The average count of 14,300 is remarkably low, and not much improvement is to be expected. The results of the test of Antibac made on Feb. 1, 1951, is virtually the same, averaging 15,500 and with only one producer exceeding the 30,000 level.

More significant probably than the averages of direct numerical counts are the relative numbers of producers whose milk showed improvement after introduction of Antibac. These data are shown in table 6.

According to this simple tabulation a great majority of producers showed an improvement after beginning to use Antibac, regardless of the basis of comparison.

A similar conclusion follows from the plate count data of table 5 when the tests after the introduction of Antibac are compared with the background average of 23,900 bacteria per ml of raw milk. This is made clear in the data shown in table 7.

The heat-resistant bacteria count data are even more noteworthy. Laboratory pasteurization consisted of holding the sample at 145°F for 30 minutes, cooling rapidly, and then proceeding with a plate count. According to the local milk inspector, prior to the use of Antibac the heat-resistant counts ranged between 50 and 75 percent of the raw milk counts. On January 25 and February 6 after the introduction of Antibac the heat-resistant counts were reduced to only 7.8 and 6.1 percent respectively of the already reduced total counts.

TABLE 4 — DIRECT MICROSCOPIC COUNTS ON MILK FROM 13 PRODUCERS  
(Local Health Department Data. All Counts in Thousands)

Producer No.	Before Using Antibac			Aver. for 1950 Jan. to Dec.	After using Antibac 1 week 2-1-51
	Jan. 1950	Nov. 1950	Dec. 1950		
1	36	24	6	38	18
2	48	12	6	68	6
6	18	60	12	24	30
7	24	6	6	14	5
9	30	30	12	21	6
10	180	96	30	84	12
11	30	18	12	47	5
12	240	36	18	451	30
13	840	12	24	154	18
16	48	30	6	27	6
19	102	750	12	310	6
21	18	18	18	19	6
22	Not producing in January 1950	18	24	21	54
Average	134.5	85.4	14.3	98.3	15.5

TABLE 5 — PLATE COUNTS ON MILK FROM 13 PRODUCERS  
(Authors' Data. All Counts in Thousands)

Producers No.	Before Using Antibac 1-23-51	After Using Antibac			
		1-25-51		2-6-51	
		Raw milk	Thermoduric	Raw milk	Thermoduric
1	18	16	0.7	60*	0.6
2	7	7	.2	2	.3
6	21	9	.8	10	.5
7	21	16	1.0	21	1.9
9	14	11	.3	6	1.3
10	25	14	1.1	7	.9
11	34	25	1.2	14	1.1
12	32	18	3.7	9	.8
13	20	26*	3.9	7	.6
16	15	10	.3	8	.4
19	29	21	1.0	6	.6
21	27	12	.2	11	.5
22	48	21	1.7	13	1.1
Average	23.9	15.8	1.24	13.4	0.82

\* These figures indicate an increase over the pre-Antibac counts.

DISCUSSION

Numerous investigators have pointed out the germicidal advantages of chlorine liberating germicides in the acidic range. Although the Armed Forces and others have experimented with compositions of this class, Antibac is believed to be the first acidic chlorine-liberating compound possessing adequate stability to be offered for commercial use.

In a previous paper<sup>1</sup> laboratory data were presented showing that the germicidal activity of Antibac is in general comparable to that of the commercial hypochlorites. In the presence of organic contamin-

ants such as foodstuffs or detergents the performance of Antibac was superior in most cases. The field results presented in this paper show that Antibac also performs effectively under commercial use conditions. Most of the results here presented are from tests designed and carried out by personnel of the health departments of several different cities according to methods which suited them. In no case was there a report of metal corrosion or germicidal performance inferior to that of hypochlorites or other commercial sanitizers.

For dairy service or heavy duty, long continued service in sanitizing restaurant and tavern ware, Antibac solution should be made up to contain 150-200 ppm available chlorine. For light duty service 100 ppm solution appear to be satisfactory. In any case the available chlorine should be replenished or the used solution preferably replaced before the available chlorine level falls below 50 ppm.

CONCLUSIONS

1. Antibac, a new type of chlorine liberating germicide, has shown in field tests the same order of germicidal activity as sodium hypochlorite.
2. Drinking utensils sanitized with Antibac at a solution strength of 200 ppm of available chlorine show very low bacteria counts, and the solutions have an effective sanitizing life of about six hours. When

used at 100 ppm of available chlorine the sanitizing life of the solutions is about three hours.

3. Antibac sanitizing solutions facilitate the draining and drying of beverage glasses, and consequently minimize water spotting. They do not affect the foam on a glass of beer.

4. Antibac contributes a less-persistent chlorous odor than hypochlorites to sanitized utensils and to the hands of the operator.

5. When dairy farm utensils are sanitized with Antibac solutions, heat-resistant bacteria counts are very low.

6. The slightly acid character of Antibac counteracts film formation when used in hard water supplies, and acts to minimize or remove many existing scale deposits and milkstone.

REFERENCES

1. Bacon, L. R. and Sotier, A. L., "Antibac - A New Type of Chlorine Sanitizer", *J. Milk and Food Technology*. (Submitted for publication).

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All members wishing to make nominations for \$1000.00 Sanitarians Award, please, send with supporting evidence, at once.

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TABLE 7 - NUMBER OF PRODUCERS SHOWING HIGHER AND LOWER BACTERIA COUNTS AFTER INTRODUCTION OF ANTIBAC

	Plate count data of 1-23-51 compared to	
	Test of 1-25-51	Test of 2-6-51
Number of dairy farm showing increased count..	1	1
Number of dairy farms showing unchanged count	1	1
Number of dairy farms showing decreased count..	11	11
Total	13	13
Reduction in average total count, % .....	33.8	44.05

TABLE 6 - NUMBER OF PRODUCERS SHOWING HIGHER AND LOWER BACTERIA COUNTS AFTER INTRODUCTION OF ANTIBAC

	DMC Data or 2-1-51 Compared to			
	1950 Ave.	Jan. 1950	Nov. 1950	Dec. 1950
No. of farms showing increased count .....	2	1	2	4
No. of farms showing unchanged count .....	0	0	0	2
No. of farms showing decreased count .....	11	11	4	7
Total .....	13	12	13	13

## THE EFFECTS OF HEAT ON BACTERIA IN MILK WITH PARTICULAR REFERENCE TO THERMAL DEATH RATES AS INFLUENCED BY VARIOUS FACTORS\*

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Much of the data in the literature dealing with the effect of high temperature on the destruction of bacteria is incomplete from the standpoint of providing adequate information on thermal death rates. In order properly to select processing temperature-time combination for market milk, ice cream mix, and the various fluid milk products, whether pasteurization or sterilization is the objective, thermal death rate data for both pathogenic and thermophilic types of bacteria need to be available.

THE RESPONSES OF ORGANISMS to thermal exposures have been studied over a period of many years. Beginning at the turn of the century and continuing for the next several decades, many studies were made of the thermal destruction of various pathogenic bacteria, particularly those associated with outbreaks of milk-borne disease. An excellent review of many of these is given by North and Park.<sup>15</sup>

While most of these early studies were incomplete in certain fundamental aspects, they resulted in the establishment of the temperature-time combinations currently in use for the pasteurization of milk.

Thermal death rate determinations make it possible to compare the thermal resistance of different species of organisms at the same temperature or to compare the resistance of one species at different temperatures. By these studies, one is enabled to describe, in quantitative terms, inherent differences between species and the effects of environmental and other factors on the thermal responses of the contained bacterial flora.

\*Presented at the Forty-seventh annual Meeting of American Dairy Science Association, Manufacturing Section, Symposium: Some Aspects of the Effects of Heat on Milk, Davis, California, June 24-26, 1952.

### DESTRUCTION OF ORGANISMS BY HEAT

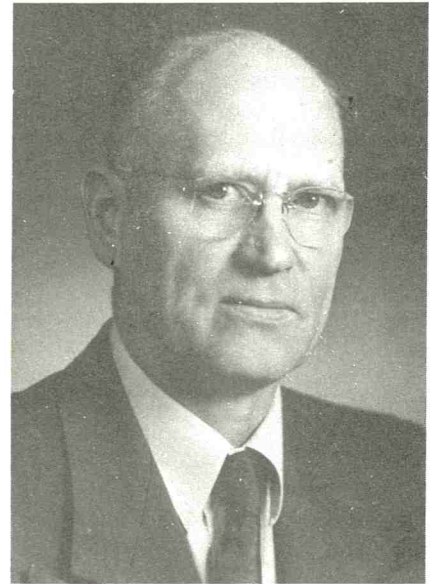
The destruction of organisms by heat is a function of both the degree of temperature and the period of time that the temperature is applied. This is illustrated by the temperature-time combinations of 143°F for 30 minutes and 161°F for 15 seconds for the commercial pasteurization of milk.

An abundance of evidence is available to support the view that the order of death of bacteria, resulting from a destructive agent, is logarithmic in nature. Following a highly technical consideration of the logarithmic order of death of bacteria, Rahn<sup>17</sup> concluded that the death of unicellular organisms is brought about by the inactivation of a certain number of essential molecules in the cell and if the number of these molecules is only one per cell the order of death is the same as if the cell were identical with this molecule. The order of death, therefore, is logarithmic and follows the mass law.

According to McCulloch<sup>13</sup> a preliminary "period of lag" is observed with many resistant organisms and a preliminary "rush" with very susceptible organisms. However, during most of the time in which the temperature is acting upon the bacterial population, the order of death is essentially logarithmic.

Stumbo<sup>26</sup> presented a critical analysis of the methods of evaluating thermal processing. He emphasized that the logarithmic order of death of bacteria should receive serious consideration in procedures for establishing adequate and desirable thermal processes for foods.

General agreement exists among present-day bacteriologists that the



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normal rate of destruction of bacteria in a pure suspension and a constant temperature is that of a chemical reaction and may be expressed by the same formula used to describe a monomolecular reaction equation. The monomolecular reaction equation is readily adapted by assuming that at any time the reaction velocity is proportional to the number of surviving organisms per unit of volume. The equation is as follows:

$$K = \frac{2.303}{t} \log \frac{C_0}{C}$$

t = time

C<sub>0</sub> = concentration of organisms at start of time t.

C = concentration of organisms at end of time t.



Assuming a condition of instantaneous heating and cooling, and considering  $t$  as a unit of time, it may be said that 90 percent of the organisms are destroyed each unit of heating time. Starting with 100,000 organisms per unit of material, the rate of destruction per unit of time may be shown as follows:

Unit of time	Number of organisms surviving
0t	100,000
1t	10,000
2t	1,000
3t	100
4t	10
5t	1
6t	0.1
7t	0.01

RATE OF DESTRUCTION CURVE

When the logarithmic order of death prevails, the normal rate of destruction is a straight line on semi-logarithmic paper when the numbers of surviving organisms are plotted in the direction of ordinates and time is plotted in the direction of abscissae. A rate of destruction curve, therefore, shows the relationship between time and numbers of organisms at a given constant temperature.

Figure 1 shows the data used in the above example, in the form of a rate of destruction curve on semi-logarithmic paper. For the purpose of explanation it may be assumed that the temperature of 143°F was used in this example. Since only four logarithmic cycles are shown, the top of the curve represents the bacterial population at the end of the first unit of time. At this period the bacterial population is at the level of 10,000 organisms per unit of material.

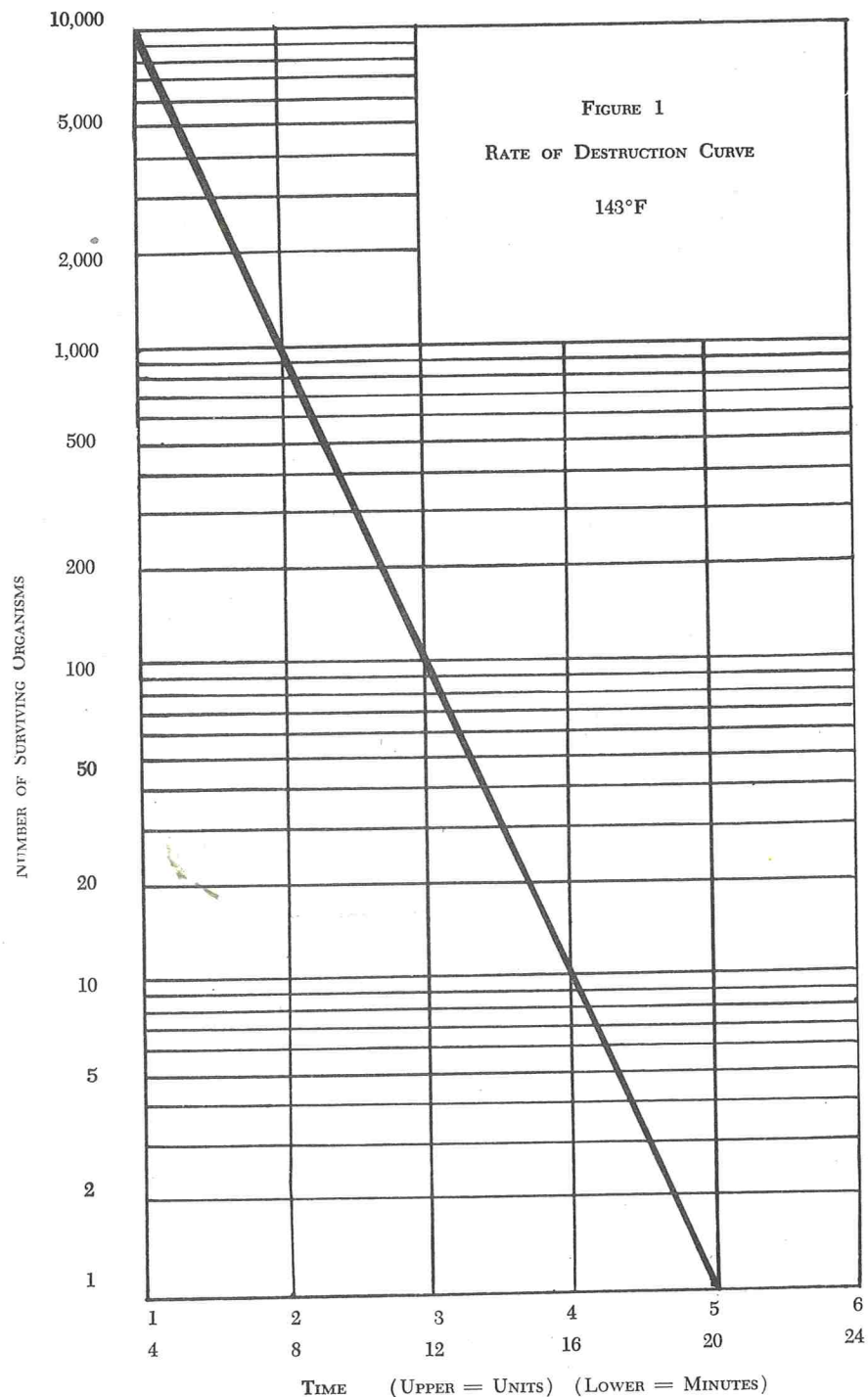
1. Slope of curve

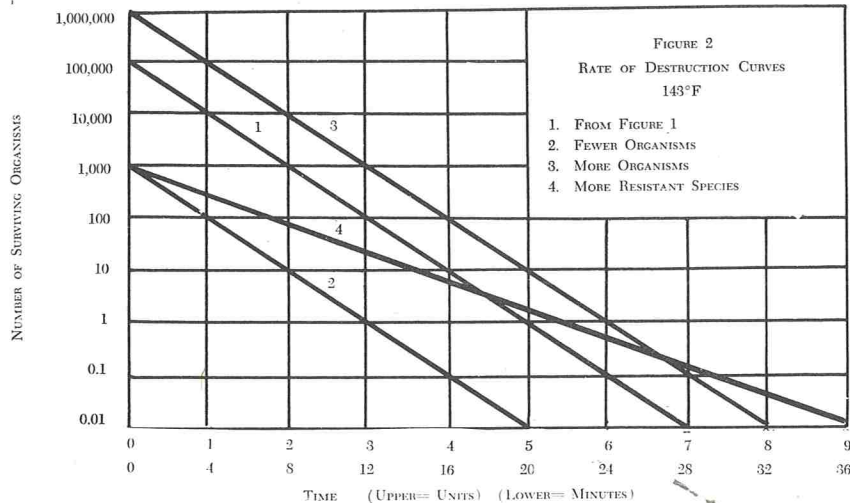
Rate of destruction curves are described, in part, by the slope of the curve. The slope is defined as the time required for the curve to pass through one logarithmic cycle. In the example presented in figure 1, an exposure period of 4 minutes

is required for reducing the bacterial population through one logarithmic cycle. Therefore, the slope of the curve is designated as being 4 minutes. As the resistance of bacterial species increases toward temperature the greater becomes the slope of the curve.

Ayers and Johnson<sup>3</sup> in their stud-

ies of the pasteurization of milk, observed that in cultures of lactic streptococci, a few cells were sometimes found which were much more resistant than the average. These observations have been confirmed by others. Beamer and Tanner<sup>7</sup> illustrated this increased resistant nature by showing a sharp break in the rate of destruction





curve, thus indicating an increased and uniform resistance. According to Rahn,<sup>18</sup> in all cases the percentage of resistant cells has been less than 0.1. The practical significance of these few highly resistant cells in the processing of dairy products and, in fact, the thermal processing of all types of foods is obvious.

Figure 2 presents the same data shown in figure 1, but on linear coordinates. The more available space of this figure makes it possible to extend the curve over its entire length. Also, three additional rate of destruction curves are presented. Curve 1 is that shown in figure 1. Curve 2 illustrates the destruction rate for a lower level of initial population; curve 3 a somewhat higher level of population; and curve 4 represents the thermal response of an organism more resistant to the effects of temperature than the one used in constructing the other rate of destruction curves. Curves 1, 2 and 3, having the same slope value of 4 minutes, illustrate the need for extending the period of exposure in order to reduce the increased numbers of initial population to a common level. These curves, although identical in slope value, occupy different positions.

Curve 4, representing a more heat resistant organism, has the greater slope value, being 7.2 minutes and occupies a different position. Curves 2 and 4 offer a com-

parison between two organisms of different heat resistance and of the same initial level of population. More than four additional units of time are required to reduce the more resistant culture to the same level as that of the susceptible culture.

## 2. Value of rate of destruction information

An understanding of the rate of destruction of organisms may be very useful in the interpretation of certain bacteriological data. The following is an example of such usefulness. Conflicting views may be found in the literature relative to the type of spoilage occurring in pasteurized milk. Ayers and Johnson,<sup>2</sup> during the period 1910-1912, conducted an extensive study of the types of bacteria that survived the pasteurizing process of 145°F for 30 minutes. Developing from this study and appearing in a subsequent publication and its several revised editions<sup>1</sup> was the general conclusion that commercially pasteurized milk usually sours because of the development of lactic acid bacteria, which on account of their high thermal death point survived pasteurization.

Following the original studies of Ayres and Johnson by approximately twenty years several studies were reported<sup>18,16,29</sup> which were not in agreement with the general conclusion concerning the role of lactic acid streptococci in the deteriora-

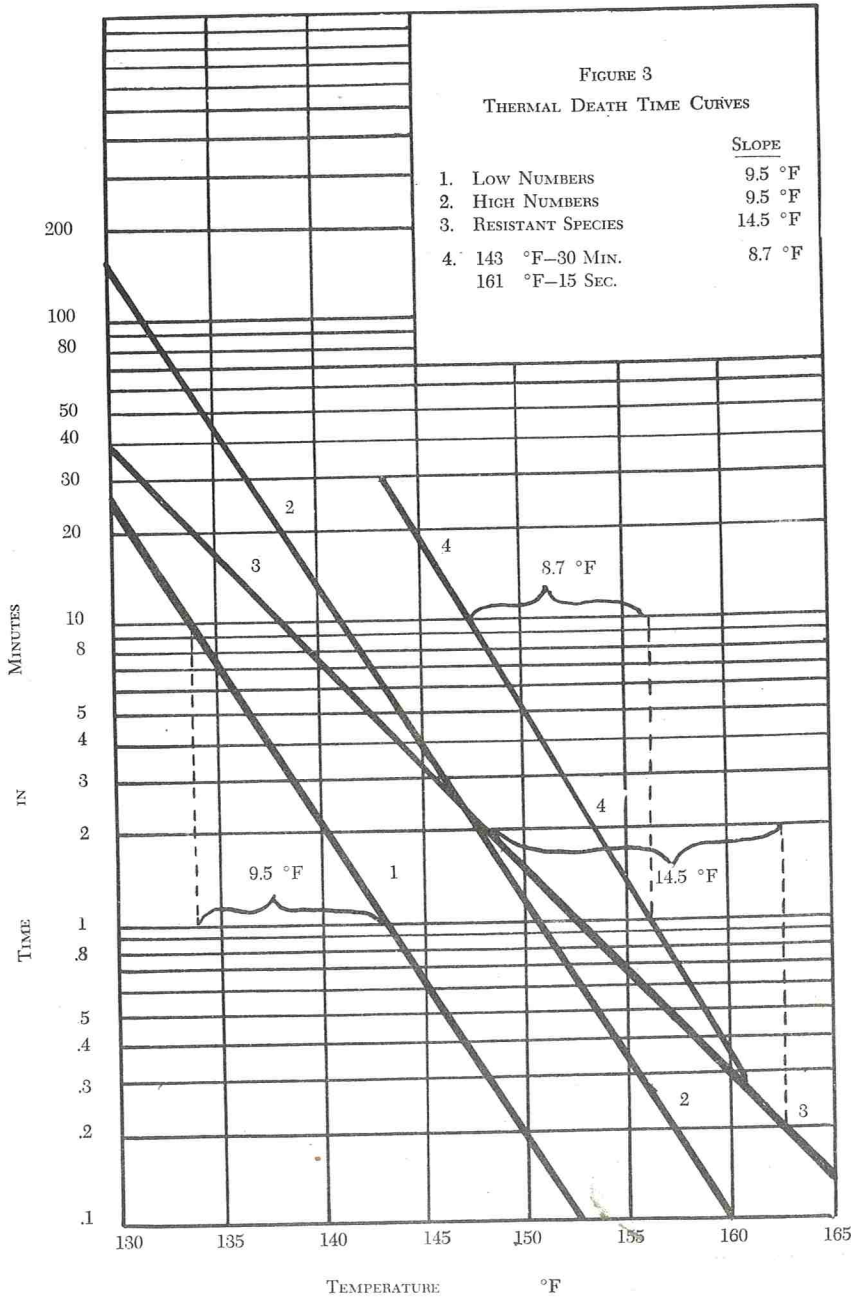
tion of pasteurized milk. Much of the milk used in the studies of Ayres and Johnson had initial plate counts far in excess of 1,000,000 organisms per ml of which many, undoubtedly, were of the lactic acid type, whereas the milk used in the study of the latter group of investigators had initial counts of only a few thousand per ml. At the time the latter studies were made the low count milk was representative of considerable portions of the milk offered for pasteurization. On the basis of the rate of destruction curve, a logical explanation is available for these conflicting points of view.

## THERMAL DEATH TIME CURVE

Another useful type of curve for expressing bacteriological data is the thermal death time curve. Thermal death time may be defined as the time necessary to reduce the viable bacteria of a given concentration, in a given suspension, at a given temperature to a given level of population. It is necessary that the initial numbers of cells or spores be known, because the thermal death time is longer with the larger inocula. The nature of the medium in which the organisms are suspended must be taken into consideration since it will influence the thermal death rate. A definite endpoint of destruction must be selected. Perhaps that most commonly used is 99.99 percent of the initial population.

In constructing this curve the time factor is plotted in the direction of ordinates and temperature in the direction of abscissae. This curve, also when plotted on semi-logarithmic paper, is a straight line. Figure 3 illustrates four hypothetical thermal death time curves.

Curve 1 illustrates the responses of a susceptible bacterial culture to the action of heat. Curve 2 represents the same organism but at a higher level of population per unit of volume. Curve 3 represents a different organism and one that is more heat resistant. Curves 1 and



2 illustrate the need for increasing the degree of temperature when it is required to destroy a large number of organisms. As shown by curve 1, a temperature of 152.5°F has the same lethal effect as the higher temperature of 160°F with the greater initial bacterial population.

#### 1. Slope of curve

The thermal death time curve, also, is described quantitatively, by

its slope. The slope or Z value is defined as the degrees of temperature required to project the curve through one logarithmic cycle. In the case of curves 1 and 2 of figure 3, the slope value is 9.5°F and the curves occupy different positions. The slope of curve 3, representing a more resistant organism is 14.5°F.

If pasteurization specifications for 143°F for 30 minutes and 161°F for 15 seconds are examined in the light of the thermal death curve

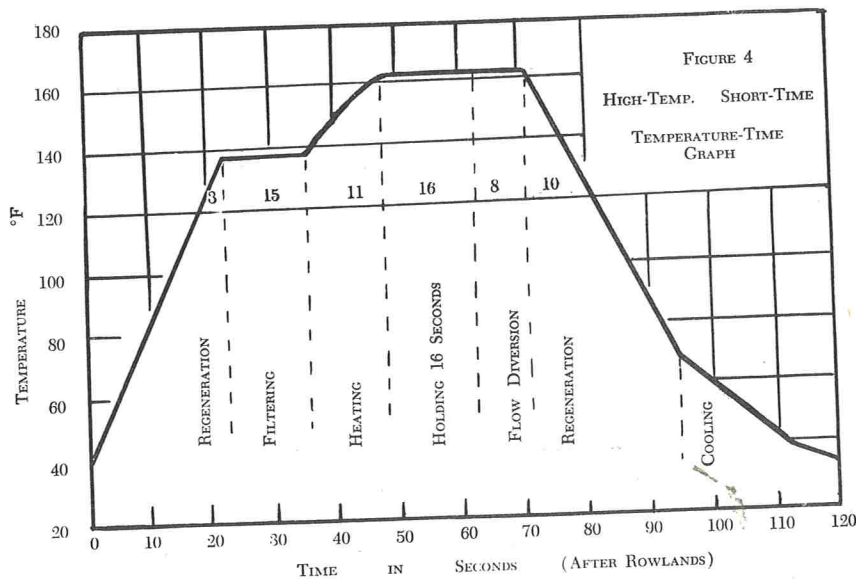
principle, it is found that any organism for which these two processes effect equal destruction the slope value of the thermal death time curve will be 8.7°F. This is illustrated by curve 4 which passes through these two points.

#### 2. Influence of heating up and cooling-down periods.

The consideration of thermal death rates to this point has assumed instantaneous heating and cooling. However, in considering the responses of organisms to any prescribed heating process, it is necessary to include the heating-up and cooling-down portions of that process. In commercial practice there is no such thing as instantaneous heating and cooling, and these portions of the process may exert important lethal effects. During the pasteurization or other heating process of milk, this lethal effect begins when the temperature reaches 120-125°F and continues with increasing intensity as the temperature is raised. Likewise, the cooling-down period continues to exert a decreasing lethal effect until the temperature has dropped to 125-120°F.

Ball<sup>4</sup> has presented a series of equations by which the lethal effects for various combinations of rise and decline of temperature of the pre- and post-holding periods may be determined in relation to the whole. It is not the intent to review these calculations in this discussion, but rather to point out the necessity for considering the thermal effects of the pre- and post-holding periods.

In discussing the period of time that milk is exposed to the lethal effects of temperature during the high-temperature, short-time process of pasteurization, Rowlands<sup>19</sup> presented the temperature-time graph which is reproduced in figure 4. In this example the basic temperature is 162°F and the holding period is 16 seconds. Increasing the temperature of the milk from 40°F to 120°F requires 18 seconds; from 120°F to 138°F 3 seconds; filtering the milk at 138°F,



15 seconds; increasing the temperature from 138°F to 162°F, 11 seconds. After the holding period of 16 seconds, the milk is maintained at the holding temperature an additional 8 seconds enroute to and from the flow diversion valve. Cooling the milk to 120° F requires 10 seconds. In all, lethal temperatures prevail for a period of 63 seconds.

In the high-temperature, short-time method of pasteurization, the temperature to which milk is exposed during the heating-up and cooling-down period may exert lethal effects almost as great as the temperature of the basic holding period. For some organisms the lethal effects of the pre- and post-holding periods, in themselves, may be adequate to effect satisfactory destruction levels. Perhaps in some instances this has not been taken into consideration and an undue amount of credit has been attributed to the temperature of 160-161°F in considering that an exposure period of 15-16 seconds at this temperature is equivalent to 143°F for 30 minutes.

#### APPLICATION OF THERMAL DEATH RATE DATA

##### 1. Commercial Pasteurization

There are numerous areas in the dairy industry in which ther-

mal death rate data have definite application. The one of major interest is in the field of the pasteurization of milk and milk products. Emphasis is from the public health and keeping quality points of interest.

##### Thermal death rates of pathogens

Many statements appear in the literature to the effect that *Mycobacterium tuberculosis* is the most heat resistant of the pathogenic types likely to be found in milk. Experience over the years has furnished an abundance of evidence that either of the two widely used methods of pasteurization for fluid milk provide an adequate margin of safety.

Ball<sup>4</sup> reviewed the literature to 1943 for data concerning the responses of bacteria to the pasteurizing process. He reported that most of the data were of such form as to be of no value in establishing thermal death time curves. Usually these data indicated only isolated points. Controlling conditions, such as concentration of organisms and rate of rise of temperature were not specified. From the data found in the literature pertaining to pathogenic bacteria for which destruction points at each of three or more temperatures in a single series of determinations were given, Ball was able to construct thermal death

time curves for only four organisms: *M. tuberculosis*, *Salmonella typhosa*, *Brucella abortus*, and *Brucella suis*.

The slope values shown by these curves were as follows: *S. typhosa* 15.3°F; *M. tuberculosis* 12.6°F and 12.4°F; *Br. abortus* 14.4°F; and *Br. suis* 9.2°F. The greater slope values for *S. typhosa* and *Br. abortus* would indicate a greater resistance of these species to temperature than is exhibited by *M. tuberculosis*. Because of certain limitations of the original data this may not be the case; however, the implication does prevail. Because of the growth characteristics of *M. tuberculosis* thermal death rate studies are difficult to carry out and very time consuming.

A very recent report by Lennette and co-workers<sup>12</sup> concerning the survival of *Coxiella burnetti*, the causative organism of Q fever, during the pasteurization of naturally infected milk under practical commercial conditions merits considerable attention. These investigators found that this organism survived the vat method of pasteurization once out of 35 times and survived the high-temperature, short-time process in two of 42 times. They also point out that in most of the commercial pasteurization operations included in their observations, more than the minimum of temperature and time was used than required by the prevailing regulations.

##### Thermal death rates of thermoduric types.

During the past two decades many studies have been made of the thermoduric types of bacteria in pasteurized milk and milk products. The major concern for these types of bacteria is associated with the deterioration of dairy products and the role they serve in making it difficult for the finished product to comply with bacterial standards set by regulatory agencies. Under certain conditions the destruction of these types may be the major concern of the pasteurizing pro-

ess. Considerable speculation has resulted as to the comparative thermal resistance of pathogenic and non spore-forming thermoduric types of bacteria.

Ball<sup>4</sup> was unable to obtain enough data from the literature to construct thermal death time curves for non spore-forming thermoduric types. He concluded, therefore, that it is impossible to state definitely that thermal death time curves for thermoduric types in milk have greater slope values than those for the pathogens. More recently, thermal death rate studies have been reported on a few selected types. For the specific use that was made of these thermoduric types, factors other than maximum heat resistance, such as ease of culturing and ease of identification, entered into their selection.

Speck<sup>22</sup> used a heat resistant micrococcus as a test organism for evaluating the efficiency of the pasteurization process. The resulting thermal death time slope was 8.1°F. Barber and Hodes<sup>6</sup> used a heat resistant micrococcus for a similar purpose. Slope values of the thermal death time curves in milk and ice cream mix were 11.7° and 9.7°F, respectively. These slope values are lower than those given for *M. tuberculosis*, *S. typhosa*, and *Br. abortus*.

Myhr and Olson<sup>14</sup> isolated from milk and studied the thermal resistance of an organism of the genus *Sarcina*. In three trials, slope values of thermal death time curves were found to be 16.8, 17.5 and 18.2, respectively.

## 2. Thermal death rates of ice cream mix, chocolate milk, etc.

The medium in which an organism is suspended will influence its thermal death rate. The best known example is the effect of pH value. Bacteria are destroyed more rapidly in acid or alkaline than in a neutral environment. It, also, is known that the thermal resistance of bacteria is increased by the ad-

dition of sugar to the medium. Not only is the concentration of importance but also the kind of sugar and the period of time in contact with the sugar.

According to Rahn<sup>18</sup> the protective action of sugars is not proportional to molarity. Disaccharides protect more than monosaccharides, but maltose appears to be an exception. Of the two common sugars used in ice cream mix sucrose offers more protection than dextrose against the lethal effects of pasteurization.

Working with a culture of *Escherichia coli*, Fay<sup>10</sup> found that only 2.5 percent of the cells survived when heated immediately after being suspended in a 50 percent concentration of sucrose, whereas the same thermal exposure left 79 percent of the cells unharmed when they had been in contact with the sugar solution for a period of two hours before heating.

Numerous investigators have pointed out that the constituents of the ice cream mix, other than the sugar, exert a protective action to organism. Based upon this accumulated evidence, the recognized standard temperature-time combination for the pasteurization of ice cream mix has been set at 155°F for 30 minutes.

Interest is current,<sup>5</sup> in the comparative thermal effects of 155°F for 30 minutes and the high-temperature, short-time method of pasteurization.

Speck<sup>22</sup> found the thermal death time, at a given temperature, of a heat resistant micrococcus tentatively identified as *Micrococcus freudenreichii* to be two to four times longer in ice cream mix than in milk. Barber and Hodes<sup>6</sup> carried on similar studies in ice cream mix. Grosche, Speck and Lucas<sup>11</sup> concluded that the pasteurization of ice cream mix at 175°F for 25 seconds would be equivalent to 155°F for 30 minutes.

Studies that are designed to fur-

nish additional information on this subject should necessarily include a consideration of pH values, the concentration and kinds of sugar used, whether sucrose or dextrose, the length of the period in which the test culture is in contact with the ice cream mix prior to thermal processing, and the concentration of the other ingredients. This applies equally well to chocolate milk and kindred special fluid dairy products.

## 3. Use of a test organism for evaluating the pasteurization process

Reference has been made relative to the use of an unidentified micrococcus and to an organism tentatively identified as *M. freudenreichii*. Others<sup>21,23,30</sup> have reported on the use of *Streptococcus faecalis*, *E. coli*, an unidentified species of the genus *Microbacterium*, and a strain of *M. freudenreichii*.

Bacteriologists engaged in the study of canned food processing are making use of a test organism for evaluating the thermal processing of various types of foods. A highly heat-resistant spore-forming anaerobe designated as Putrefactive anaerobe 3679 is used as the test organism for studies in the temperature range of 240°F and above. The organism is cultured in a prescribed manner and the spore suspension is prepared according to a prescribed procedure.

In the selection and use of such a test organism for evaluating various combinations of temperature and time for the pasteurization of dairy products, standard procedures would need to be formulated. These should include the composition and reaction of the medium in which the test organism is cultured, the temperature of incubation, and age of the culture and the population level at which it is used. Specific information, also, should be available concerning its thermal death rates as compared with those of the non spore-forming pathogenic types.

#### 4. High temperature processing of milk products

##### Evaporated milk.

Spoilage problems continue to arise in connection with the processing of evaporated milk. Ruyle and Sognefest<sup>25</sup> recently reported the thermal death rate studies of a facultative aerobic spore-forming bacterium of unusual heat resistance and the cause of a sweet curdling type of spoilage in evaporated milk.

##### Whole fluid milk.

Within the past two years several commercial operations have developed for the canning of whole milk at processing temperatures ranging from 250°F up to 300°F and for very brief exposure periods of but a few seconds. The literature is void of data on the thermal death rates of organisms at these temperature ranges and for these brief periods of exposure.

#### NEWER TECHNIQUES

At the present time, the most active workers in the study of bacterial responses to thermal processing are those interested in the preservation of foods by canning. Current investigations in this field are concerned with the development of new techniques and extending the scope of knowledge to temperatures in the range of 240°F and above.

Suitable laboratory techniques are difficult to develop for thermal death rate studies at high temperatures and for very brief periods of exposure. Stumbo<sup>27</sup> has developed an apparatus to which he has given the name "thermoresistometer," by which it is possible to subject minute test portions of food materials seeded with heat-resistant test spores to any given temperature between the range of 220°F and 270°F and for periods of exposure ranging from five seconds upward. With this apparatus it is possible to accomplish virtually instantaneous heating to the desired temperature and instantaneous cooling to non-

lethal temperatures. Using the apparatus, Stumbo *et al.*<sup>28</sup> studied the nature of the thermal death time curves for the spores of P.A. 3679 and *Cl. botulinum* suspended in food products and subjected to temperatures up to 270°F. They found the thermal death time curves to be logarithmic in nature and essentially straight lines. They state that there is nothing about the nature of the curve to indicate that it should not be a straight line when extended to include resistance of the spores to higher temperatures than those employed. Schmidt<sup>24</sup> has described the construction of a miniature retort satisfactory for thermal death rate studies in the range of 240° - 260°F.

The use of these recently developed techniques for evaluating for thermal processing at the higher temperatures should result in data having a direct application to the processing of evaporated milk and to the processing of whole fluid milk.

A better understanding of the thermal death rates of the various bacteria, the pathogenic, the non spore-forming thermophilic, and the spore-forming spoilage types will be of major assistance in the selection of temperature-time combinations best suited to accomplish the purpose for which the various thermal processes are intended.

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(Continued on page 76)

## PRINCIPLES OF FOOD MICROBIOLOGY\*

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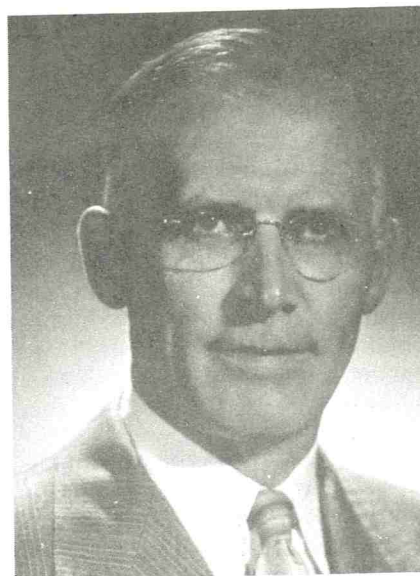
A discussion of some of the fundamental principles that are involved in food microbiology. Particular stress is placed on the factors that contribute to initial and inplant contamination and to those affecting the growth of the organisms which can give rise to very large numbers in a relatively short time when conditions are favorable. Tables and figures are used to illustrate the importance of avoiding contamination with actively growing cultures.

**I**F YOU LIVED in an environment where the dirt that got into food doubled in amount every 20 minutes, you would be faced with a very difficult problem of sanitation. This sounds unrealistic, but actually it can happen if you regard microorganisms as dirt, and it serves to emphasize the difficult problem faced by those who handle foods. Microorganisms are self-duplicating units, so that a few can grow to make many.

Let us focus our attention for the moment on a packing plant where meat is being cut on wooden blocks as is often common practice. The wood becomes saturated with meat juices, and these are difficult to remove by the most thorough washing. At the end of the day the blocks are washed and look clean, but still there are meat juices down in the grain of the wood. Due to continued use the surfaces of the wooden blocks are not smooth. They are irregular so that after rinsing, small puddles of water are left on the blocks. If this water is allowed to remain, the few microorganisms, which are present after adequate cleaning, will begin to multiply so that by next morning each puddle will be an actively growing culture teaming with

healthy vigorous organisms. In fact the population in this water could reach values as high as one billion bacteria per milliliter. The next morning when the operations again are started, the first pieces of meat which are cut on this block will absorb this water and thus become contaminated very heavily with an actively growing culture of organisms. Let us assume that the population in this water is 1 billion organisms per milliliter and let us assume further that the amount of meat which comes in contact with this water has a volume one thousand times greater than the water itself. This means that each gram of the meat will become contaminated with 1/1000 of 1 billion or 1 million organisms. This in itself is a heavy contamination. However, it is unlikely that this number of organisms would cause any immediate spoilage. In food that begins to become off-flavored or spoiled, the population is probably at least 10 million organisms per gram. This means that in our sample of meat the population would have to increase 10-fold before incipient spoilage became evident. How long would this take? If the food is contaminated with an actively growing culture, we may assume that the population can double every 30 minutes. Thus our 1 million per gram would become 2 million per gram at the end of 30 minutes, 4 million at the end of 1 hour, 8 million at the end of 2 hours. The keeping time of this meat would be just a few hours.

Now you may question the above arguments on the grounds that if the block had been properly cleaned, and if only clean water formed the puddles, there would not be enough food material to allow the bacteria to grow to the extent indicated. Let me, therefore, cite you



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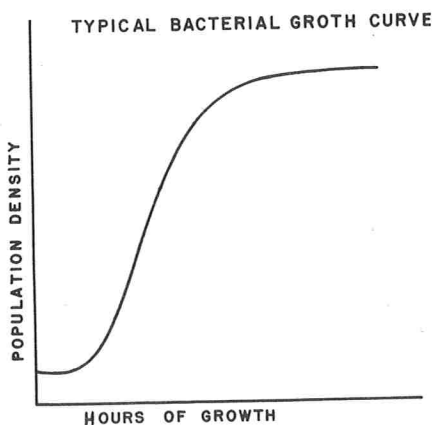
Author of *Quantitative Bacteriology*. 1933, Burgess Pub. Co., and a number of scientific articles.

an experiment that will demonstrate that bacteria can grow in places where there is a very small amount of food. Take a tube of ordinary broth such as the bacteriologist uses for culturing bacteria. This broth is made by dissolving enough meat extract in water to make a 1 percent solution, so it is to begin with a relatively weak solution. Let us now take a loopful of this broth (a loopful contains approximately 0.04 ml) and transfer this loopful to a test tube containing 10 ml of pure water. We will mix this thoroughly and then remove a loopful from this tube and transfer it to another tube containing 10 ml of pure water. You may now rightly assume that a very small amount

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of the original food material present in the broth had been transferred to the second tube of water and yet there is enough food material in this second tube to support a population of 3 million bacteria per ml. I question whether any one could wash a block of wood that has been saturated with meat juices well enough so that the clean water left in the puddles would not contain sufficient food material to support a tremendous population of bacteria.

What makes this type of contamination particularly dangerous is that the food is contaminated with organisms that are in the active stage of growth. Perhaps this can best be illustrated by calling your attention to the growth curve of bacteria. Let us imagine that we introduce some organisms into a flask of broth and then at 15-minute intervals remove samples and count the number of organisms that are present. If we do this over an extended period of time, we will get data which, when plotted on graph paper where the vertical axis represents the number of organisms per ml and the horizontal axis represents the time, will produce an S-shaped curve such as is illustrated in figure 1.



It is to be noted that in the early stages of this curve the population increases at an accelerated rate. In bacteriology we refer to the life span of an organism as the "gen-

eration time". This is the time which elapses between the formation of a new daughter cell and its subsequent division. In the early stages of the growth curve this generation time is very long, may in fact be several hours. But as growth begins it becomes shorter and shorter until it reaches a limit of 20 to 30 minutes. In our previous illustration we were contaminating the fresh meat with organisms that were in the mid stage of their growth curve, and therefore, had a very short generation time. Under these conditions food can spoil very quickly. On the other hand, if the food is contaminated with organisms which are not in the active growth stage, but rather in the dormant stage, the generation time will be long and thus spoilage may not take place for a considerable period of time.

Let us assume that the same food is contaminated to the same extent as previously illustrated in the case of meat, but with organisms in the dormant stage. The initial population we will assume to be 1 million per gram of food, but let us say the generation time is now 4 hours instead of 30 minutes. In our previous illustration we found that we would be able to detect incipient spoilage in a very few hours. In this event we should not be able to detect spoilage until after the elapse of a day or more. The situation can be improved even more by assuming that the initial contamination is much less. If instead of having 1 million organisms per gram we introduce 100,000 and the organisms are in a dormant stage, so that the generation time is long, the keeping time could be materially extended.

My topic for to-day was to deal with the fundamentals of food microbiology. A few of these have been illustrated by the examples I have just given you. In order to more sharply delineate this topic, let us enumerate the factors that are of fundamental importance. This is my concept of them:

- (1) CONTAMINATION
  - (a) Initial — in food
  - (b) In plant
- (2) SUBSEQUENT GROWTH
  - (a) Vigor of organisms
  - (b) Elapsed time
  - (c) Temperature
  - (d) Nutrients
  - (e) Retarders
  - (f) Moisture content

#### CONTAMINATION

It is practically impossible to obtain any kind of food material that is not already contaminated with microorganisms. Thus, no matter how carefully we might draw milk from cows, we will find that some organisms have been there at the very beginning. No matter how carefully we slaughter animals, we shall find that the flesh is contaminated with a few organisms. The same thing will hold for almost any kind of food that might be mentioned; even though it is procured under the most sanitary and most carefully controlled conditions, it will contain a number of bacteria. Thus the initial contamination is real and always present even though it may be of minor importance from a quantitative standpoint.

More important perhaps is the contamination the food receives during handling, or what we call "in-plant" contamination. The extent of this can vary greatly, depending upon the sanitary conditions of the plant. By maintaining scrupulous care of equipment, and avoiding the holding of the food in unfavorable environments, the amount of this contamination can also be kept to a minimum. That, of course, is always the thing to strive for.

The keeping time of the food will undoubtedly bear some relation to the extent of this contamination. If food is procured relatively free from bacteria, and if it is handled in a plant that is scrupulously clean, the in-plant contamination can be held down low



enough so that the number of organisms should not exceed a few thousand or at the most a few hundred thousand per gram. However, if the plant operations are accompanied by poor-housekeeping, the in-plant contamination can become considerable and may result in the introduction of from 1 to 3 million organisms per gram of food. It is questionable whether conditions can be bad enough to account for larger numbers. It is however important to remember this fact. Whether the initial contamination is low or high the organisms that are introduced as contaminants do not in themselves cause spoilage. This is done by the off-spring.

SUBSEQUENT GROWTH

Whether contamination is low or high, spoilage results from the growth of the organisms that are in the food.

This emphasizes the importance of growth and the factors that control it. First of all, as indicated previously, the rate of growth will depend upon the vigor of the organisms introduced. If these come from actively growing cultures, they will continue to multiply at a high rate, so that relatively few cells can give rise to large populations and early organoleptic changes. Thus in the illustration which was mentioned earlier the contamination was 1 million per gram but within 2 hours this increased to 16 million.

The nature of the organisms and their position in their growth curve are probably more important than the actual number introduced. If one introduces a few organisms that are in an active growth phase, they can multiply fast enough to overtake a much higher population made up of organisms that are obtained from a dormant phase in their growth cycle. This serves to emphasize the importance of maintaining proper plant sanitation and avoiding the accumulation of areas or environments where organisms can grow in equipment previous to its use for the handling of food.

The second important factor in governing growth and the resulting damage done by organisms is the time of storage. Food, with a light contamination, stored for a long period of time can attain as high a population as other samples that may have been contaminated very heavily and stored for a rather short period of time. We must not lose sight of the fact that microorganisms are self-duplicating units that keep on multiplying, so if we give them enough time, they can produce unwanted populations even though the initial numbers may have been small and even though their rate of growth may be slow.

The third important factor governing growth is the temperature. Temperature affects the rate of growth of bacteria approximately the same as it does the rate of ordinary chemical reactions. The rate will generally double for each 10°C rise in temperature. This, of course, does not go on indefinitely because if the temperature is raised too high, it becomes lethal. This does not sound like a very marked effect. But let us look at it more closely. Let us examine the problem in the reverse direction by seeing how a reduction in temperature decreases the growth rate. Assume that we have an organism at an optimum temperature of 40°C and that at that temperature the generation time is 20 minutes. If we reduce the temperature to 30°C, the generation time will have been lengthened to 40 minutes, at 20°C it will be 80 minutes, and at 10°C 160 minutes. Over a period of 24 hours a single cell with a generation time of 20 minutes can reach an ultimate population of 4,800 billion billion—a figure represented by 48 followed by 20 zeros. With a generation time of 160 minutes the population after 24 hours will be only 500. You can see from this that the difference is very great indeed.

In this connection tables 1 and 2 will be helpful. The first one shows the ultimate population that can

be attained from a single cell after various numbers of generations. It is assumed in this, of course, that all of the cells survive and that each one grows at the same rate as all other sister cells in the population. The second table shows the number of generations that can be attained in 24 hours for various generation times.

TABLE 1 — POPULATIONS ATTAINED FROM A SINGLE CELL WITH VARYING GENERATIONS

No. of generation	No. of individuals
0	1
1	2
2	4
3	8
4	16
5	32
6	64
7	128
8	256
9	512
10	1024
20	1000 x 1000 = 1,000,000
30	1000 x 1,000,000 = 1,000,000,000
40	1000 billion
50	1 million billion
60	1 billion billion

TABLE 2 —NUMBER OF GENERATIONS ATTAINABLE IN 24 HOURS WITH VARIOUS GENERATION TIMES

Generation time	No. of generations
20	72
30	48
40	36
50	30
60	24
80	18
100	14
120	9

There is probably no other factor that is more effective in lowering the rate of growth than lowering the temperature. If it is a product that should not be frozen, then the temperature should be brought as close to the freezing point as possible. If we follow the reasoning used above, it is apparent that refrigeration will not completely eliminate spoilage but will merely increase the length of time food will

remain wholesome. However, give it sufficient time and it can spoil also in the refrigerator. If one wishes to stop the growth of the organisms completely, then one must either sterilize the product so as to kill all organisms or store the product at temperatures below freezing. If this is done and the temperature is low enough so that the water in the food is all frozen, then growth can be completely stopped. This will probably require temperatures from 10° to 15°C below freezing.

It is self-evident that nutrients can influence the growth of microorganisms. Adequate nutrients in sufficient concentration will permit more extensive and more rapid growth than a deficiency in the quantity or quality. Usually, however, this is not a matter which can be controlled by the food microbiologist. He usually deals with natural products, and such natural materials or extracts of them nearly always contain the ingredients that are ideal nutrients for bacteria. It must be assumed that in any food product there are sufficient good quality nutrients to permit the most rapid growth.

It has long been a common practice in many food industries to retard the growth of microorganisms by the use of inhibitors. Many of these have been used since antiquity certainly long before the science of bacteriology was developed. Thus, we find that in packing industries common salt is depended upon to prevent bacterial growth in many meat products. Various organic acids have been

used very effectively either by adding the organic acid directly, as for example the addition of vinegar to pickles, or by the formation of organic acid through bacterial fermentations as for example in sauerkraut. In the meat-packing industry, nitrate and nitrite also exert some inhibitory action on the growth of bacteria. Sodium benzoate has been used in some tomato products. More recently there has been considerable interest in the use of antibiotics to inhibit the growth of bacteria in food. Although to-day a usable and practical antibiotic has not been found, there still is hope that one may be found in the future.

While the number of compounds that can be used as inhibitors in food is somewhat limited, there are the few mentioned above which are fairly effective. Whenever these can be used without altering the quality and flavor of the food, they can be depended upon to retard the growth of bacteria and thus enhance the keeping quality of the food. All of these will be most effective if they are added to food products which have relatively few organisms to begin with. Most of these inhibitors are relatively ineffective if added to products that have large numbers of actively growing cells.

The moisture content of food materials has an extremely important bearing on the rate and extent of growth of bacteria. These organisms must get their nutrients in the dissolved form and consequently they cannot grow unless there is an abundance of water present.

In many food products the moisture content is high enough to be ideal for growth, but it is often possible to remove some of that moisture without damaging the food. In fact this is nature's way of preserving foods. Seeds and grains owe their keeping quality to the lack of moisture. The quality of water that has to be present depends on the type of material involved. In a non-absorbent material such as sand, bacteria can grow even though the moisture content is as low as 10 percent. However, in a product such as meat, bacterial growth can be stopped when the moisture content is around 35 percent. Likewise bacteria do not grow in bread with a moisture content below 30 percent. Fundamentally it is not the percentage of water that is important, rather it is the equilibrium vapor pressure. Most bacteria do not grow in products when the equilibrium vapor pressure is below 94 percent of what it should be for pure water. The percentage of moisture necessary to produce this equilibrium vapor pressure varies with the product and in particular with the amount of soluble materials that are present.

From the foregoing it is evident that there are a number of fundamental factors that need to be taken into consideration when one wishes to prevent or limit the extent of damage that microorganisms can bring about in food products. The fundamental principles are self-evident but the interpretation of them requires an understanding of the factors that control contamination and subsequent growth of the organisms involved.

## THE EFFECTS OF HEAT ON BACTERIA

(Continued from page 72)

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### 3A SUGGESTED METHOD FOR THE INSTALLATION AND CLEANING OF CLEANED-IN-PLACE SANITARY MILK PIPE LINES FOR USE IN MILK AND MILK PRODUCTS PLANTS

Formulated by

INTERNATIONAL ASSOCIATION OF MILK AND FOOD SANITARIANS, INC.  
UNITED STATES PUBLIC HEALTH SERVICE  
THE DAIRY INDUSTRY COMMITTEE

#### PREAMBLE

THE IAMFS, USPHS, and DIC are convinced that piping can effectively be cleaned in place. Information available indicates that clean piping has resulted under a variety of controlled conditions. Consequently, it is deemed inadvisable at this time to present 3A Sanitary Standards covering this practice. However, because of the wide interest in this method of cleaning pipelines, the following suggested procedure is presented:

#### (A) MATERIAL

1. Cleaned-in-Place (C-I-P) sanitary piping should consist of 3A Standard 18-8 stainless steel tubing or heat resistant glass piping.\*

2. Fittings in contact with the product should be made of 188 stainless steel or heat resistant glass.

3. Such piping and fittings should have minimum interior and exterior finish equivalent to 120 grit properly applied.

4. Gaskets, when used, should be made of a low absorbent, relatively stable material which is smooth and nontoxic.

5. The cleaning solution circulating unit, including pump, nameplate, tank and threaded connecting fittings, should be made of stainless steel or equally corrosion-resistant material. Hoses should be permitted to be used for cleaning solution circulation connections only. (See B-1-c, B-2-c and B-3-b.) The material should be noncorrodible and nontoxic.

#### (B) CONSTRUCTION

C-I-P sanitary piping should con-

form to one of the following constructions:

1. Stainless steel or glass pipe lines with a gasket in the joint.

(a) Gaskets should be self-positioning, and of such design as to form a substantially flush interior joint.

(b) To prevent accidental tampering with the joints in C-I-P sanitary lines, the connections should be readily distinguishable from lines and fittings required to be disassembled for cleaning.

(c) A fixed return recirculating line when used, should be of stainless steel or glass.

2. Stainless steel pipe lines with fittings without gaskets.

(a) The fittings should have self-positioning joints of such design and finish as to form a smooth flush interior joint.

(b) To prevent accidental tampering with the joints in C-I-P sanitary lines, the connections should be readily distinguishable from lines and fittings required to be disassembled for cleaning.

(c) A fixed return recirculating line when used, should be of stainless steel or glass.

3. Stainless steel or glass pipe lines with welded connections.

(a) The interior surface of any weld should be flush and drainable and have a finish equivalent to the adjacent surfaces.

(b) A fixed return recirculating line, when used, should be of stainless steel or glass.

#### (C) INSTALLATION

The C-I-P circuit should be installed to meet the following conditions:

(a) The lines should be supported so that pipes and gaskets remain in alignment and position.

(b) Inspection openings should be provided at all changes of direction on welded metal piping, preferably through the use of removable elbows.

(c) Horizontal lines should be pitched for self-drainage to drain points.

#### (D) LAYOUT AND ENGINEERING REQUIREMENTS

1. A drawing should be provided by the supplier, installing contractor or processor for each installation, or subsequent addition or modification, showing each circuit of C-I-P sanitary piping to be cleaned, noting thereon size of pipe, lengths, fittings, pitch, drain points, static heads, length of circuit, and other pertinent facts, such as location and specifications of circulating unit, direction and rate of flow, and size and type of return line to circulating unit.

There should be indicated on this drawing side lines which must be dismantled for manual cleaning and also the points of drainage. A copy of the drawing should be supplied for reference at the office of the regulatory agency having jurisdiction, as well as at the plant.

2. Rate of flow of the cleaning solutions is but one of the factors responsible for the removal of residue from the piping; others are time of circulation, and the temperature and concentration of the solutions. Experience indicates that a flow velocity of five feet per second, with other factors favorable, results in satisfactory cleaning. In some instances satisfactory results have been obtained with lower velocities; in other cases, higher rates of flow have been necessary.

The circulating unit, consisting of a motor-driven pump and solution tank should therefore provide an average velocity of not less than five feet per second when calculated through the cross section of the largest pipe and/or fittings. This operation is to be checked by observation and tests. The rate of flow per second through the piping of known diameter can be determined from the following table:

\*Glass of a borosilicate type with a coefficient of expansion between 30°C. and 300°C. of between 3.0 and 3.5 parts per million per degree centigrade.

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

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

3. (a) The solution tank should be so constructed as to allow a minimum solution depth of 18 inches above the pump suction when the complete C-I-P circuit is full, in order to assure the pump operating at full capacity, void of air.

(b) It is recommended, where the capacity of this tank is less than the total capacity of the circuit, plus any added volume necessary to maintain the 18-inch solution depth above the pump suction, that automatic means be provided for the continuous addition of water and the uniform addition of a stock cleaning solution through the filling period.

(c) An automatic temperature regulator with a range suitable for the control of cleaning and sanitizing solution should be used.

4. The C-I-P system should be provided with a recording thermometer, with a scale range from at least 40°F to 190°F., protected against damage at bulb temperature of 220°F. Temperature charts should be initialed, dated and kept on file at the processing plant for a period of at least three (3) months, or a time to be specified by the regulatory agency.

5. The circulating pump or pumps should be provided with a plate bearing serial number, R.P.-M., and rated head at the required G.P.M. of the circuit, and denoting on which of the C-I-P sanitary piping circuits said pump or pumps can be used.

### (E) SUGGESTED CLEANING PROCEDURE

Certain practices and past experience in the used of C-I-P lines have proved satisfactory from a sanitary, quality control and operation standpoint. It is the purpose of this section to set forth a *suggested* procedure as a guide to sanitarians and processors in establishing the best practices in cleaning these lines. It is recommended that a written outline covering the cleaning procedure to be followed be required of the management of the plant contemplating a C-I-P pipeline installation.

It is recognized and commended that a considerable number of research projects are currently being conducted by sanitarians, universities, and processors throughout the country. It is anticipated that the results of these studies will greatly aid in the development of new and improved cleaning and operating procedures. It is planned to incorporate such new developments into future revisions.

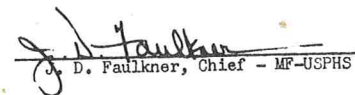
Immediately after concluding the day's operations, all connections between cleaned-in-place lines and processing equipment should be removed, the openings capped, bypass connections made, and the lines rinsed thoroughly with water at 100°F. to 120°F., continuously discarding the rinse water. All caps, plugs, and special fittings should be removed and brushed clean. Valve seats, cross ends, and tee

ends should also be brushed. Each day a nondepositing alkaline cleaning solution, heated to 120°F. or above, should be circulated for at least 15 minutes, then discarded. If water conditions are such that deposits form at these temperatures, cleaning solutions at 115°F. to 130°F. may be used for longer periods. If necessary for hot milk lines, an acid cleaning solution heated to 120°F or above should be circulated at least 15 minutes before discarding. Because of the possibilities of corrosion, the recommendations of the cleaning compound manufacturer should be followed with respect to the time, temperature, and the concentration of specific acid or alkaline solutions and bactericides. To insure proper strength of solution and to avoid corrosion, the cleaning compound should be completely dissolved or dispersed prior to circulation. The lines should then be rinsed with cold or lukewarm water, and examined. The solution tank should be thoroughly cleaned each day. Used solutions should be discarded and fresh solutions prepared daily.

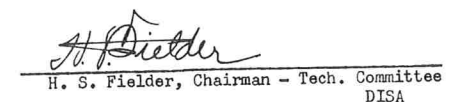
Within one hour\*\* before starting milk flow, the lines through which that milk will flow should be given bactericidal treatment.

APPROVED BY:

  
C. A. Abele, Chairman - CSP of IAMFS

  
J. D. Faulkner, Chief - MF-USPHS

  
E. H. Parfitt, Chairman - SSC-DIC

  
H. S. Fielder, Chairman - Tech. Committee  
DISA

\*\*Under no circumstances should the final chlorine solution, if used, remain in the piping for a longer period than one hour, in order to avoid any possibility of corrosion.

# APPARATUS TO REMOVE AGAR FROM PETRI PLATES<sup>1</sup>

T. J. CLAYDON

Kansas Agricultural Experiment Station, Manhattan, Kansas

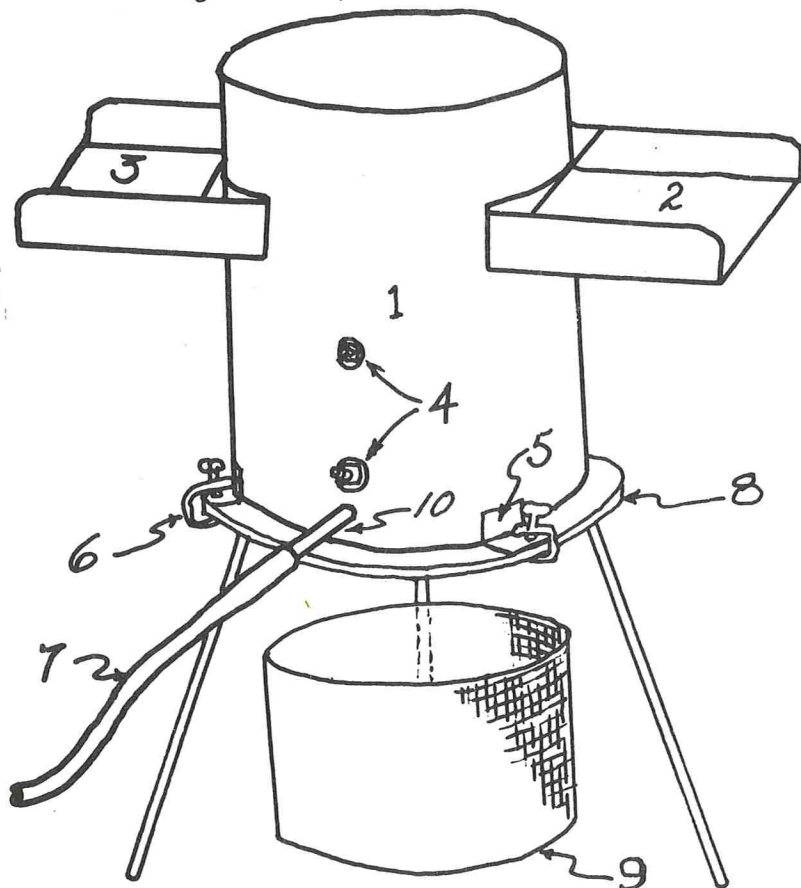
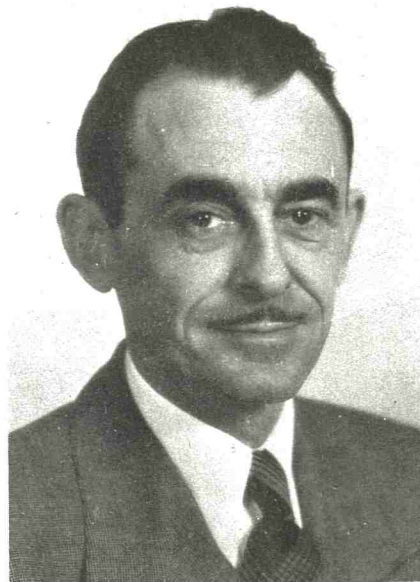


FIGURE 1

- |  |  |
|--|--|
| 1. Water jet chamber                         | 6. Clamp                                     |
| 2. Plate carrier (entrance)                  | 7. Rubber tubing to water line               |
| 3. Plate carrier (exit)                      | 8. Ring stand                                |
| 4. Eye bolts (to hold jet tube)              | 9. Wire basket (about $\frac{1}{8}$ " mesh)  |
| 5. Angle support (for clamping on ringstand) | 10. Metal tubing $\frac{1}{8}$ " (water jet) |

TO SPEED UP THE PROCESS of removing used agar from petri plates, and also to achieve a tidier operation than usually is accomplished by hand, the apparatus shown in the illustrations was devised. A rather rough model has been in use for about two years and has been employed effectively by laboratory helpers. It is efficient, and removes agar from petri plates as rapidly as the plates can be fed through. The average rate is about 15 to 20 plates per minute.

The apparatus consists primarily of a water jet and a petri plate carrier to hold the plate in position over the jet. The carrier and

jet are supported in a housing which also serves to control water

splash. The apparatus is clamped on a large ring-stand and placed in a sink or tray provided with drainage facilities. The inverted petri plate bottoms are continuously fed into one side with one hand. Each plate inserted pushes forward those ahead, which are caught with the other hand as they come off the exit side of the carrier. The water jet (connected to a water faucet

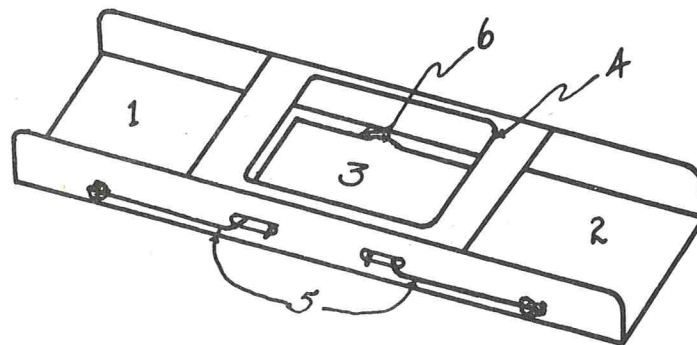


FIGURE 4. PETRI DISH CARRIER

- |                      |  |
|----------------------|--|
| 1. Entrance section  | 4. Upper opening (to reduce splash)                |
| 2. Exit section      | 5. Spring wire (to position plate)                 |
| 3. Water jet section | 6. Lower opening (from water jet and agar removal) |

<sup>1</sup>Contribution No. 214 Department of Dairy Husbandry.

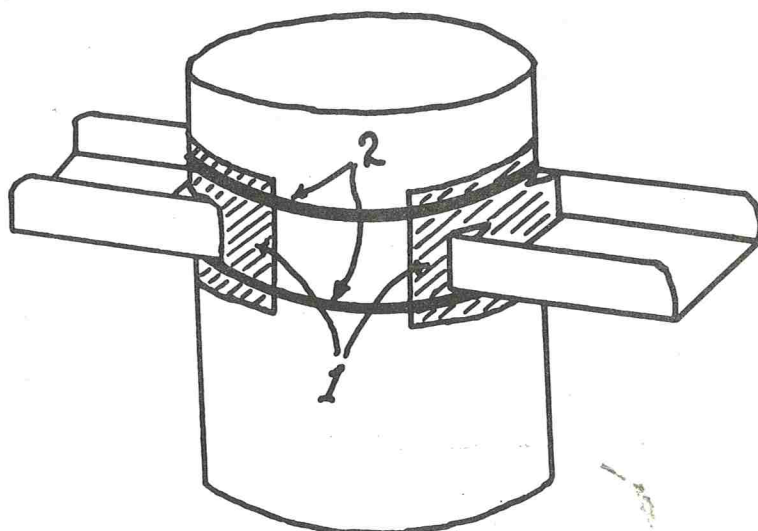


FIGURE 2  
1. Canvas splash curtains  
2. Spring steel clip bands

### Water Jet Chamber Vertical Section

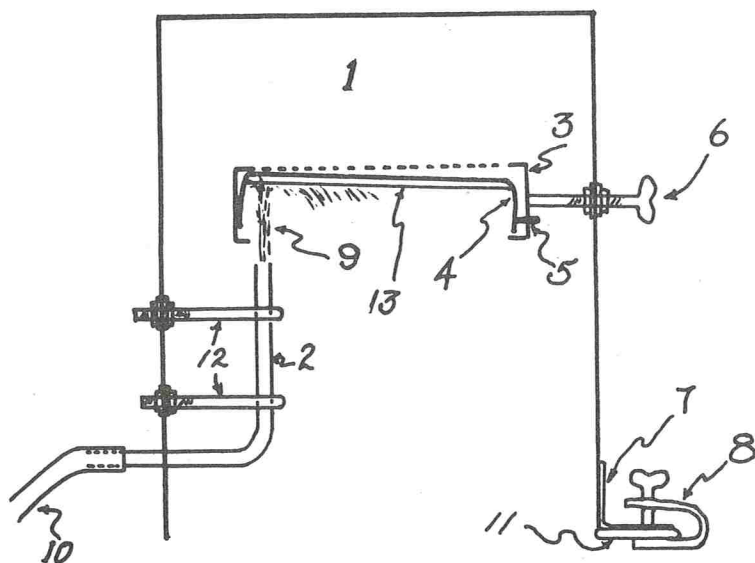


FIGURE 3  
1. Water jet chamber  
2. Metal tubing  $\frac{1}{4}$ " (water jet)  
3. Petri plate carrier  
4. Petri plate  
5. Spring wire  
6. Wing bolt (holds plate carrier)  
7. Angle support  
8. Clamp  
9. Water jet  
10. Rubber tubing (to water faucet)  
11. Ringstand  
12. Eye bolts  
13. Agar layer

and adapter with rubber tubing) loosens and forces out the agar layer from the plate and the agar falls into the wire basket below. Water splash is controlled by canvas curtains held in place with spring clips.

The petri plate carrier frame, presented in more detail in figure 4, is the key part of the agar ejector. It helps to seat the plate and hold it while the water jet removes the agar.

With the exception of the petri plate carrier, the exact dimensions are not particularly important but should be in approximate proportion to those in the illustrations. The carrier should be of such size that an inverted petri plate bottom can be readily pushed through, with little play above or at the sides. The plate should fit into place with a gentle snap between the spring wires in the water jet section. The carrier is removable and is held in place by a wing bolt. Carriers of different sizes, to accommodate different size plates, can be interchanged in the same housing. The housing or body is of sufficient size to accommodate the carrier and jet. Two opposing, slot-like openings in the housing permit the carrier to be placed in position with the entrance and exit sections protruding. The jet is located so that the water stream strikes the outer edge of the agar in the plate. The material for the carrier and housing should be heavy enough to resist bending or twisting from ordinary use.

The model in use was made from a one-gallon can with a galvanized sheet iron carrier and copper jet tube. Various other materials could be employed. Since cold water is commonly used for the jet, some types of plastic likely would be suitable for construction of the apparatus. Certain modifications could be made to streamline the device if it were made commercially.

The petri place agar ejector is surprisingly effective and accomplishes rapid and complete removal of the agar, even after considerable drying has occurred.

# MILK and FOOD SANITATION

## SOME AIDS IN THE MATHEMATICS OF MILK CONTROL

EVAN WRIGHT

Director Food and Drug Division  
Kansas State Board of Health,  
Topeka, Kansas



Two new methods of determining logarithmic averages of standard plate counts are proposed, the first is based on the principle that the logarithmic average of four counts is equal to the fourth root of the product of the counts; the second is a simple graphic method which also serves as a record. A similar graphic method is described for the arithmetic average of four temperatures. A nomograph for calculations of survey ratings to be used with U.S.P.H.S. Form No. 9421 is given.

THE ADMINISTRATION of the Standard Milk Ordinance involves a certain amount of mathematics which, while not complicated, can become time consuming. The use of the mathematical devices described in the paper may in some cases, greatly reduce the time consumed in calculations.

In the use of bacterial counts as one of the factors in grading, the logarithmic average of four counts is required. The method for the determination of the logarithmic average described in the Code\* is the most direct and perhaps the simplest to understand in relation to the common method for arithmetic averages. However it requires frequent references to logarithm tables and some arithmetic.

The first method for determining logarithmic averages is one which can be used when large numbers of counts are to be averaged and when a calculating machine is available.

The method consists simply of multiplying the four counts and extracting the fourth root of their product. To reduce the size of the numbers involved, the simple ex-

pedient is employed of setting the decimal place four places to the left in each factor. After finding the fourth root of the product, the decimal point is moved four places to the right.

The method of obtaining a logarithmic average of four counts and extending its use to make it cover the last four counts is shown in the following example:

1. 1st count           33,000
2. 2nd count           5,000
3. 3rd count          150,000
4. 4th count           3,000

Set the decimal points in each count four places to the left, and multiply:

$$\begin{array}{r}
 5. \quad \quad \quad 3.3 \\
 6. \quad \quad \quad x \quad .5 \\
 \hline
 7. \quad \quad \quad 1.65 \\
 8. \quad \quad \quad x \quad 15 \\
 \hline
 9. \quad \quad \quad 24.75 \\
 10. \quad \quad x \quad .3 \\
 \hline
 11. \quad \quad \quad 7.425
 \end{array}$$

Extract four root of product:

$$12. \quad \sqrt[4]{7.425} = 1.650$$

Move decimal point four places to right:

13. Logarithmic average of four counts = 16,500
14. 5th count           25,000

Divide product (line 11) by first factor (line 5):

$$\begin{array}{r}
 15. \quad \quad \quad 2.25 \\
 16. \quad \quad \quad 3.3 \sqrt{7.425}
 \end{array}$$

Multiply quotient (line 15) by the fifth count with the decimal point set four places to the left:

Evan Wright was born in Garnett, Kansas. He attended Washburn College and the University of Kansas and took one of M.I.T.'s early summer courses in food technology. He was appointed a food and drug inspector for the Kansas Board of Health in 1935, and became the director of the food and drug division in 1940. For the past eight years he has been secretary-treasurer of the Association of Food and Drug Officials of the United States. His unusually developed interest in the fields of mechanics and mathematics goes back to his senior year in high school where he designed a calculator for cereal chemists which has been used in all parts of the world.

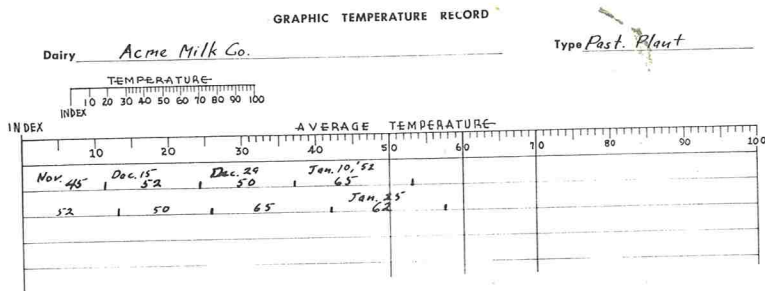
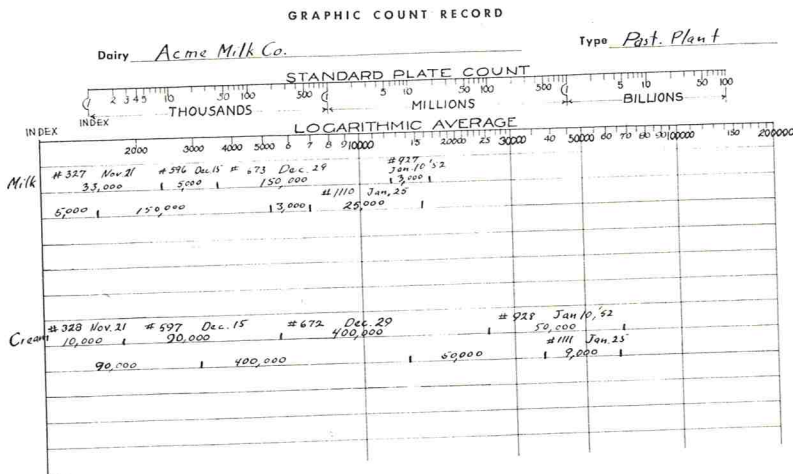
$$\begin{array}{r}
 17. \quad \quad \quad 2.25 \\
 18. \quad \quad \quad x \quad 2.5 \\
 \hline
 19. \quad \quad \quad 1125 \\
 20. \quad \quad \quad 450 \\
 \hline
 21. \quad \quad \quad 5.625
 \end{array}$$

Extract fourth root of product:

$$22. \quad \sqrt[4]{5.625} = 1.540$$

Set over decimal point four places to right:

23. Logarithmic average of last four counts = 15,400



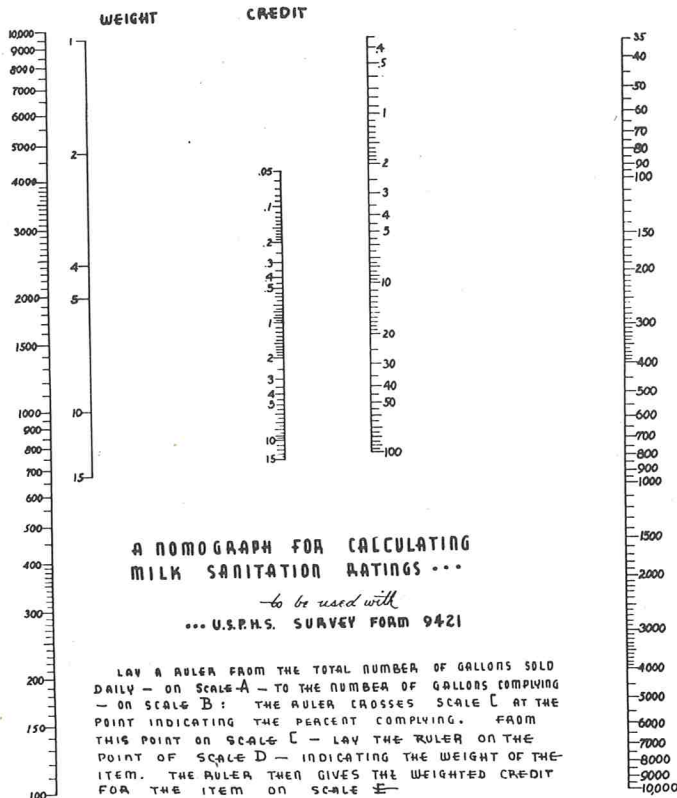
**SCALE A**  
GALLONS SOLD DAILY

**SCALE D**

**SCALE E**

**SCALE C**  
PERCENT COMPLYING

**SCALE B**  
GALLONS COMPLYING



-EVAN WRIGHT - KANSAS STATE BOARD OF HEALTH

In order to keep the arithmetic to a minimum, it is only necessary to continue by dividing the last product by the factor representing the count to be dropped from the calculations before multiplying by the new count factor.

If a table of fourth roots is not available, the fourth root may be determined from a table of square roots by taking the square root of the square root of the product.

By use of a specially divided record paper designed by the author, logarithmic averages of counts can be determined in a few seconds. A graphic record of the counts and their logarithmic averages with respect to the legal maximums set by the ordinance may be maintained on this form.

The form consists of a record section divided at the top logarithmically. The maximum logarithmic averages permitted for the several types of milk are indicated by vertical lines from the scale. A logarithmic scale indicating the individual plate counts is also provided. This scale has a 1 to 4 relation with the first scale. Thus any four lengths of the plate count scale indicating individual counts, when laid out on the logarithmic average scale, will indicate on it the logarithmic average of the four.

In use, the individual counts are found on the upper scale, and the length from the left end (index) of the scale to the point indicating the count is laid off on one of the record lines below, beginning at the left vertical line (index line). Each succeeding count is measured from the end of the one preceding until four consecutive counts are represented.

Then the position of the final mark with respect to the logarithmic average scale indicates the logarithmic average of the four. The lengths may be transferred by dividers, by marking the lengths with a pencil along the edge of a piece of paper or by using a piece

(Continued on page 85)



## DEFENSE AGAINST BIOLOGICAL WARFARE\*

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Biological warfare, "Public Health in Reverse," calls for new methods of fighting disease, because when disease is willfully spread, it can take on new aspects. By understanding why an enemy may choose to use BW instead of some other weapon, we may be able to forecast its use and prepare to repel it.

Various BW agents, means of distribution, and required properties are discussed. Although counteracting forces now exist in the health services of the United States, we must fashion and learn to use special defensive weapons.

The author outlines four essential elements in a program of defense against BW.

IN RECENT MONTHS, several talks have been presented by highly qualified persons on the subject of biological warfare. These presentations have all avoided the spectacular and pointed out the basic ideas which we, as health workers, must understand to carry our share of the burden if this method of warfare is ever used against our country. This restraint was not always present, as was pointed out in the Federal Civil Defense Administration's publication, entitled "What You Should Know About Biological Warfare," which all public health workers especially should read without delay. For each of us has a heavy responsibility, one that can be borne only if we know something about the potentialities and the limitations of this weapon.

What is biological warfare? How could it be used? With what effect? And what are we doing to defend ourselves against it? This paper will attempt to answer these questions.

\*Delivered at the Radiological Health and Civil Defense Conference, March 27-30, 1951, University of Florida, Gainesville, Florida.

### WHAT IS BIOLOGICAL WARFARE?

Biological warfare may be described as the "intentional use of living disease agents and their toxic biological products, or of chemical plant regulators to produce disease or death in man, animals, or crops." Attacks on animals or crops are of concern chiefly to professions other than public health and will not be discussed in this presentation. Biological warfare differs from our normal struggle against disease in that the resulting illnesses are wilfully brought about by man and hence can conceivably take on new aspects, man having gone to the aid not of his fellow man but of the disease organisms. Some have called this process *public health in reverse*, a term which fits well.

Without getting into the question of moral values in the use of biological warfare — though you may be sure this phase of the problem has received and will continue to receive much attention — we should understand why an enemy might wish to use BW instead of some other weapon. This will help us to foretell how and when an attack might be made and enable us better to prepare for it.

In many respects, the BW weapon is in a class by itself. It is relatively cheap; capable of being perfected and produced by any country, large or small, which has a supply of good biological scientists; and can be fashioned to meet a very wide variety of circumstances. This flexibility is one of the most important attributes of the BW weapon. Microorganisms, or agents, could be chosen which would produce a high fatality rate in susceptible individuals. Perhaps,



Mr. Richard S. Green was graduated from Harvard College in 1936 and obtained his Master's degree in Engineering from Harvard Graduate School of Engineering in 1937. He served as Sanitary Engineering with the Massachusetts Department of Public Health from 1937-38, and in 1938 accepted a position as Superintendent, Water Purification, The Panama Canal. He held the position of Research Associate in Air-borne Infection at the School of Medicine, University of Pennsylvania, from 1940-41. He entered the Public Health Service in May 1941, and after various assignments in Maine, Washington, and Alaska, was assigned to the division of Sanitation, Washington, D. C., where he is presently stationed.

however, an enemy's purposes would be better served by a debilitating disease, one that would make people ill for a long while, tie down medical and nursing care, and take workers away from production lines. If so, a variety of agents could qualify for this task. Or possibly, an enemy would want to make a selected strategic area difficult to occupy. Widespread contamination of the area with a resistant disease agent would do this. Such attacks might be made openly by disseminating fine sprays or aerosols, or might be carried out entirely by acts of sabotage. Attacks might be directed at selected groups of persons, either before or after an open declaration of war, by introducing disease germs or

bacterial toxins into the air, food, or water supplying these groups. If cleverly carried out, it might be very difficult to tell whether BW had been used or whether the outbreak was just an unfortunate breakdown in normal disease controls.

While it is true we have no evidence that any major use has been made of BW, we know quite positively that all the previously mentioned applications of BW are possible and we feel sure if such attacks were made, they would be at least partially successful. In spite of all we might do, some people would get sick.

#### HOW IT COULD BE USED

It is important for health workers to realize that because biological warfare agents are purposely selected, grown, and disseminated by man, we can expect the worst his ingenuity can bring about. A little thought on the matter will show any qualified bacteriologist that an effective BW agent would have to be as highly virulent as possible, and that its virulence would need to persist through whatever method of dissemination might be selected. For example, it should be able to withstand reasonably well such adverse conditions as the drying effects of air dispersal, or the trip through a public water supply system. The agent should be capable of quick production in large amounts and yet have good storing properties. Furthermore, it should preferably be an organism for which there exists no effective immunization and no effective treatment. Special culturing methods might be used to bring about particularly desired characteristics in the various agents chosen.

Having considered any of several organisms which might meet these requirements, one might now question the possible effects of infections distributed through unusual routes. A disease which normally spreads by way of the gastro-intestinal tract or the bite of an insect,

might be adapted very well to infection spread artificially through the lungs in the form of an aerosol or mist, perhaps with quite different symptoms. Accidental infections in many of our research laboratories show that there are possibilities of such an occurrence. The situation might be further complicated by dispersing a virus and a bacterial agent simultaneously, thus making both diagnosis and therapy more difficult.

#### DEFENSE PROCEDURE

To a considerable extent, the forces necessary to counteract an enemy BW attack already exist in the well-developed health and medical services of our country. These forces consist of persons well-trained and experienced in the principles of the medical and sanitary sciences. However, special defensive weapons still must be fashioned, and we must learn to use them. We must adapt our arsenal to the stresses of what could be a more difficult battle than any the public health profession has yet faced.

Obviously, in order to prevent infection from BW agents, we must keep them from reaching us and invading our bodies. It might be very difficult, however, if not impossible, for us to know when a cloud of BW agents had been loosed in a target area before someone becomes ill. The saboteur might succeed in infecting a water supply or the output of a food-packing establishment without being discovered. It should be clear, therefore, that we should plan our program of defense against BW to include the following major items.

1. Improvement of our system of reporting of communicable diseases.
2. Strengthening of our public health and diagnostic laboratories.
3. Development of improved means of detection and identification of possible BW agents.
4. Establishment of a system of internal security to aid in preventing BW sabotage activities.

1. We should improve our sys-

tem communicable diseases to obtain more complete information more promptly. Early reporting may save many lives. Remember, the epidemiology of a BW disease might not be the same as the occurrence of that disease in its normal manner. We might get a sudden and widespread incidence of an illness which normally would appear only sporadically or spread only very slowly among any considerable number of persons. Only prompt and complete reporting will enable us to act effectively in meeting such an outbreak. Necessary as reporting of communicable disease is to a public health program in normal times, it becomes all the more urgent when disease organisms are intentionally guided to their hosts. The National Office of Vital Statistics, the Public Health Service Communicable Disease Center in Atlanta, and the National Institutes of Health in Bethesda, Maryland, have already begun a concerted effort to improve our entire program of disease reporting. In order that we may be prepared to identify a BW outbreak, physicians and laboratory technicians especially should be on the alert not only for diseases of an unusual character but also for diseases not normally present in an area. There is a need for specially trained epidemiologists to help meet this eventuality.

2. Public health laboratories must be prepared to receive many specimens which they may never have handled before. Obviously, not all public health laboratories can be staffed and equipped to handle adequately the gamut of bacteria, viruses, rickettsiae, and fungi with which they might be confronted. However, by careful advance planning and a well-prepared system of inter-laboratory cooperation, most areas should be able to handle this situation. Special training for laboratory workers should be developed, with guidance given in the intricate task of planning for mutual assistance. One badly needed laboratory tool is an identification key especially suited for

use by laboratories which may be called upon to identify potential BW agents. No adequate key is available now. Without, one, much valuable time surely would be lost. There is a good possibility, too, that as more people become alert to the potentialities of BW, our laboratories will be receiving varieties of specimens which have no real significance. Nevertheless, many of these will have to be run down in the laboratory if we are to practice vigilance. This work must be made as efficient as possible.

3. In this discussion so far, no mention has been made of any special techniques for the detection of BW agents prior to their appearance in infected persons. Those of you who are familiar with methods used in the field of industrial hygiene for sampling air will know that a wide variety of devices is available for tracking down the various pollutants associated with air hygiene, including some particularly adapted to bacterial sampling. However, you also know that even if these sampling techniques are well developed, the time required for classical laboratory determination of the bacterial samples is a least several days. If we were to become interested in the viruses, it might take our laboratories much longer to tell us what virus has been collected. Meanwhile, the outbreaks of human illness from these agents might have given us the answer before the laboratory staff could.

While several plans are under way to shorten the time necessary for ordinary identification for biological samples by the usual processes of culturing, our strongest hope for success in this problem seems to lie in a completely new approach. Physicists and chemists are working closely with the bacteriologists in an attempt to apply certain principles from these related sciences to this very difficult problem. It may be that we can depend on certain inherent chemical or physical properties of potential BW agents to bring about rapid identification in the laboratory. This problem calls for the application of our best talent.

4. As important as any single action we might take to protect ourselves from BW attack will be the organization of a system of internal security to guard against the covert dissemination of BW agents. We must remember that certain groups of people, such as key administrative talent and hard-to-get technical and mechanical personnel, and public facilities such as waterworks and food-and milk-packing plants, are attractive to the saboteur. The BW agent is in some ways almost an ideal weapon in the hands of a clever saboteur, because it might be entirely possible for him to perform his tasks and be hundreds of miles away before its results can be detected.

Perhaps of greatest importance in our effort to meet the threat of

biological warfare to our country is the need to adopt completely open minds on new developments in the field of biology and public health. Many of our everyday methods, though adequate now, are simply not sufficiently effective to combat the malicious workings of an enemy mind when it sets out to assist what we might call "the natural development of disease in the population." We must expect efforts to outguess us, and we must work diligently to prepare for the worst. There is no reason to become alarmed about this threat, but there is every reason in the world for understanding it completely and facing it squarely. I cite as an example of what hysteria can do to a population the recent excitement raised in one of our major cities when it was rumored that the water supply had been poisoned. The mindless behaviour of large masses of people gripped in the paralysis of this sort of fear can be as destructive as any agent of warfare yet devised. BW works silently. It cannot be seen. Nobody knows where or when it will strike next. Hence, apprehension, mounting to fear, and finally reaching the heights of mass hysteria, is a possible development to be guarded against.

Public health workers must assume their obvious responsibilities in this part of the over-all problems of civil defense.

### SOME AIDS IN THE MATHEMATICS OF MILK CONTROL

(Continued from page 82)

of cardboard with one of the plate counts scales pasted on it as a ruler.

If the logarithmic average indicated falls to the left of the line indicating the maximum logarithmic average count, no further attention need be paid to it.

When a new count is to be entered, the last three counts are transferred to the line below, beginning

at the left index line. The new count is added to the three previous ones. An example of how the graphic record is carried appears on the sample sheet. (Fig. 1)

A similar system may be used for recording temperatures, and calculating the arithmetic average of the last four temperatures. When an arithmetic average is involved, the scales are equally divided rather than logarithmic.

Fig. 2 shows a graphic temperature record. The individual tem-

peratures are transferred from the small scale to the record lines just as in the case of the logarithmic average above. The temperature values indicated in the record section are the arithmetic averages of the last four temperatures.

In calculating surveys made according to the United States Public Health Service methods, employing Form No. 9421, the nomograph shown in fig. 3 is helpful in reducing the arithmetic involved. The method of operation is given in the text on the nomograph.

## SCHARER MODIFIED PHOSPHATASE METHODS

HARRY SCHARER\*

### INTRODUCTION

In January 1952 while on duty in Cincinnati, Ohio, Mr. Scharer developed in the Milk and Food Sanitation Laboratory of the Environmental Health Center the modifications of his laboratory and field phosphatase tests described in the accompanying article, but returned to New York before completing their write-up. When the

writer\*\* was in New York City on February 12 and again on March 16 and 17, a preliminary and a final draft of the methods prepared by Harry Scharer was discussed with him. At that time it was his plan to prepare one or more manuscripts dealing with the modified phosphatase tests and with his experience with phosphatase tests in general. He suffered another heart attack on March 18 which incapac-

itated him for a while and nothing further had been done on the projected manuscripts at the time of his death on May 27, 1952.

However, on March 14 he had written a letter to the A.P.H.A. and A.O.A.C. Referee on Phosphatase Tests, Dr. L. H. Burgwald, accompanying the modified phosphatase methods sent to him for inclusion in a collaborative study. Since this is Scharer's last expression on the modified procedures described in this article, it is reproduced in its entirety in lieu of a discussion and for the additional comments contained therein.

March 14, 1952

Dr. Louis H. Burgwald  
Professor of Dairy Sanitation  
Department of Technology  
Ohio State University  
Columbus, Ohio

Dear Professor Burgwald:

At long last I am sending you the new modifications on my laboratory and field phosphatase tests. In the development of these procedures I have tried to give more attention to practical requirements than to the degree of precision and 'absolute' results apparently necessary for collaborative studies, or research procedures.

Lacking a photometer I am not too certain of the instructions for preparing the standard curve or color standards. Dr. L. A. Black felt that I should include some method of photoelectric measurement so that the technic could be compared with other technics using such measurements. I hope to be able to provide permanent inorganic color standards in the near future.

Most users of the phosphatase test apply it as a 'stop or go' procedure and rightly so since a negative result is relatively meaningless and indicates only that the sample has less phosphatase activity than the sensitivity for which the test is designed. In my opinion, the reproducible ability to detect readily a positive result, (comparable to the presence of say 0.1% raw milk) is far more important than the ability to report 'precise' units. Most users will not have a photometer, or if they do, they frequently will not have the personnel nor the time to use such apparatus. Hence the practical necessity of a technic which gives no color or a very minimum of color on a properly pasteurized sample so that even a slight positive (one of public health significance)

is at once apparent to the unaided eye. Along this line of thought, it is perhaps unfortunate that the various phosphatase tests are reported in units - better effect might have been achieved by reporting results as +, ++, +++, and +++++.

The procedures I have submitted are amenable to a higher degree of accuracy when subjected to abuse than any other procedure. Incidentally, as a practical measure, the test gives even better results when the amount of sample is doubled, that is 2 cc on the lab test and 1 cc on the field test. No other change in technic is necessary. Of course this raises the question whether results in units should not be divided by two since the sample is doubled. As a practical measure I have found no significant increase in the color of a pasteurized milk result and a great increase in the color of an improperly (sic) pasteurized milk value.

The factors behind our new technic will be elaborated in a forthcoming article. The new INDO-PHAX tablets will contain a copper-trichloroquinoneimine complex superior to the reagent now in use.

I should like to caution you in preparing the samples for collaborative study, that a raw milk free of antibiotics be utilized. In checking the new technic following my return from Cincinnati, I achieved greatly decreased sensitivity and felt considerably disheartened until I traced the effect to the presence of antibiotics - the milk would not 'set up' for making yoghurt culture.

Experiences of others with this procedure may result in diminishing the concentration of zinc sulfate from 5% to 4% with an additional drop being added if necessary. This would result in fewer instances of turbidity. Addition of a sequestrant always reduces the speed of indophenol formation.

(S) Harry Scharer

It is our understanding that the Indo-Phax tablets prepared by the Applied Research Institute, 2 East

\*Late consultant, Environmental Health Center, Cincinnati, Ohio. Sept.-Oct., page 204.

\*\*Luther A. Black, Chief, Milk and Food Sanitation Laboratory, Environmental Health Center, has assembled the material for posthumous publication of this paper.

23rd Street, New York 10, New York, bearing lot or control numbers over 2,000, contain the copper salt mentioned in the above letter. When such tablets are used, since they already incorporate reagent 6, reference to reagent 6 should be deleted in the Scharer modified laboratory or field phosphatase tests.

### SCHARER MODIFIED LABORATORY PHOSPHATASE TEST

Reagents.

1. Buffer. 10% Sodium sesquicarbonate dihydrate ( $\text{NaHCO}_3 \cdot \text{Na}_2\text{CO}_3 \cdot 2\text{H}_2\text{O}$ ). Dissolve 100 grams in water and make up to one liter.
2. Buffer substrate. Dissolve 0.5 gram crystalline disodium phenyl

phosphate (phenol-free grade) in water, add 25 ml buffer (reagent 1) and make up to 500 ml. Make up an amount of solution sufficient for immediate needs; store under refrigeration.

Alternately — dissolve one PHOS-PHAX tablet (new type) in 50 ml water.

3. Precipitant. Dissolve 10 grams zinc sulfate ( $ZnSO_4 \cdot 7H_2O$ ) in water and make up to 100 ml.
4. Sequestrant. Dissolve 10 grams trisodium dipotassium triphosphate in water and dilute to 100 ml.
5. CQC Reagent. Dissolve 30 milligrams crystalline 2,6 dichloroquinonechloroimide (special grade for phosphatase work) in 10 ml methyl or ethyl alcohol. Larger quantities should not be prepared at one time. Store in a glass-stoppered bottle under refrigeration. For convenience, transfer a few ml to a brown dropping bottle with dropper calibrated to deliver approximately 50 drops per ml. The dropper closure must be non-phenolic. Discard solution if it turns brown or after one week.

Alternate — Dissolve one Indo-Phax tablet (new type) in 5 ml alcohol.

6. Catalyst. Dissolve 200 milligrams of copper sulfate ( $CuSO_4 \cdot 5H_2O$ ) in 100 ml of water.
7. N-Butyl alcohol, (Neutralized). Boiling point 116-118°C. Add 0.1 N NaOH to the alcohol until a small portion tested with bromothymol blue gives a green or light blue color.
8. Phenol standards.  
Stock solution — Dissolve one gram phenol in 0.1 N HCl and dilute to one liter with 0.1 N HCl. Store under refrigeration.

- a. Dilute 10 ml of stock phenol solution to a liter with water. One ml contains 10 micro-grams ( $\mu g$ ) phenol.
- b. Dilute 10 ml of the above (8a) to 50 ml with water. One ml contains 2  $\mu g$  phenol.

*Preparation of Standards*

To a series of test tubes similar to those which will be used for the test procedure add the amounts of dilute phenol and water specified in the following table:

$\mu g$ phenol/5 ml. or units	Phenol solution	Ml phenol solution	Ml water
0.0	—	—	5.0
0.5	8b	0.25	4.75
1.0	8b	0.5	4.5
2.0	8b	1.0	4.0
3.5	8b	1.75	3.25
5.0	8b	2.5	2.5
7.5	8b	3.75	1.25
10.0	8b	5.0	0.0
20.0	8a	2.0	3.0
30.0	8a	3.0	2.0
40.0	8a	4.0	1.0
50.0	8a	5.0	0.0

Add 0.5 ml buffer (reagent 1). Mix. Add 1 drop of catalyst (reagent 6) Add 2 drops of CQC reagent. Mix immediately and allow to stand for 5 minutes. Add 2 drops sequestrant (reagent 4). These color standards are not stable.

*Procedure*

To a suitable test tube transfer 1 ml of a well mixed sample of milk using a separate, clean pipette for each sample. Add 10 ml of buffer substrate (reagent 2). Warm to 40°C in a water bath and incubate at 37-42° (40-41° preferred) for one hour. After incubation add 0.5 ml of zinc sulfate (reagent 3) precipitant drop by drop. Allow to react for one minute, stopper, shake vigorously, and filter immediately using any inexpensive qualitative paper. To 5 ml of filtrate, add 0.5 ml buffer (reagent 1), shake. Turbidity developing is due to a slight excess of zinc sulfate but should be disregarded at this point. Add one drop of catalyst (reagent 6) and 2 drops of CQC (reagent 5). Shake and reincubate for 5 minutes. Remove from water bath, clarify any turbidity by adding the necessary amount of sequestrant (reagent 4) drop by drop,

shaking after the addition of each drop, until the solution is clear. Compare with color standards.

Any value of 1 unit (2.3  $\mu g$ /ml) or more is indicative of improper pasteurization.

To convert units to  $\mu g$  phenol per ml milk, multiply by factor 2.3.

**SCHARER MODIFIED FIELD PHOSPHATASE TEST**

Reagents are prepared as for the laboratory test.

Apparatus. (a) Test tubes, 12 x 114 mm, calibrated at 5.0, 5.5 and 8.5 ml to the TOP of the meniscus.

(b) Rubber stoppers to fit tubes.

(c) Glass droppers and nipples to be used as pipettes.

*Procedure*

To 5 ml buffered substrate (reagent 2) add 0.5 ml of well mixed sample, by means of dropper pipette using a clean dropper for each sample. Admix. Warm mixture to about 40°C, then incubate at about 40°C for 15 minutes. Add two drops of catalyst (reagent 6) and 6 drops of CQC (reagent 5 — tablet solution preferred). Mix well and reincubate for 5 minutes. Remove. Add 3 ml butyl alcohol and extract indophenol blue by quickly inverting the test tube 4 times through a half circle. Lay tube immediately on a flat surface for about two minutes to permit separation of the butyl alcohol. Repeat extraction and separation step.

Stand tube erect and compare with color standards. Any blue color is indicative of improper pasteurization.

#### Addendum

In September 1951 as a member of the Applied Laboratory Methods Committee of the INTERNATIONAL ASSOCIATION OF MILK AND FOOD SANITARIANS, Harry Scharer discussed difficulties encountered by laboratories in applying the phosphatase test to ice cream, dessert toppings, and chocolate milk. Although this appears in the Committee report *J. Milk and Food Technology*, 15, 111 (1952) his suggestions that apparent false positive results may be corrected by more adequate controls, are reproduced below for completeness.

"If fruits or nuts are present in ice cream, they should be filtered out before testing and since no appreciable amount of enzyme leaches into the mix from the fruit or nuts, the remaining material can be tested.

"Vanillin and other flavoring or coloring materials added to milk products during manufacture may result in apparent positive phosphatase test results due to the presence of phenolic substances which

can react with the 'CQC' solution to yield an indophenol or indamine blue. On the other hand, the coloring material may be extractable by the butyl alcohol and obscure or magnify the extracted indophenol blue.

"Where a positive result is obtained by a routine test, the procedure should be repeated and also a control test made using the same amount of sample but substituting for the buffered substrate an equal amount of buffered water prepared in the same manner except that the disodium phenyl phosphate is omitted. No substrate being present, the enzyme cannot liberate any phenol by hydrolysis; consequently, any blue color adduced in this control test is caused by an interfering substance and the amount of this blue color must be subtracted from the color obtained in the regular procedure. Conversely, the absence of blue color in the control test when color is obtained with the substrate indicates the presence of the phosphatase enzyme, and therefore improper pasteurization.

"Another procedure which can be employed to resolve the false positive is to allow the mixture of sample and substrate to incubate for an hour (or even two hours)

and compare the resulting extracted indophenol blue with similar treatment of a sample which has incubated only 20 minutes. If the phosphatase enzyme be present, the longer incubation period will yield more blue color than the shorter period. If the enzyme be absent and an interfering substance be present, the extracted color will be constant regardless of the length of incubation.

"Where both the phosphatase enzyme and an interfering substance be present, the longer the incubation period employed for both the control and the actual test, the more readily can the color value of the control be compared with or subtracted from the color value of the actual test."

#### APPLICATION OF CATALYTIC EFFECT OF COPPER SALT TO PROCEDURE FOR DETERMINING PHENOLS IN WATER

In January 1952, Mr. Scharer demonstrated at the Environmental Health Center that by the addition of a copper salt to the Gibbs method for phenols in water, a decided increase in sensitivity resulted. His later letter dated March 15, 1952, commenting on this, follows:

March 15, 1952

equal to the amount of CQC used. The small amount of copper salt so added is insufficient to color the sample. Preferably the copper should be added before the CQC.

Turbidity in the sample resulting from the interaction of calcium and magnesium salts with the buffer can be clarified by adding a suitable sequestrant such as trisodium dipotassium tripolyphosphate which has practically the same pH as the buffered sample. The sequestrant should not be added until the indophenol formation is completed. If n-butyl alcohol extraction is resorted to, the alcohol should be neutralized by the addition of successive small amounts of 0.1 N NaOH until a small portion of alcohol gives a light blue or green color when tested with bromthymol blue.

The indophenol color formed under this procedure will be a brighter blue more amenable to visual or photoelectric measurement than heretofore.

Respectfully submitted

(S)

H. Scharer

U. S. Public Health Service  
Environmental Health Center  
1014 Broadway  
Cincinnati 2, Ohio

Att: Dr. Luther A. Black

Dear Dr. Black:

Regarding my suggestions of last January concerning modifications of the procedure for determining phenol and structurally related compounds by the Gibbs method (Ettinger and Ruchhoft January 1947) further investigation of the factors involved indicate that a decided increase in sensitivity as well as saving in time can be achieved by utilizing a 10 to 20% sodium sesquicarbonate buffer such that the ultimate dilution with the sample of water achieves pH 9.7 - 10.1. Dichloroquinonechloroimide is suggested rather than dibromoquinonechloroimide because of the greater chemical stability of the former. The alcoholic solution should be added directly to the sample.

The formation of the indophenol can be catalyzed by adding copper sulfate (or other soluble copper salt) in a quantity such that the amount of copper ion is gravimetrically

## NATIONAL CONFERENCE ON INTERSTATE MILK SHIPMENTS JUNE 10-12, 1952

J. L. ROWLAND, *Chairman*

### HISTORY OF THE INTERSTATE MILK SHIPMENT PROBLEM

The sanitary quality of milk shipped interstate, as well as intrastate, has been a matter of concern to receiving areas for many years. In spite of the fact that concerted efforts had been made to establish a uniform milk control program for our nation, failure of some states to realize the value of such a uniform program developed a condition which adversely affect the consumer, the dairy industry, and the milk control officials.

Lack of a uniform approach to a solution of the problem has resulted in the creation and continuance of a confusing condition in milk sanitation. Failures to adopt recognized uniform standards, differences in interpretations by state and municipal enforcement agencies, and the experience of areas receiving poor quality milk resulted in a feeling of apprehension on the part of the receiving authorities. Consequently, officials of the receiving areas, in order to secure good milk supplies, insisted on making inspections of the milk plants and dairy farms in the producing areas. This system of supervision invariably caused multiplicity of inspection, and along with it, the application of regulatory standards of a wide variety of requirements caused confusion and misunderstanding. This system was costly to the receiving areas, it created ill-feeling between official agencies and caused industry to conclude that there was little coordination between milk control agencies—a belief amply supported by established facts.

Unfortunately, some local areas have used milk regulations for the erection of trade barriers. Occa-

Reprints of this article may be obtained at the office of International Ass'n. of Milk and Food Sanitarians at a nominal cost.

sionally, geographical restrictions have been used to limit inspection areas. This restriction of inspection has, without exception, been declared illegal by the federal courts having jurisdiction over interstate commerce. Therefore, inspection of milk sources beyond the limits of routine inspection is a problem. Some local regulations also include provisions with limited bearing on public health, yet used under the guise of health protection to exclude acceptable milk from adjacent areas within the same state. It should be obvious that the American belief in free enterprise is being flouted in such instances and public health protection given a minimum of consideration.

In periods of stress, artificial trade barriers break down. During floods, devastating wind storms, and other incidents where population shifts are made, local available milk supplies seldom are available in sufficient quantity to meet demands. During these emergencies, milk may be secured from interstate and intrastate sources. Following these critical periods, industry and the public frequently demands to know why—"Milk good enough to use then is not good enough to use in the future." This situation inevitably causes confusion and antagonism toward milk control programs, a condition which could be avoided by the establishment of acceptable sources of quality milk that could be used at any time.

A classic example of the changes brought about by emergencies is furnished by the events of World War II. The outbreak of hostilities saw tremendous shifts in population. Industrial plants were greatly expanded and new plants were erected in other areas. Army, Navy and Air Corps training camps sprang up all over our nation. Milk

was made a part of armed forces' rations and employees of manufacturing plants were encouraged, because of the recognized beneficial results, to drink milk during rest periods and with their meals. This increase in the demand for milk caused industry, procurement officials of the armed forces and health officials, to scour the country for milk complying with fundamental quality standards. In short, there was not a sufficient amount of clean safe milk to meet the demands of our people. This war-time condition is not too different from the situation found today, as in many areas of our country, the supply of acceptable milk does not meet the demand. Consequently a blend of poor quality with good quality milk may be made under the guise of compliance. The industry, the public and the milk control officials all suffer from such a condition.

As a matter of fact, while the desirability of providing approved sources of milk, to balance the area of need with the area of supply, had been under discussion for some time, the impact of World War II awakened the receiving and producing states the importance of establishing a system to facilitate the receiving states in locating, and the producing states in shipping, supplies of milk and milk products of high sanitary quality.

Availability of milk supplies which comply with the fundamental standards for milk of high-sanitary quality will assist in the improvement of the situation by (1) providing milk of acceptable quality for both armed forces and civilians, (2) allowing for greater utilization of good quality milk and milk products, (3) stimulate the production of a greater amount of high quality milk, (4) reduce the cost of securing milk supplies, and (5) reduce the amount of confusion both in the receiving and producing states.

### BACKGROUND OF 1951 CONFERENCE

In 1946, the Conference of State and Territorial Health Officers re-

quested the United States Public Health Service to develop a plan for the certification of interstate milk supplies. This plan is outlined in a letter dated December 31, 1946 from the Surgeon General to all state milk control authorities. In 1949, the Association of State and Territorial Health Officers again requested the Public Health Service to assist the states with the problem. Similar demands were made by state health departments and state agricultural departments, local health officials and representatives of the milk industry. In December 1949, representatives of several midwestern states met in Indianapolis for the purpose of discussing the problem and of determining whether some plan could be set up to deal more effectively and efficiently with the interstate milk problem. As a result, representatives of eleven midwestern states met in Chicago, Illinois, in February, 1950. At this meeting, a committee was named to investigate the problem and to arrange for a national conference.

This committee requested the Surgeon General to invite all states to have their representatives attend a national conference at St. Louis, Missouri, June 1, 2 and 3, 1950. Representatives of industry, state health departments, and state agricultural departments of 26 states attended and participated in the meeting. As a result of group discussions and joint planning, certain basic conclusions and procedures were established to be used in developing and administering state milk control programs that would be in agreement with one another.

The report of the 1950 conference was used by many states in developing sound and more uniform programs of milk control. As such it was used as a guide for organization and administrative action, and its use developed a greater degree of reciprocal trust between the producing and receiving states. The plan was also used by many states to set up systems for

the supervision and certification of intrastate milk sources, and has assisted many areas to secure better milk supplies for their people.

The 1951 conference was held to evaluate the interstate plan, to make constructive improvements, and to clarify certain aspects of the plan so that the program would more accurately meet the true interstate problem. From the progress reports of the producing and receiving states, it is evident that the plan has been placed in operation by several of the states and that the benefits of providing better milk supplies for many of our people are being enjoyed.

Public health benefits to our people and the welfare of the dairy industry, both in the producing and the receiving states, provide ample justification for the continuance of a National Conference on Interstate Milk Shipments.

#### RESUME OF SECOND NATIONAL CONFERENCE ON INTERSTATE MILK SHIPMENTS

The National Conference of representatives of the states meeting in behalf of the Interstate Milk Shipment Program convened at 8:30 A. M. in the Statler Hotel, St. Louis, on June 4, 1951.

At the conclusion of registration Mr. J. L. Rowland, Chairman of the Conference, re-stated and re-emphasized the slogan and main objective of the conference—"The Best Possible Milk Supply for all the People"—and reiterated the oft repeated statement that it could only be attained by working together.

Visual aids were again very effectively used by Chairman Rowland, through the magician's magic, to remind the conferees of the human frailties and obstacles, the elimination of which could clear the way to our goal.

It was pointed out by the Chairman that twenty-one states had participated in the program during the past year; that a number of

other states had taken steps to implement the program; and that still other states had indicated an interest in participating as soon as possible.

Dr. Buford G. Hamilton, Director of the Division of Health of Missouri, welcomed the Conference. He stressed that the success of our program could be assured by the willingness to accept and obey the so-called eleventh commandment, and admonition for the individual not to take his own importance too seriously.

Chairman Rowland requested Mr. H. L. Thomasson of Indiana to preside as chairman during the period when the progress reports and comments from representatives of the shipping states were presented to the Conference.

Mr. M. L. Raines from Texas State Health Department presided as chairman while the progress reports and other comments from representatives of the receiving states were presented to the Conference.

Mr. A. W. Fuchs, Chief of the Milk and Food Branch of the U. S. Public Health Service reported on the progress made by the Public Health Service in connection with tasks assigned to them by the 1950 National Conference.

Comments on the objectives of the Conference and of the extent, possibility and need of further progress were addressed to the Conference by the following representatives of other agencies:

- Lt. Fred E. Stewart, U. S. Navy
- Col. Russell McNellis, U. S. Army
- Col. B. F. Leach, U. S. Air Force
- C. J. Babcock, U. S. Department of Agriculture
- E. B. Kellogg, Executive Secretary, Milk Industry Foundation
- H. L. Wiltsee, Council of State Governments

Conferees moved for adjournment until the following morning.

On June 5, 1951, at 9:00 A. M. the conferees reconvened in Gen-



eral Assembly. Chairman Rowland assigned the delegates to the following task forces to study and make recommendations for the solution of the problem assigned to them:

1. Certification
2. Supervision
3. Laboratory
4. Education
5. Promotion of Interstate Program
6. Manufactured milk products
7. Channels and forms for reporting.

Chairman Rowland announced the following rules to govern the operation of

#### 1. Task Force Rules

(a) Task forces will be appointed by the Chairman.

(b) Each task force will select its own chairman.

(c) Each task force will select a sub-committee of three to prepare the report of the task force

(d) The chairman of the task force will present the report to the General Assembly at 4:00 P. M., Tuesday, June 5.

#### 2. General Assembly Rules

(a) In general assembly, each state will be entitled to one vote. If there is more than one state agency represented they should caucus to decide whether to vote "yea", "nay" or "pass."

(b) Representatives of municipalities, industry, Public Health Service, and other federal agencies will not be entitled to a vote in the General Assembly.

The General Assembly adjourned until 4:00 P. M. to permit the task forces to convene and organize; receive and discuss the questions; and develop their recommendations for submission to the General Assembly.

The General Assembly reconvened at 4:15 P. M. and Chairman Rowland recognized Mr. E. B. Kellogg, Secretary of the Milk Indus-

try Foundation, Washington, D. C., who presented the following statement of policy, agreed upon by the representatives of producers and processors of milk in attendance to the conferees in General Assembly:

1. We support the objective of this conference to do all possible to furnish the public with an adequate supply of dairy products of high quality as best serving the interests of producers, processors and consumers.

2. We believe that inspection requirements should be simplified as much as possible to include only those directly related to quality and safety.

3. We believe that the principle of certification of the quality of milk and cream supplies by a responsible authority will promote its acceptability to areas needing additional milk and cream.

4. The representatives of producers and processors here present are happy to make our contributions to the problems under consideration, and commend the originators of the Conference for their foresight and excellent leadership.

Chairman Rowland then requested Mr. C. K. Luchterhand of the Wisconsin State Board of Health to preside as chairman of the meeting while each task force chairman or his spokesman restated the questions, reported the names of the task force members, and submitted the recommendations of the group. A full report of the task force committees' recommendations are contained in the main report of the Conference.

The General Assembly then adjourned until 9:30 A. M., June 6, 1952, at which time it reconvened for consideration and final action on the task force recommendations.

The reports and recommendations of each group were again read, discussed and either accepted, amended, or rejected by the General Assembly. The final approved recommendations are also contained in the main report of the conference.

Several of the task force committees recommended to the General Assembly the study of specific problems relating to the implementation of the interstate milk shipment program adopted by the Conference. These recommendations, as

amended and approved by the General Assembly, were as follows:

1. The task force on Certification recommended that the Conference Chairman appoint a committee to prepare uniform shipping tags and bills of lading for use on interstate shipments of bulk milk and submit the information to the U. S. Public Health Service for circulation to and approval by the states.

2. The task force on Supervision recommended that a committee composed of industry and state representatives be appointed to study the feasibility of recognizing industry inspection under a broad plan of official supervision of such industry inspection.

3. The task force on Education recommended that a committee be appointed by the chairman to make a study of the educational procedures to be followed in furthering the aims of the National Conference on Interstate Milk Shipments and that this committee submit its report to the 1952 Conference.

4. The task force on Manufactured Milk Products recommended that a committee composed of representatives of state regulatory agencies, the Public Health Service, and the manufacturers of dairy products, be appointed to study and expedite the formulation of standards for Grade A supplemental milk fats, concentrated and dry milk products, and standards for the manufacture and processing of these products. Industry members of this committee should include representatives of the national associations of the products affected, including but not limited to, the American Dry Milk Institute, International Association of Ice Cream Manufacturers and the Milk Industry Foundation.

The following is a resolution that was submitted to and adopted by the General Assembly giving priority to the formulation of standards on concentrated milk:

WHEREAS, it is the opinion of this Task Committee that the goal of the National Conference of Interstate Milk Shipments to provide "The Best Possible Milk Supply for all the People" can be obtained more rapidly by shipment of Grade 'A' concentrated milk; it is suggested that the U.S.P.H.S. give priority to the formulation of the necessary standards, etc., for this product."

Selection of dates for the 1952 National Conference was referred to the Executive Committee. The General Assembly then adjourned the 1951 National Conference.

**Summary of Policies Adopted by the First, Second, and Third National Conference on Interstate Milk Shipments  
1950 — 1951 — 1952**

**REGULATION**

Since there is no widely adopted standard available, other than the Milk Ordinance and Code recommended by the U. S. Public Health Service, the 1939 Edition shall be used as the basic standard. Compliance with this standard shall be measured by the U. S. Public Health Service Milk Sanitation rating method.

**SUPERVISION**

The receiving states should recognize inspection and supervision by the following:

1. Full-time local health department personnel.
2. Full-time local State agricultural department personnel.
3. Full-time local State health department personnel.

Supervision shall be based on the procedure outlined in the 1939 Edition of the U. S. Public Health Service Milk Ordinance and Code. It shall be measured by the enforcement rating procedures outlined in Reprint Number 1970 from the PUBLIC HEALTH REPORTS, entitled "Methods of Making Sanitation Ratings of Milk Sheds."

The certifying agency in each shipping state shall be responsible

for maintaining a record of volume control either directly or through designated agencies. A complete method of Volume control should include monthly reports from each shipper on total quantity received and its subsequent utilization. These reports should be audited periodically.

**CERTIFICATION**

Receiving States should accept ratings made only by certified rating officials of either the U. S. Public Health Service or the State Health Department. Certification shall include survey ratings on:

1. Producing farms.
2. Receiving stations or plants.
3. Enforcement rating of the supervising Agency.

IT IS THE RESPONSIBILITY OF THE STATE CERTIFYING AGENCY TO KEEP THE RATING OF SUPPLIES WITHIN THEIR STATE CURRENT.

Area ratings shall be made not less than every two years. If an individual source is in a 90% rating area, an individual rating is not necessary, provided that individual ratings shall be furnished upon request of the receiving area. Milk plants or individual sources not under an area survey or which are in areas with less than 90% ratings shall have surveys made (NOT LESS THAN EVERY TWO YEARS) but not more often than semi-annually. If a request is received for a milk source not under recognized supervision, the survey will be denied.

The U. S. Public Health Service is to initiate a program to standardize the rating procedure of:

1. Its own personnel
2. State rating officials

There shall be published by the U. S. Public Health Service a list of state survey officers who have been standardized and whose rating methods have been spot-checked and approved by the U. S. Public Health Service.

All interstate shipments of milk shall be sealed at the time of loading with a single service seal in such a manner as to prevent unauthorized additions or withdrawals.

SANITATION COMPLIANCE RATING OF INTERSTATE MILK SHIPMENT SHALL INDICATE WHETHER OR NOT A PLANT IS RECEIVING MILK OTHER THAN THE MILK REPRESENTED BY THIS RATING AND THE PERMIT NUMBER OF THE PLANT SHALL BE SHOWN ON THE LIST.

When an exported supply (raw or pasteurized) changes status because of degrading or permit revocation, the shipping state shall immediately notify the receiving state and the U. S. Public Health Service. The receiving state shall likewise notify the shipping state of any irregularities in the imported supply.

**COMMITTEE REPORT—BILLS OF LADING AND SHIPPING TAGS**

As directed at the National Conference on Interstate Milk Shipments—June, 1951—the Chairman appointed a "Special Committee to prepare Uniform Shipping Tags and Bills of lading for Use on Interstate Shipments of Bulk Milk."

On November 25, 1936, the Interstate Commerce Commission issued an order prescribing the contents of bills of lading to be used by motor vehicle common carriers. The name of the consignor and consignee, the points of origin and destination, the number of packages, the description of the articles, and the weight, volume or measurement were included. A record of this information must be kept by the carrier by preservation of a copy of such bill of lading. (Many motor carriers use a bill of lading similar to the uniform bill of lading used by the railroads.)

It was the opinion of the committee that it is unnecessary to pre-

pare a form of bill of lading for use with interstate milk shipments. Rather, it is a matter of obtaining proper and complete use of bills of lading now required by the Interstate Commerce Commission.

This Committee recommends that the following requirement be added to the policies adopted by the National Conference on Interstate Milk Shipments, Part III, Certification.

"All interstate shipment of milk or milk products shall be accompanied by copies of a bill of lading. One copy of the bill of lading shall be retained by the consignor, one copy shall be retained by the common carrier and two copies shall be delivered to the consignee with the shipment. The consignee shall forward one copy to the local health authority or, in its absence, to the state health authority."

"Such bills of lading shall show information required by the interstate Commerce Commission and in addition —

- (1) The grade of the product, i.e., A. B. C. or Ungraded
- (2) The date shipped, and
- (3) The serial number of the bill of lading and copies, stamped or printed thereon.

"These bills of lading, properly filled out, should be accepted by health departments in lieu of special letter, wires or certificates from local health authority for each shipment."

(Note: The 1952 edition of the U.S.P.H.S. milk ordinance and code under Item 23p requires: "For each tank shipment a bill of lading containing all necessary information shall be prepared in triplicate and shall be kept on file by the shipper, the consignee, and the carrier for a period of 6 months for the information of the health officer." The code will specify that the consignee's copy shall accompany the shipment.)

#### SHIPPING TAGS

It was the opinion of the committee that preparation of a uniform shipping tag was unnecessary.

The main purpose of identification of the product and source is accomplished by means of the bill of lading when properly executed as specified above.

The 1939 P.H.S. code upon which the conference has based its policies, requires the labeling of all containers. Some localities require additional information on such labels which may not be of common need.

Therefore, the committee recommends that the following requirement be added to the policies adopted by the National Conference on Interstate Milk Shipments, Part III, Certification:

"All containers of bulk milk or milk products in interstate shipment shall carry label tags. Such tags may be those prescribed by the Milk control authority supervision the consignor's milk supply; Provided, that the minimum requirements of Section 4, of the 1939 edition of the U.S.P.H.S. milk ordinance and code are complied with."

#### LABORATORY

The procedure outlined in the latest edition of Standard Methods for the Examination of Dairy products of the American Public Health Association shall be followed strictly. Where alternative methods are permitted by the Standard Methods, milk intended for interstate shipment should be examined by either the Standard plate count or the direct microscopic count. This examination shall include routine samples from each producer. Samples from each dairy farm shall be examined not less than the frequency prescribed in the 1939 Edition of the Milk Ordinance and Code Recommended by the U. S. Public Health Service. The state may accept the results from local official laboratories which have been approved as complying substantially

with American Public Health Association standard Methods and checking closely with results obtained at least twice a year on split samples. The state may accept the results from officially designated laboratories which they have similarly officially checked periodically and found to be satisfactory. By "officially designated laboratories" is meant a private laboratory authorized to do official work by the supervising agency, or a milk industry laboratory similarly officially designated for the examination of Grade A raw milk for pasteurization.

The requirements as to adherence to Standard Methods as to frequency of sampling, as to state approval of local laboratories, and as to certification of laboratories of state agencies should apply to both raw and pasteurized, milk and milk products. **SAMPLES OF MILK, WHICH ARE PICKED UP FROM FARM TANKS BY TANK TRUCK, MAY BE COLLECTED BY THE SUPERVISING AGENCY. A NON-TRANSFERABLE PERMIT SHOULD BE ISSUED BY THE SUPERVISING AGENCY, IF THE EXISTING STATE REGULATIONS DO NOT PROVIDE FOR THE COLLECTION OF MILK SAMPLES FOR BACTERIOLOGICAL ANALYSIS BY PERSONS LICENSED AS MILK AND CREAM TESTERS.**

**SIMILAR ACCEPTANCE OF INDUSTRY SAMPLING IS RECOMMENDED FOR TANK TRUCK AND TANK CAR INTERSTATE SHIPMENT OF GRADE A RAW MILK FOR PASTEURIZATION.**

The state approval of local laboratories should include an annual visit to the laboratory, at which time, evaluation of the quarters, equipment, procedures, results, and records shall be made on appropriate survey forms of the U. S. Public Health Service or the equivalent.

To insure uniformity, the U. S. Public Health Service is to spot-

check the laboratories of the state agencies participating in the certification of milk for interstate shipment, and to certify their compliance with standard methods.

It is recommended that the state certification agency notify the state laboratory agency as soon as possible of required laboratory surveys, and that the state laboratory agency send duplicate copies of its laboratory surveys, together with supporting data of the results of split samples, to the appropriate U. S. Public Health Service Regional Office. The Regional Office should then send one copy of the Laboratory survey and data to the Milk and Food Laboratory of the Environmental Health Center. The Environmental Health Center will then spot-check and certify the compliance, or lack of compliance of the state laboratory agency to the appropriate U. S. Public Health Service Regional Office, which in turn, will transmit this information to the certifying agency.

INQUIRIES WERE MADE AT BOTH THE 1951 AND 1952 CONFERENCES RELATIVE TO TESTS FOR THE DETECTION OF (1) RECONSTITUTED MILK; (2) FLASHING MILK; (3) ANTIBIOTICS; AND (4) QUATERNARIES. METHODS FOR THE DETECTION OF RECONSTITUTED MILK, PRESUMABLY ARE BEING WORKED OUT BY THE A.O.A.C. REFEREE FOR RECONSTITUTED MILK. EXPERIMENTAL WORK HAS BEEN CARRIED OUT, BUT NOT PUBLISHED ON DETECTION OF ADMIXTURES OF RAW AND HEATED MILKS; RESULTS INDICATE THE TESTS WILL BE SATISFACTORY. TESTS FOR ANTIBIOTICS WILL BE INCLUDED IN THE NEXT EDITION OF THE STANDARD METHODS. REQUIREMENTS FOR PRECAUTIONS IN COLLECTING SAMPLES OF TANK TRUCK MILK ALSO WILL BE OUTLINED IN THE NEXT EDITION OF STANDARD METHODS. INFOR-

MATION OF SUCH TESTS AND REQUIREMENTS MAY BE OBTAINED FROM THE FEDERAL SECURITY AGENCY, ENVIRONMENTAL HEALTH CENTER, CINCINNATI 2, OHIO. IT IS RECOMMENDED THAT THE SANITARIAN AND LABORATORY WORKER BE ALERT TO THE POSSIBILITY OF HEAT TREATED OR CHEMICALLY TREATED MILK AND THAT THEY UNDERTAKE APPROPRIATE TESTS AS NEEDED.

#### CHANNELS AND FORMS FOR REPORTING

The State Health Officers of the shipping state shall report the results of every survey promptly to the Regional Office of the Public Health Service. That official shall report these results to the other Public Health Service Regional Offices concerned. An individual in the receiving states desiring information on a milk supply should make the request to the State Control Official in his own State who will transmit the request to the Regional Office of the Public Health Service. Industry in a shipping state desiring a survey should likewise make the request to the Regulatory Official in his own state.

To expedite information concerning sources on which rating results are not available, requests and reports may be sent direct from one state agency to another state agency with carbon copies of requests and reports being sent to the Regional Office of the U. S. Public Health Service. To implement these procedures, the following are recommended.

1. The present interstate milk shipper survey report form shall be amended as shown on the attached copy. This report form should be printed in pad form on thin paper and be numbered. Wherever a part of this survey report form is left blank, the reason for such omission shall be indicated.

2. Permission shall be obtained from shippers for the release and publication of survey ratings through the use of an appropriate form. A suggested form is attached. issued bi-monthly.

3. The U. S. Public Health Service is requested to publish the shipper compliance rating list semi-annually with supplements to be issued bi-monthly.

4. The Conference proposes to the U. S. Public Health Service that columns two and three in the listings of compliances ratings of shippers (May 10, 1951) be changed to show (a) volume of rated supply, and (b) Products.

To clarify the designation of the point of origin on milk supplies by the certifying agency, the following was suggested.

1. Modify report form 1659 S. E. to include information about the point of origin of milk (i. e. receiving stations, plants, etc.).

2. Provide for information on form 1959 S. E. regarding whether or not heat treatment is used (i.e. Yes or No.).

3. Reaffirm the necessity of furnishing complete information on the report form submitted by shipping states.

In the event both an area rating and an individual rating are available on an individual source of milk (shipper) the latest rating should be used in reporting.

#### ROLE OF THE PUBLIC HEALTH SERVICE

The state regulatory authorities should carry their work load involved in the interstate milk program with the assistance of the Public Health Service. The Public Health Service shall be prepared to extend to state regulatory authorities and educational institutions, such assistance in the training of field representatives of the state and local governmental units, or of industry, of plant and field

personnel and state survey officers as the respective states may require in operating the interstate milk shipment plan. The public Health Service shall sponsor annual seminars of state survey personnel in each of its regions for the coordination of survey rating procedure and interpretations. The Public Health Service should also train or assist in training laboratory personnel of state or local laboratories or of industry as requested by state authorities.

The Public Health Service should spot check the inspection and survey work of enforcement agencies to determine whether milk regulations are being correctly interpreted and enforced.

The Public Health Service should furnish state regulatory agencies periodically with interpretations of regulations based on questions submitted by such agencies and also that state authorities relay such interpretations to local enforcement agencies and/or industry.

It should be recognized that assistance from the Public Health Service can only be effective in so far as state regulatory authorities cooperate. Information can only be disseminated after it has been correctly and promptly submitted by the states. Upon request, interpretations of regulations will be supplied. Therefore, the Public Health Service should urge all state authorities to continuously furnish it with information so that all states may be kept informed. The general purpose of the foregoing statements is to promote uniformity in interpretation and enforcement of standards for interstate milk shipments. The prime role of the Public Health Service is to bring about the highest degree of uniformity in attitude and performance on the part of state authorities so that any certification of milk supply can be accepted with confidence.

**New Policies and Recommendations Established at the 1951 and 1952 Conference**

### MANUFACTURED MILK PRODUCTS

The program should be expended to include all milk constituents used in the preparation of "milk products" as may be defined under Section 1, paragraph K, 1939 Edition of the U. S. Public Health Service MILK ORDINANCE AND CODE, and also to include all milk constituents used in frozen desserts.

In addition the following action on specific products is recommended:

#### 1. CONCENTRATED MILK

Adequate standards shall be formulated for the concentrating operations and the finished products. These shall include the pasteurization and the packaging as a finished Grade A product.

#### 2. DRY MILK SOLIDS

Adequate standards shall be formulated for the drying operations and the finished product.

3. Adequate standards shall be formulated for supplemental milk fats to be used in milk products and frozen desserts.

The industry and regulating agencies are in need of standards for Grade A supplemental milk fats, concentrated and dry milk products and for the manufacturing and processing thereof. It is recommended that the Public Health Service, together with representation from this Conference, to which would be invited representatives of the national association of the products affected, including, but not limited to, the American Dry Milk Institute, the International Association of Ice Cream Manufacturers, and the Milk Industry Foundation, consider the recommendations contained in this report, and take all means necessary to expedite the formulation of such standards as are necessary.

### RESOLUTIONS

1. Whereas, brucellosis is a public health hazard to both the

livestock handler and the milk consumer, and

Whereas, brucellosis is a costly disease from the standpoint of of milk production,

Therefore, be it resolved that all milk control officials and industry join forces with their respective state livestock control officials to establish an active and immediate program for the eradication of brucellosis.

2. Whereas, there are no known and recognized standards for the product, "canned whole milk",

Therefore, be it resolved that a committee of this Conference be appointed to meet with other interested groups in joint session to study the problem, and if need is so indicated, to formulate standards of compliance for the product.

Such Committee has been appointed by the Executive Board.

### EDUCATION

The following resolution on education was adopted by the Conference.

1. Simplification and Unification of Standards and reciprocity of inspection should be extended and re-emphasized to all groups including regulatory agencies both state and local, Industry, Educational Institution and the General Public.

2. Endorses the resolutions on education and promotion of the Interstate Program which were adopted in 1951 Conference.

3. Definite action should be taken to implement the resolution adopted by the 1951 Conference and the following procedures are suggested:

(A) Every member of this conference assist in developing further understanding and a broader acceptance of this program through educational methods such as:

1. Use of available material
2. Personal contacts
3. Enlistment of cooperation of

interested groups at State and Local Levels.

4. Prepared articles for publication.
5. Appearances on programs.

(B) This task force recommends that the chairman of this Conference appoint a Central Committee to prepare and disseminate material for use in this educational program. Also that a regional subcommittee be appointed to assist the Central Committee and to carry out an educational program within their own region.

OFFICIAL ACTION JUNE 10, 1953

Official actions taken at the National Conference on Interstate Milk Shipments June 10, 1952. Chairman Rowland appointed a committee to set up procedures for selecting responsible officials to direct future activities of the conference.

Following is a report of this committee reported to the group on June 10, 1952.

PARLIMENTARY PROCEDURE COMMITTEE

This Committee was charged with the task of outlining a suggested parliamentary procedure for the selection of responsible officials to direct the activities of this conference in the future.

The following people were selected by the membership to study this problem and outline a procedure for the selection of responsible officials to direct the activities of this Conference in the future.

The following people were selected by the membership to study this problem and outline a procedure:

- C. K. Luchterhand, Chm. Wisconsin
- John Welsh, Secretary ..... Illinois
- R. G. Ross ..... Oklahoma
- P. E. Riley ..... Illinois
- C. Holcombe ..... Minnesota
- C. W. Larson ..... New York
- A. C. Fay ..... Massachusetts
- J. Newlin ..... Pennsylvania
- H. Wainess ..... Illinois

After considerable discussion the members of this committee agreed and set forth the following suggested procedure in selecting the officers who are to direct the activities of this Conference in the future.

It was recommended and agreed upon that:

1. The Executive Board shall appoint in each year for the purposes of nominating members for the Executive Board, a nominating committee of 4, composed of a representative of health and representative of agriculture from shipping states as a group and like representatives from receiving states as a group.

2. Composition of Board — The Executive Board shall be composed of 12 members including the preceding Chairman, who automatically becomes a member of the Executive Board. The remaining 11 members to be selected from the following categories.

- 1 — From a State Health Department
- 1 — From a State Department of Agriculture
- 1 — From a Municipal Health Agency
- 1 — From Industry

As representatives from shipping states as a group, and like representatives from receiving states as a group, plus 1 representative of U. S. Public Health Service, 1 from the U. S. Department of Agriculture and 1 representative of Educational Institutions.

3. The Executive Board shall elect a Chairman from among its own membership.

4. Term of Office:

As of 1952 the members representing the State Department of Health and the State Departments of Agriculture and the representative of the U. S. Public Health Service, the representative of the U. S. Department of Agriculture shall be elected for a period of 2 years. The representative of municipal health

agencies and from Industry, and the the representative of educational institutions shall be elected for a period of 1 year.

Each succeeding year thereafter members shall be elected to the Executive Board to replace those whose terms have expired.

All members of the Executive Board shall continue to serve until their successors are duly elected.

In addition to those proposed by the nominating committee, nominations may be made from the floor of the Conference, providing they comply with the forementioned categories.

In the event of a vacancy occurring the Executive Board by its action shall fill such vacancy with a qualified representative for the unexpired term.

5. Powers of the Chairman: — The Chairman shall, with the approval of the Board be empowered to appoint as many Committees as necessary to carry out the purposes of the Conference and special standing committees as the Conference membership indicates.

The Chairman may appoint a secretary.

6. Roberts Rules of Order shall govern all parliamentary procedures.

7. Amendments:

A motion from the floor, made by Mr. Whitehead of Mississippi and seconded by Mr. Woodward of Arkansas directed the Committee to make an additional statement on the selection of a Chairman. This is covered in statement number three.

A motion was made and seconded by Mr. Doughty of New Mexico and seconded by Mr. Anderson of Pennsylvania that the report be accepted with the amendment as read.

All states voted in favor with one state abstaining.

Report of the Nominating Committee — as recommended by the

Parliamentary Procedures Committee and its subsequent report, the Chairman, J. L. Rowland, called for a report of the Nominating Committee to place before the Conference a list of individuals representing the areas set up in the parliamentary Procedure Committee report, to be voted upon by the states represented.

Mr. O. L. Hunnicutt, State Dept. of Agriculture of Ohio, the chairman of the Nominating Committee reported back to the group. The following names were submitted for the action of the Conference.

Representing State Department of Agriculture in the receiving and shipping areas:

Mr. C. H. Holcombe, State Department of Agriculture, Minnesota.

Mr. Alex G. Shaw, State Department of Agriculture, Florida.

Representing State Department of Health in receiving and shipping areas:

Mr. D. H. Evans, Texas State Department of Health.

Mr. C. K. Luchterhand, Wisconsin State Board of Health.

Representing Municipal Health Departments in receiving and shipping areas:

Mr. J. A. Meany, Chicago, Board of Health.

Dr. Milton R. Fisher, St. Louis Department of Health

Representing Industry in receiving and shipping areas:

Mr. John M. Buechel, Robert's Dairies, Lincoln, Nebraska

Mr. M. R. DeBeats, Bowman Dairy Company, Chicago, Illinois

Representing Federal Department of Agriculture:

Mr. C. J. Babcock, U. S. Department of Agriculture, Washington, D. C.

Representing Public Health Service:

Dr. R. J. Helvig, U. S. Public Health Service, Washington, D. C.

Representing Educational Institution:

Mr. I. E. Parkin, Pennsylvania State College

A motion was made by Mr. Sjwald of Minnesota and seconded by Mr. Whitehead of Mississippi that the secretary be instructed to cast the unanimous ballot for the entire slate. Chairman J. L. Rowland called for a voice vote on the slate, such vote being unanimous.

Supplementary report on the Nominating Committee which was not listed previously. The Nominating Committee was selected by the Chairman at the suggestion of the membership and was to be comprised of a member of agriculture from the receiving area, a member of agriculture from the shipping area, a member of health from the receiving area and a member of health from the shipping area. The Chairman, O. L. Hunnicutt of the Department of Agriculture, Ohio, was previously listed while Mr. Alex Shaw of Florida represented agriculture from the receiving area. Dr. R. G. Ross of the Oklahoma Department of Health, represented the health department of the receiving area, while Mr. D. B. Norton of Illinois represented health from the shipping areas.

By the action of the Board the committee studying the problem of non-fat solids was elevated from a sub-committee to a full-committee and additional members were added to the already existing membership. The additional members were as follows:

Mr. D. B. Whitehead, Mississippi Board of Health

Mr. H. L. Hortman, Louisiana Department of Health

Mr. Martin Kloser, Bowman Dairy Company

Mr. James Doughty, New Mexico State Board of Health

Mr. R. S. Doughty, Philadelphia Dairy Products Company, Inc.

A committee to study and explore the feasibility of using industry fieldman as a substitute for official governmental inspection personnel was carried over from this meeting. By the direction of the membership the Board and the Chairman set up a new committee to again study this problem. The following members were appointed.

Mr. W. S. Anderson, Pennsylvania State Board of Health

Mr. H. Clifford Goslee, Connecticut State Department of Farms and Markets

Mr. E. H. Fahrenbach, Nebraska State Health Department

Dr. Fay, H. B. Hood Company, Boston, Massachusetts

Mr. James Meany, Chicago Health Department

Dr. R. G. Ross, Oklahoma State Board of Health

Mr. Harold Robinson, U. S. Public Health Service

Mr. D. H. Evans, Texas State Department of Health

Mr. Alex G. Shaw, Florida State Department of Agriculture

At your 1951 Conference, the following recommendation was adopted:

"The industry and regulating agencies are in need of standards for Grade A supplemental milk fats, concentrated and dry milk products and for the manufacturing and processing thereof. It is recommended that the Public Health Service, together with the representation from this Conference, to which would be invited representatives of the National Associations of products affected, including, but not limited to the American Dry Milk Institute, International Association of Ice Cream Manufacturers, and the Milk Industry Foundation, consider the recommendations contained in this report, and take all means necessary to expedite the formulation of such standards as are necessary."

As a result, a Special Committee to study and Expedite the Formulation of Standards for Grade "A" Supplemental Milk Fats, Concentrated and Dry Milk Products, and Standards for the Manufacture and Processing of these Products composed as follows, was appointed:

#### DRY MILK SUB-COMMITTEE

Mr. John T. Walsh, *Chairman*, American Dry Milk Institute, Inc., 221 N. LaSalle St., Chicago, Illinois;

Mr. Charles H. Holcombe, Supervisor of Inspections, Dairy and Food Division State Department of Agriculture, State Office Bldg., St. Paul 1, Minn.;

Mr. Joseph Stakes, Assistant Commissioner and Director, Dairy Division, State Department of Agriculture, Jefferson City, Missouri;

Mr. Clarence K. Luchterhand, Wisconsin State Board of Health, Madison 2, Wisconsin;

Mr. K. G. Weckel, University of Wisconsin, Madison, Wisconsin;

Mr. Harold Wainess, U. S. Public Health Service, 69 West Washington Street, Chicago, Illinois

#### CONCENTRATED MILK SUB-COMMITTEE

Mr. E. B. Kellogg, *Chairman*, Milk Industry Foundation, 1625 Eye Street, Northwest, Washington 6, D. C.

Mr. P. E. Riley, Illinois Department of Public Health, Springfield, Illinois;

Mr. John Taylor, Director, Bureau of Dairy Products, State Board of Health, Indianapolis, Indiana;

Mr. Ivan Van Nortwick, Kansas State Board of Health, Topeka, Kansas;

Mr. Samuel Coulter, University of Minnesota, St. Paul, Minnesota;

Mr. Harold Wainess, U. S. Public Health Service, 69 West Washington Street, Chicago, Illinois.

#### SUPPLEMENTAL MILK FATS SUB-COMMITTEE

Mr. Robert C. Hibben, *Chairman*, Executive Secretary, International Association of Ice Cream Manufacturers, 1105 Barr Building, Washington 6, D. C.;

Mr. Carl W. Larson, Dairy Products Improvement Institute, Inc., Liberty Bank Building, Buffalo 2, New York;

Mr. H. Clifford Goslee, Division of Dairy Sanitation, Department of Farms & Markets, State Office Building, 165 Capitol Avenue, Hartford 15, Conn.;

Mr. Harold Wainess, U. S. Public Health Service, 69 West Washington Street, Chicago, Illinois

The Special Committee to study and Expedite The Formulation of Standards for Grade "A" Supplemental Milk Fats, concentrated and Dry Milk Products, and Standards for the Manufacture and Processing of these Products held a meeting in Chicago on January 29, 1952, and in St. Louis on June 8-9, 1952. Those participating in the various meetings are listed below:

#### JANUARY 29, 1952

Harold Wainess, U. S. Public Health Service, Chicago, Illinois.

Ivan Van Nortwick, Kansas State Board of Health, Topeka, Kansas.

L. C. Peckham, U. S. Public Health Service, Chicago, Illinois

John Taylor, Indiana State Board of Health, Indianapolis, Indiana.

John T. Walsh, American Dry Milk Institute, Chicago, Illinois.

John R. Kleinman, Beatrice Foods, Co., Chicago, Illinois.

Dr. G. C. North, Beatrice Foods, Co., Chicago, Illinois.

Dr. W. C. Winder, University of Wisconsin, Madison, Wisconsin.

C. K. Luchterhand, Wisconsin State Board of Health, Madison, Wisconsin.

Dr. J. C. Flake, Evaporated Milk Ass'n., Chicago, Illinois.

Robert C. Hibben, International Ass'n., of Ice Cream Manufacturers, Wash., D. C.

Carl W. Larson, Dairy Products Inspection Inst., Buffalo, N. Y.

Joseph T. Stakes, Director, Dairy Division, Jefferson City, Missouri.

H. Clifford Goslee, Chief, Dairy Division, Hartford, Connecticut.

O. L. Hunnicutt, Supervisor, Dairy Section, Ohio Dept. of Agric., Columbus, Ohio.

C. W. Van Schoik, Chief, Food and Dairy Div., Ohio Dept. of Agric., Columbus, Ohio.

C. H. Holcombe, Supervisor of Insp., Dairy and Food Div., State Dept. of Agric., St. Paul, Minn.

#### JUNE 8-9, 1952

Harold Wainess, Chicago, Health Department, Chicago, Illinois.

Dr. J. C. Flake, Evaporated Milk Ass'n., Chicago, Illinois.

Robert C. Hibben, International Ass'n. of Ice Cream Manufacturers, Wash., D. C.

Carl W. Larson, Dairy Products, Inspection Inst., Buffalo, N. Y.

O. L. Hunnicutt, Supervisor, Dairy Section, Ohio Dept. of Agric., Columbus, Ohio.

John T. Walsh, American Dry Milk Institute, Chicago, Illinois.

John M. Schlegel, Indiana State Board of Health, Indianapolis, Indiana.

Owen Owens, Dairy Coop., Institute.

C. K. Luchterhand, Wisconsin State Board of Health, Madison, Wisconsin.

C. N. Holcombe, Supervisor of Inspections, Dairy and Food Division, State Department of Agriculture, State Office Bldg., St. Paul 1, Minnesota.



P. E. Riley, Illinois Department of Public Health, Chicago, Illinois.

Minutes and Resolutions have been prepared and the summation of their findings are presented in the following:

#### 1. *Format*

It is understood that the activities of the National Conference on Interstate Milk Shipments relative to Supplemental Milk Fats, Concentrated Milk and Concentrated Milk Products and Dry Milks are limited to those products as used in the Manufacture and/or processing of milk and milk products as defined in Section I, paragraph K of the 1939 edition of the Milk Ordinance and Code recommended by the U. S. Public Health Service.

#### 2. *Supplemental Milk Fats*

Where information is requested regarding Grade A Supplemental Milk Fats, the 1939 edition of the Milk Ordinance and Code recommended by the U. S. Public Health Service shall be used as a basis.

#### 3. *Concentrated Milk and Concentrated Milk Products*

The Committee wishes to point out that the 1952 edition of the Milk Ordinance and Code will contain a definition of Concentrated Milk and Concentrated Milk Products. It was therefore their opinion that additional definitions and standards are not necessary.

#### 4. *Dry Milks*

"Dry Milk Solids — adequate standards shall be formulated for drying operations and the finished product."

#### A. PROGRESS PROCEDURE FOLLOWED TO DATE WITH CONCERNED GROUPS:

Prior to the development and adoption of the foregoing Recommendation on the part of this Conference, The U. S. Public Health Service and the Dry Milk Industry, through its American Dry Milk In-

stitute, had cooperated for a number of years in matters of mutual interest and the possible formation of a code for Grade A Dry Milks.

The following local "Dry Milk Sanitation Advisory Committee" was established by the Chicago regional office to assist in the development of the proposed dry milk standards:

Mr. H. J. Weavers, Wisconsin Department of Agriculture.

Mr. C. K. Luchterhand, Wisconsin State Board of Health.

Mr. C. O. Widder, Wisconsin State Board of Health,

Mr. P. E. Riley, Illinois Department of Public Health.

Mr. P. G. Larsen, Chicago Health Department.

The following "Grade A Advisory Committee" was established by the American Dry Milk Institute:

Dr. A. H. Johnson, National Dairy Research Lab., Oakdale, L. I., N. Y.

W. J. Corbett, Dean Milk Company, Rockford, Illinois.

Dr. A. C. Fay, H. P. Hood & Sons, Boston, Massachusetts.

D. S. Flack, Dairymen's League Coop., Syracuse, N. Y.

Burdet Heinemann, Producers Creamery Co., Springfield, Mo.

R. J. Holmberg, Land O'Lakes Creameries, Minneapolis, Minnesota.

Martin Kloser, Bowman Dairy Company, Chicago, Illinois.

Dr. E. A. Louder, Pet Milk Company, Greenville, Illinois.

Chester L. Nelson, Baldwin Coop., Cr'y., Ass'n., Baldwin, Wisconsin.

Mr. H. Schweppe, Consolidated Badger Coop., Shawano, Wisconsin.

Dr. A. P. Stewart, Golden State Company, San Francisco, California.

Mr. W. E. Uselman, Galloway-West Company, Fond du Lac, Wisconsin.

Following through upon the sentiment expressed by the Conference at its 1951 meeting, the USPHS offices immediately thereafter advised the American Dry Milk Institute that it was their desire to develop standards for grade A dry milks, i.e., non-fat dry milk solids and dry whole milk, intended for use in milk and milk products as provided for in the Milk Ordinance and Code and in cities and areas operating under the Code.

It was pointed out that the prevailing fluid milk Code covers the production and handling of grade A raw milk supplies which of necessity would be required in the manufacture of grade A dry milks. Hence, their consideration for developing grade A dry milk standards would commence with the outlet valve on the high pressure pump ahead of the dryer and on through the drying, conveying and bulk packaging operations of interested dry milk manufacturers.

Rather than work with dry milk manufacturers on an individual basis and since the USPHS and other regulatory agencies had relatively little prior experience or familiarity with milk drying operations and processing and, further, since they were seeking the most reliable possible information, it was agreed advisable to seek the cooperation and counsel of the dry milk manufacturers through the Institute. This appeared to be a desirable procedure for developing sound and practical grade A dry Milk standards.

#### 8. WORK PROCEDURE ADOPTED BY USPHS IN COOPERATION WITH ADMI:

Meetings were held with interested equipment manufacturers on an individual basis for purpose of reviewing the construction and operation of respective equipment. Some of the equipment considered in

these discussions included high pressure lines, valves, drying chambers, air ducts, collector systems, conveyors and sifters.

A number of Sanitarians visited a representative selection of milk drying operations to personally observe processing procedures and the operations of the various types of spray dryers presently in use in the industry. The types of dryers included Mojonier, Gray-Jensen, Bufflovak, Rogers, Minnesota, Merrell-Soule and Golden State.

There have been three joint meetings with representatives of USPHS Washington, D. C. and Chicago offices and ADAMI personnel.

There have been four meetings of the Sanitarians and the Institute's "Grade A Advisory Committee" in regard to the development of the proposed sanitary standards.

An in-plant project "to study the sanitary aspects and designs of several types of high pressure lines suggested for use in spray nozzle milk dryers" was undertaken and completed at the plant of Wisconsin Cooperative Creameries, Inc., Union Center, Wisconsin. Participants in this particular project were USPHS, Wisconsin Cooperative Creamery, ADAMI, University of Wisconsin Dairy Department, Wisconsin State Health Department and Wisconsin State Department of Agriculture.

#### DISCUSSION

It is agreed that the raw milk supply to be used in the manufacture of grade A dry milks shall meet the milk production, handling and applicable plant requirements as presently included in the Milk Ordinance and Code.

As the work of developing the desired standards and requirements for the milk drying phase of plant operations progressed, it became very apparent that not all of the provisions relating to plant operations as set forth in the recommended Milk Ordinance and Code were:

(a) Practical,

(b) Applicable, or even to be required in view of the fact that milk immediately upon drying, is not subject to the bacteriological hazards of the fluid and/or condensed milk from which it is made.

It is our opinion at this time, the following provisions contained in the recommended Milk Ordinance and Code are applicable to milk drying plants interested in the production of grade A dry milks:

- floor
- walls and ceilings
- doors and windows
- lighting and ventilation
- miscellaneous protection from contamination
- toilet facilities
- hand washing facilities
- disposal of wastes
- storage of single-service containers
- pasteurization
- overflow milk
- personnel, health
- personnel, cleanliness

In regard to the remaining plant requirements of the fluid milk Code, it appears very likely in the light of our current information, limited research work as well as industry experience, that several are not applicable and a number of others will have to be modified and/or revised as progress and experience may indicate or warrant.

In this latter category, we have these principal items for further consideration.

- water supply
- sanitary piping
- construction of equipment
- cleaning/bactericidal treatment of equipment

#### SUMMARY-RECOMMENDATION

It is obvious from the foregoing report of work that the USPHS with the cooperation of the American Dry Milk Institute and the members of this organization's Special Committee to Study and Expe-

dite the Formulation of Standards for Grade "A" Supplemental Milk Fats, Concentrated and Dry Milk Products, and Standards for the Manufacture and Processing of these Products, working together have made substantial progress as a result of a sincere continuous endeavor to fully develop the suggested grade A standards for dry milks. However, despite this progress in work there are several provisions requiring further study and exploration prior to the satisfactory development of minimum standards of compliance. The early consideration of a proposed tentative yet practical Code for grade A dry milk requires the satisfactory development of these several provisions and it is anticipated that there will be available for distribution and comment, not later than January 1, 1953, a tentative Code for grade A dry milks.

Specifically and in regard to the use of non-fat dry milk solids when combined, for commercial distribution, with other substances to produce buttermilk, reconstituted milk and other milk/milk products defined in the recommended Milk Ordinance and Code, and as an interim policy, it is recommended that State and Local Boards of Health continue to provide for the use in graded milk and milk products, of non-fat dry milk solids which:

- is made from grade A raw milk supplies
- is "Extra" grade according to dry milk industry standards
- complies with an E-coli requirement of "not more than 10 per ml." (reconstituted basis)
- is manufactured in a milk drying plant under routine supervision

All bulk containers of this quality of non-fat dry milk solids shall be properly labeled and include the permit number and name of the supervising agency of the manufacturing plant.

In conclusion, we believe you will be interested in learning that we have enjoyed the fullest cooperation on the part of the dry milk manufacturers and the American Dry Milk Institute in all of the work to date.

The industry, as you well know, has made tremendous strides in quality of production and utilization of its production, particularly these recent 10 years. As an industry, it has voluntary, sanitary and quality Code applicable to incoming milk supplies and plant sanitation.

Consequently, only those spray dry milk manufacturers having access to available and/or surplus amounts of grade A fluid milk supplies will be in a position to furnish grade A dry milks for use in graded milk and milk products as provided for in the recommended Milk Ordinance and Code. It is our belief that increased amounts of the desired grade A non-fat dry milk solids will be produced to meet demands as increased production of grade A raw milk supplies are developed and/or made available for drying purposes and as proposed tentative grade A dry milk plant operating standards are completed.

5. It is recommended that the Sub-Committee relative to Supplemental Milk Fats and Concentrated Milks be dissolved and that the

present Sub-Committee on Dry Milk be raised to the status of a full committee, be further implemented by four additional members and be maintained until the complete tentative grade A plant standards for dry milks have been developed.

6. We submit to the National Conference on Interstate Milk Shipments this progress report for your consideration and acceptance.

7. Your Committee looks forward to submitting for review and consideration at the next conference a completed report of the assignment.

Respectfully submitted,  
HAROLD WAINESS,  
*Secretary, Special Standards Committee*  
*National Conference on Interstate Milk Shipments.*

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Mr. James A. Meany, Director of Dairy Inspection, Chicago Board of Health, Chicago, Illinois.

Dr. Milton R. Fisher, Chief of Milk Control, St. Louis Health Dept., St. Louis, Mo.

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Dr. R. J. Helvig, Asst. Chief Milk & Food Branch, Washington, D. C.

I. E. Parkin, Extension Dairy Specialist, Room 213 Dairy Building, Pennsylvania State College, State College, Pennsylvania.

## IAMFS BECOMES PUBLIC MEMBER FOOD LAW INSTITUTE

The election of the INTERNATIONAL ASSOCIATION OF MILK AND FOOD SANITARIANS, INC., to public member in the Food Law Institute, Inc., has been announced.

The only other two "Public Members" are the Association of Food and Drug Officials of the United States and the Association of Official Agricultural Chemists.

The Food Law Institute is rendering a pioneer and valuable public service in the area of the food and drug law, through its basic research study and university instructions in food law. The Federal Food,

Drug, and Cosmetic Act is a great public law of profound economic, social, and legal importance, looming as influential as the Sherman Anti-trust Act. Thanks to the efforts of President Dunn, the future graduates in law and public health will know much more about food law than has obtained in the past. This is a growing field and our Association is excellently equipped to contribute by virtue of the experimental, official and technological qualifications of its membership

J. H. SHRADER

\*See this Journal, March-April, 1952, page 50

# Association News

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1373 S. E. 12th St.....Portland

### PUBLIC HEALTH CLUB AT INDIANA UNIVERSITY UNIQUE

At Indiana University an active public health club has been organized by undergraduate students who have elected public health and sanitary science as their major course of study. Monthly meetings are held during the school year and student officers handle all affairs and arrange the program. Various specialists in public health are invited to speak at meetings.

The Club's objectives are two fold, first to interest students in public health as a career field, and second to better acquaint them with professional opportunities in public health work.

Indiana's course leading to a Bachelor of Science degree in public health is now in its fifth year. A carefully planned curriculum assures the student excellent training in the basic sciences during the first three academic years, followed by intensive specialized training in sanitary science during the senior year. Graduates are readily placed in positions with states, municipal and local health departments.

Faculty advisor to the club is Dr. S. H. Hopper, Associate Professor of Public Health.

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Paul Corash, New York City.

Food Handling Equipment Committee:  
Franklin Fiske, Denver, Colo.

### WASHINGTON STATE INSTITUTE OF DAIRYING

Twenty-second Annual State College of Washington Institute of Dairying, Pullman, Washington was held March 9-12, 1953. Nationally known guest speakers. Dairy products, judging and scoring contests. Excellent prizes and diplomas. Special sessions for sanitarians and fieldmen.

### FIRST SHORT COURSE FOR MILK SANITARIANS HELD IN OREGON UNDER NEW LAW

The first annual Oregon Milk Sanitarians' Short Course, was con-

ducted jointly by the Oregon State Department of Agriculture and Oregon State College December 1, 2, and 3, on the state college campus at Corvallis, under the direction of E. L. Peterson, State Director of Agriculture, and P. M. Brandt, head of the college department of dairy husbandry.

This short course will be held annually on the same dates and is believed to be the only one of its kind in the country. The course is required under 1951 amendments to the Oregon fluid milk law, which requires every milk inspector in the state to satisfy the State Department of Agriculture that he has satisfactorily completed the course before his inspection authority will be renewed for another year.

Studies of and discussions on housekeeping items in the dairy field occupied most of the three days.

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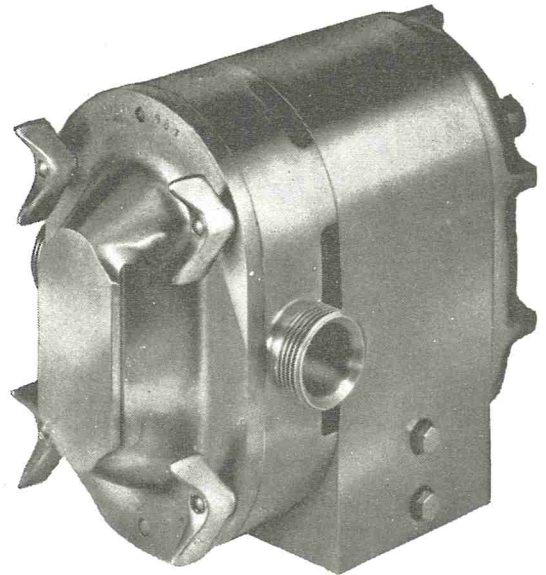
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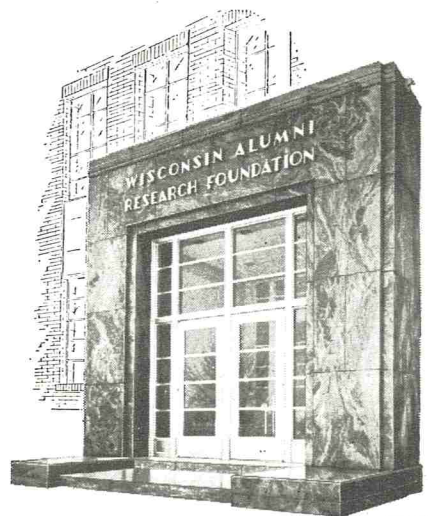
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## INDEX TO ADVERTISERS

American Can Co. ....	IX
American Seal-Kap Corp. ....	IV
Borden Co. ....	VIII
Bowey's Inc. ....	Inside Back Cover
Cherry-Burrell Corp. ....	II
Creamery Package Mfg. Co. ....	VII
Crown Cork and Seal Co. ....	Inside Front Cover
Difco Laboratories ....	Back Cover
Diversey Corp. ....	IV
Johnson & Johnson ....	I
Klenzade Products, Inc. ....	XI
Mojonnier Bros. Co. ....	103
Oakite Products Inc. ....	103
Sealright Co. Inc. ....	XII
Schwartz Mfg. Co. ....	V
Sterwin Chemicals Inc. ....	VI
Waukesha Foundry Co. ....	X
Wisconsin Alumni Research Foundation ....	X

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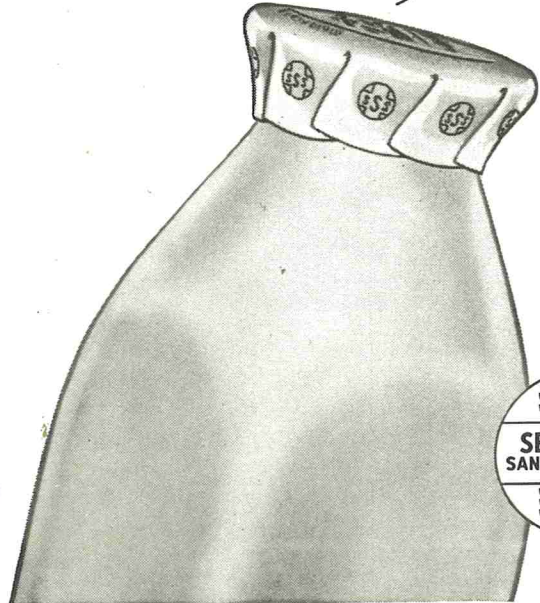
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