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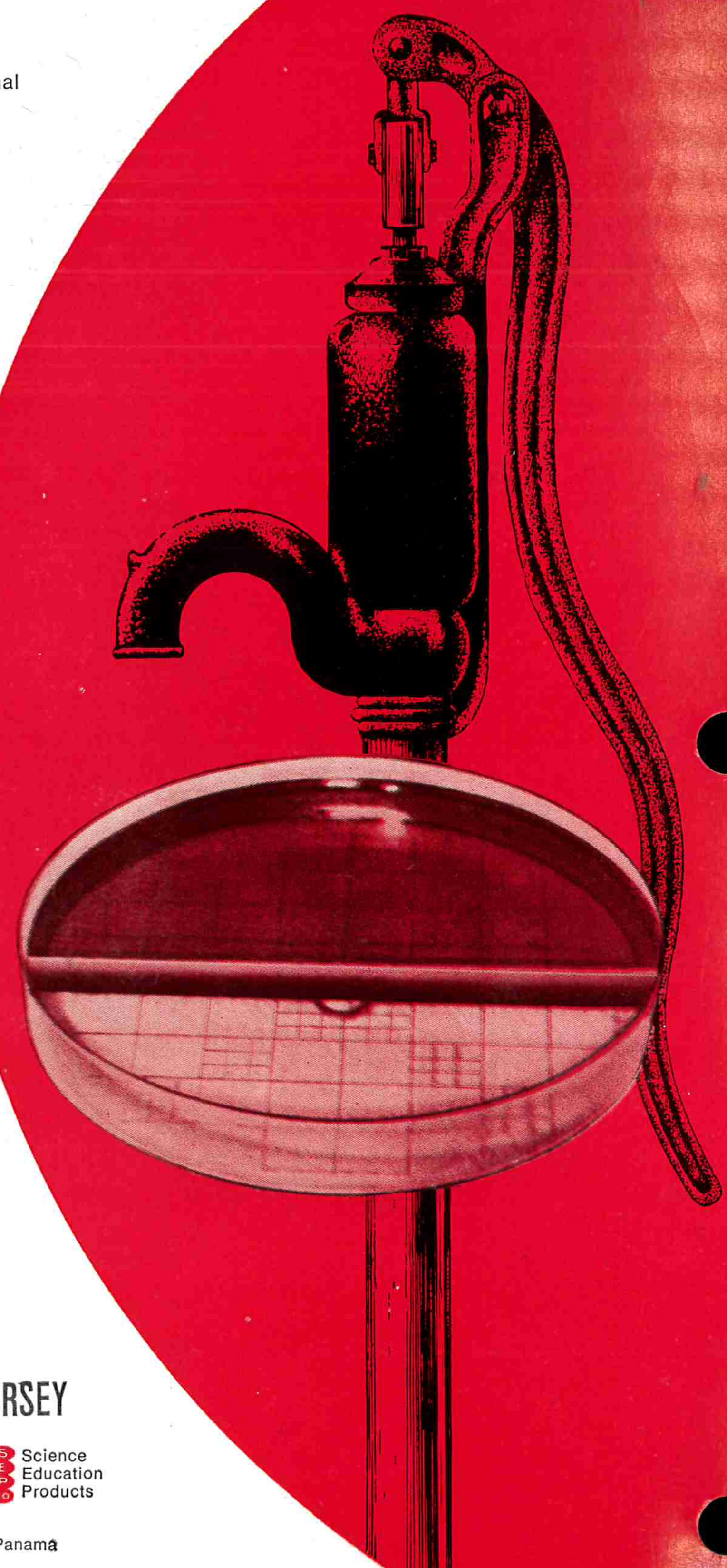

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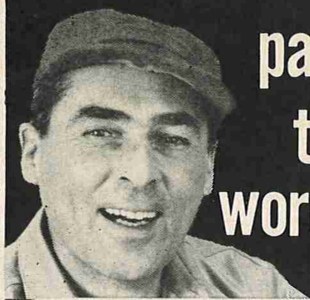

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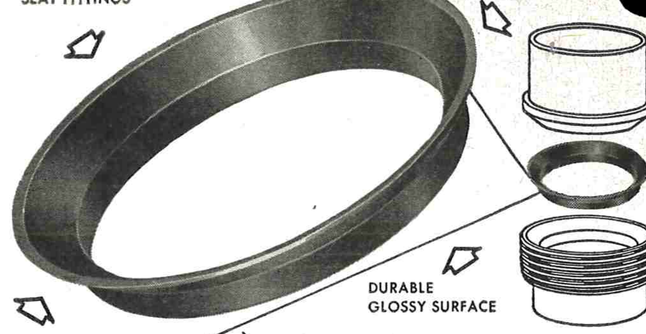

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A PHYSICIAN LOOKS AT THE PUBLIC HEALTH PROFESSION[1]

Otis R. Bowen[2]

Bremen, Indiana

I suspect that a physician's opinion of the profession of public health may differ from a layman's opinion in that he may be more critical but, I hope, more understanding. The physician usually is more interested in matters of personal health rather than matters which impose restrictions on people's activities in the guise of health protection to the public. Actually, the subject of my talk is so broad that it permits me to ramble a little and offer some praises sprinkled with some criticisms of your profession.

When it comes to criticisms, remember you have asked for them and I hope that you will take them as they are meant – in a friendly constructive manner. It is easy to resent such scrutiny and criticism – even to dismiss it as unnecessary. But criticism, if informed and objective, is good for all who work to serve the public and in any case we have to expect it. In a society as ours, changing so rapidly, every franchise and every right and every dividend is to be continually re-earned.

It was my pleasure a couple of sessions ago to work closely with members of your organization in your behalf to help add some stature to your profession through creation of some requirements and licensure provisions in the Legislature. It is gratifying to note the progress you have made and I congratulate you for your efforts to maintain high standards.

I want to stress in my remarks today the importance of public relations in your job – what people think of what you are doing – your public image. I want you to sit back and pretend you are sitting on the fence watching yourself go by. My comments will be directed more to you who are representatives of public agencies; however, I trust that my viewpoints will be of interest to others also.

Probably the physician's opinion of public health is not as important as that of the general public because there are relatively few of us. From the public standpoint, however, you are a part of the government being maintained by tax funds and anything supported by public funds deserves close scrutiny and close accounting down to the last penny.

Need For Responsible Action

Sometimes I get the feeling that this is the age of the goof-off. So many of us are willing to settle for something less than the best – the age of the half done job. We seem to be stampeding away from responsibility. We find laundry men who won't iron shirts, waiters who won't serve, carpenters and electricians and plumbers who will come around someday – maybe, executives and professional men whose minds are on the golf course, teachers who demand a single salary schedule so that achievement cannot be rewarded or poor work punished, students who take easy snap and cinch courses because the hard ones make them think and work, spiritual delinquents of all kinds who triumphantly are enjoying their so-called leisure time in less than honorable ways.

I am hoping that our people soon become sick of this goofing off and improve their sense of responsibility. We don't show much responsibility or stability when we have a two hour lunch period, a three-day weekend, the all day coffee break, or when we buy a $500 jeweled pill box with a built-in musical alarm to remind us that it's time to take our tranquilizer.

It is your job and my job to teach and influence those over whom we given responsibility and supervision that work can be fun and that the only real reward that life offers is the thrill of achieving something and that where achievement amounts to most is on the job. People must realize, regardless of whose payroll they are on, that they are still working for themselves. If we as a total population in a nation of responsible people do not assume such responsibilities and stay hard at work, a stronger nation might emerge that could put us to work.

Importance of a Good Image

Many people resent your public health profession. To them your image is poor. I doubt that one could change the minds of these particular people, regardless of attempts to try. They suffer from too little knowledge, too much excitability and too little judgment. At the other extreme there is a group which is over-enthusiastic about public health. These folks suffer from too much knowledge and frenzy and from too little judgment poorly directed.

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[1]Presented at the 15th Annual Meeting of the Indiana Association of Sanitarians, Indianapolis, October 7, 1965.

[2]Practicing physician and member of the Indiana State Legislature.

Somewhere in between these two extremes is where the majority of us stand. Yet some are just luke warm about the public health program and just tolerate it while others are enthusiastic over only certain phases of it and hostile towards others. I must confess to having been less willing many years ago to accept the necessity of so many public health rules and regulations whereas I am today more knowledgeable about them. I think I am rather average in ability and understanding and I believe that your image in my eyes has improved through gaining more knowledge of the needs and how you administer to them. Most people will react the same way if you can reach them with the truth. Let the people know the truth and they will be reasonable.

The success and effectiveness of any public health program depends on the public's confidence. This is so hard earned and so easily damaged. If one were to measure the length of time it takes to earn the public's confidence it would require a calendar; but if one were to measure the length of time it takes to destroy the public's confidence it would require only the second hand of a stop watch.

I have experienced the same misunderstandings serving in the Legislature. I have given a great many talks to various groups concerning many phases of legislation. I believe without exception I could sense the chips on the shoulders of almost every member of the audience before starting to talk. However, after trying to explain the reasons, the needs, and the places for which the tax monies were to be used and perhaps after explaining that I did not agree with all that was done but this represented the best that could be accomplished under the political situation at the time, the chips seemed to fall harmlessly to the floor. I still have had many who disagreed but not so violently after proper information was given.

The only way to improve the public image of public health programs is to bring information to the people as to needs and as to how you are attempting to solve them so that they will get their money's worth. The image of an entire program can be ruined by improper dissemination of information or from a single ill-considered act by any one of the employees of any one of the county departments or the State Department of Health.

I want to call your attention to an occurance after the horrible tornados last April. In an honest attempt to prevent mass illness from mass feeding, many county departments of health restricted use of foods that were home canned and home prepared. People had taken pride in giving these foods for use and their feelings were hurt because their food was turned down. Perhaps attempts were made to explain the reasons but apparently they were inadequate for it snowballed into rumors that picnics, church carry-in suppers, home baked wedding cakes, and club money-making projects such as smorgasbords and even communion wines, if home made, were to be abolished. I had numerous nasty letters, for the writers thought that the Legislature had passed laws to do away with these longstanding, pleasant customs. So, in your work, go to all kinds of trouble to get the proper information disseminated and it will save much grief and time later trying to get it straightened out.

We in Indiana and in the United States are still, in spite of many problems, a very fortunate people. On the whole we live well—in fact, better than any other nation. We have enough to take care of our health and our educational needs and still are able to afford many conveniences and luxuries. In fact, it seems even with my children that the family who doesn't have two cars, a Honda, a lake cottage, a boat and a couple of horses are underprivileged.

Sometimes I get disturbed at the image of our country when I see and hear so much about poverty in the United States. We have people arguing for aid to cover every conceivable situation and demanding all sorts of welfare type programs that involve public health. Some have good arguments and mean well but one can get the impression of an America made up largely of the poor, the sick and the illiterate, the undernourished and halfstarved, unhealthy slums and the unemployed.

Those in the field of public health need to be careful not to give the image that public assistance is the answer rather than individual initiative. The best public relations picture that can be made is to show how you are trying to help people help themselves through the various programs. Education of the tax paying public is essential. Education of recipients is just as important. The one thing more expensive than such education is ignorance. It is better to be known to the public that you are there as an advisor or an encourager for the lower echelon to do things for themselves.

CARRYING OUT YOUR RESPONSIBILITIES

Of all the careers, few can match yours for sheer variety; the field of public health can never grow dull for you are connected directly with problems of people who are undergoing life's greatest crises and dramas—birth, illness, epidemics, handicaps, recovery, poverty, rearing of children, marriage difficulties, broken homes, problems of the aged, the migrant worker and many others. Helping people swept up in these dramas is one of life's greatest satisfactions.

Your duties and your responsibilities are numerous. You must be responsible to your employer, the unit of government for whom you work directly. You must also be responsible to the people who need and receive your public assistance. Let's not ever turn this around and think that the people are there to do as you say. You are a servant of the people.

In carrying out your responsibilities you have to be fair but firm, sympathetic and generous but decisive. You have to have plain common sense. You need to know the rules and regulations that govern your actions. You must have integrity and you must be a good investigator, fearless and able to do what is right whether it is popular at the moment or not. In short, you must have the qualities of a minister to counsel, a business man to get the most for the dollar spent, a doctor to diagnose, a district attorney to ferret out the truth and the chiseler, and a nurse to soothe and comfort. You must be a good listener and a good persuasive talker and you must also be a taxpaying citizen to understand the feelings of those who pretend not to understand.

To have all of these qualities is impossible; yet I'm sure the most of you have the majority of these attributes. We all get discouraged at times and feel that our best is not good enough. We all experience feelings of inadequacy—except for those too smug to do so. But were it not for this feeling of inadequacy, there would be no progress and no human betterment.

As the population of our state and nation grows and hours in a work week lessen, so does the activities of more individuals and groups grow. Our lives become more complex and more hectic. With this combined increase in population and activities there are in turn more problems, more crime, more juvenile delinquency, more chance for epidemics, more stream and air pollution, more aged people, more needs for recreational, educational and health facilities. All of these needs are directly or indirectly related to your field of endeavor. Our advancing technology is directed toward solving these problems and you as members of the public health profession are an integral part of this advancing technology.

Ways and Means of Getting Things Done

There is no question that one of the public health worker's problems is and always shall be a constant battle with the legislature, the county councils, county commissioners and city councils for enough money to carry on the programs that our expanding society dictates is necessary if we intend to continue to keep an ever older population healthy and happy. Yet in spite of financial handicaps, there still are ways and incentives to function properly. When problems arise that seem insurmountable at the moment, we can't make the situation more difficult by becoming a part of the problem by throwing up our hands or dragging our feet. We need to ask ourselves "Do we come with a solution or are we becoming a part of the problem?" When solutions seem elusive it's no time to become propelled into an increasing state of frustration or anxiety. No substitute has yet been found and probably never will be for the confidence engendered by a sound relationship between you and the community that you serve, whether it be at the township, city, county or state level. You have at your disposal many valuable tools, and much valuable knowledge to help society cope with these stresses of modern living.

People in the field of public health have to do a lot of inspections and are often labeled as snoopers and trouble makers. But in my book, and in anyone's book who is conscientious about the importance of public health work, the man looking for a possible violation is not necessarily a pessimist but is a man doing his duty. The inspector who is frequently a little unsatisfied and who continues to look the situation over carefully even when things are going pretty good is a man "on top of his job". He is looking for hidden faults and can ferret out weaknesses before they can do any serious harm. He knows that beneath an apparently calm surface, there can be faults that won't be uncovered without digging for them. So, when someone accuses you of being a troublemaker, calmly but effectively explain the "why" of what you're doing. When they understand the "why", even though they disagree with your answer, they not only will respect you for your conscientious attention to duty but, more important, will respect you for your courtesy of explanation. It is time consuming, it takes a little extra effort and it takes a little more patience, but it surely does a lot for your public image and builds respect for your profession.

An axiom voiced by physicians on innumerable occasions states that it is not always the illness but also the patient that is to be treated. Public health officials could do well to apply that, too. Often the fault or the illness you find that needs correction can be corrected or treated easier if you consider the feelings of the people on whom you are imposing restrictions or penalties. Finding the problem and knowing the scientific treatment or solution are only two parts of your work. Application of the corrective treatment with sympathetic understanding is just as important.

Public health activity can breed good will if it is in harmony with the community; it helps no one if it is ugly. There is always the danger of going too far too fast and, possibly by doing so, getting into areas that really should be left alone for the time being. I had this brought home to me when a surgery patient jokingly but with some seriousness, handed me his poetic warning not to go beyond my realm of necessary duty. The note read:

I am a young man with a hernia.
I'm telling you doctor, gol dernya.
When improving my middle,
Be sure you don't fiddle
With matters that don't concernya.

In spite of harrassments from within and without, you members of the public health profession are respected and indispensible elements of our society and are greater contributors to the health, happiness and economy of mankind than almost any other profession. Public health is accused of cynical opportunism. It is embroiled often in legislative controversies and is the subject of attack and rebuttal, claim and counterclaim to an extent unparalleled in history. One needs only to think of such things as cigarette smoking versus cancer, fluoridation, cholesterol, air pollution, stream pollution and detergents, milk inspection, nursing homes and hopsital construction and inspections, migrant worker camps, etc., etc., etc.

Now, I'm sure that your profession is not without blemish; like any other profession it too is plagued by some irresponsible members whose malfeasances have been attributed to the profession as a whole. As a result, sometimes its magnificent achievements and its monumental role in prevention, cure and treatment and alleviation of disease and lengthening of life have been obscured in the public's mind.

PUBLIC HEALTH CONTRIBUTIONS TOWARD A BETTER WORLD

There have been great strides in the field of preventive medicine and public health. An old patient of mine recalled the influenza epidemic of 1918. Today people get flu shots. The real breakthrough was in the sulfa drugs, then came penicillin and now the mycins. About three fourths of prescriptions today are for drugs that weren't even known in 1950.

Before the sulfa and antibiotic days, pneumonia used to be a big killer. Besides that it took weeks to recuperate and even then complications such as lung abcesses and empyema were common. Now, if an otherwise healthy person gets pneumonia and isn't back to work in a week or ten days, they consider the doctor no good. Twenty-five years ago New York City reported over 12,000 cases of whooping cough with 105 deaths; last year there were 212 cases and no deaths. In 1935, 70,080 Americans died of tuberculosis; in 1963, 9,311.

There are hundreds of such figures and the figures, in turn, have been plotted on hundreds of graphs to show the relationships of disease to lost work time, to gross national product, to average life span, to cost of treatment and medication. In virtually every category, the records show dramatic gains over the comparable statistics of less than a generation ago.

No one asserts that the credit belongs exclusively to the public health officials but no one denies the important part that they have played in this success story. These figures alone should tell you that the physician as well as any thinking citizen has a high opinion of public health. But, let's not get too elated and impressed with ourselves. There is still much to be done—sclerosis, heart diseases, psychological and emotional disturbances, diabetes, geriatric problems, cancer and the population explosion.

I want to dwell for a moment or two on this last mentioned problem—the population explosion. It has become increasingly evident that neither the church, voluntary service organizations, nor private philanthrophies have been able to keep up with the many needs of a rapidly growing population. For this reason municipal, state and federal agencies have taken increasing responsibilities for the people's welfare. This has been all well and good but there are inherent dangers of over expansion of governmental programs to take over too many of the individual's responsibilities. There must remain a balance between governmental and private efforts.

Other than all out war, the greatest threat we face is that of unrestrained population increase on our resources and social structure. Apathy and opposition are diminishing and deep concern is being expressed by more and more people. Yet progress is too slow to avert the danger of suffocation by numbers. This is a real challenge for your leadership. As we work toward population stabilization, we still have to combat hunger, disease, and ignorance which condemn so many millions to degradation and misery and still tax a multitude of others for their support.

Frankly, I do not know if the public health profession should assert more leadership in this field, but there are other areas where there is great need. There are many problems without solutions as yet and I feel compelled to state that your work has only begun. Your profession deserves much commendation for its past accomplishments and certainly warrants encouragement for the tasks yet to be undertaken. Keep up the good work.

This brings me back to the title of my talk, "What is a physician's opinion of people in public health?" My answer is, "I think you're great."

SOME FACTORS RESPONSIBLE FOR VARIATION IN COUNTING SOMATIC CELLS ON PRESCOTT-BREED SMEARS OF MILK[1]

R. Schneider and D. E. Jasper

Department of Clinical Pathology, School of Veterinary Medicine
University of California, Davis, California

(Received for publication April 9, 1965)

Summary

By means of direct microscopic observation of cells in stained smears and projection of a series of color transparencies, differences in criteria used by individuals for identification of cells to be counted in Prescott-Breed smears were discovered and described. Extensive studies revealed a unique pattern of cell distribution within smears which can materially affect the outcome of a cell count depending upon the area selected for cell counting. Among other factors, variation in size of the smear was found to have a marked affect upon resultant sample count.

The current widespread trend toward screening of total herd milk (bulk tank samples) for market suitability by means of estimated leucocyte numbers has brought a new phase of application for the Prescott-Breed or direct microscopic cell count method *(6)* which emphasizes the importance of accuracy. In a critical examination of the Prescott-Breed method for counting somatic cells in milk *(9)* the highest counts were observed to be as much as three times the lowest count for some groups of counts, the average high count being 1.9 times the average low count. Others have also shown large differences in results when duplicate smears were counted *(4, 5)*.

Cell numbers have been observed to be distributed in a 3:4:3 ratio through the central 1/3 area of smears which had been divided into three equal parts *(3)*. The numbers of bacteria per field in milk smears have been shown to decrease in proportion to the distance of a given field from the center of the smear *(2)*.

Thus a likely source of error would involve the areas of the smear selected for counting as related to the distribution of cells within a smear. A second source of error could involve differences in criteria used for cell recognition by the counter. Some of the factors affecting cell distribution were therefore critically examined in this study and uniform criteria for cell recognition were explored.

Materials and Methods

Criteria for determination of cells to be counted were studied subjectively utilizing 6 counters. Direct microscopic observation of cells in stained smears and projection of a series of color transparencies selected to illustrate the variety of visual objects seen in milk films served as a basis of discussion between participants. Differences in criteria used by individuals were thereby discovered and reconciled into substantial agreement.

Samples of milk at room temperature in 1-oz bottles were used for smear making. Mixing was assured by shaking through an arc of 180° and back again at least 25 times over a period of 30 to 45 seconds *(8)*. Smears were made on precleaned glass microscope slides placed over templates delineating round or square 1-cm^2 areas. A clean movable sheet of plate glass made level on a laboratory table provided a uniform surface for the slides during smear preparation and drying. Smears were dried at room temperature and were fixed and stained within a few hours using the Broadhurst-Paley triple step process *(7)*. Adequate observations on cell distribution required counting of representative microscopic fields from one edge of the smear to the other. Other than the above, procedures as outlined in Standard Methods for the Examination of Dairy Products *(1)* were followed.

In order to minimize any bias resulting from smear making in studying the distribution of cells in a smear, the main factors affecting smear making were varied in trials 1, 2 and 3A. Using both a 0.01-ml loop and a syringe[2], multiple round and square smears were made from various milk samples at separate times by different smear makers. Care was taken to keep the loop in a vertical position when withdrawing it from the milk.

In Trial 1 separate horizontal and vertical counts of 25 fields each through the center, were made on 6 smears. The number of cells in each of the parts of areas B and E (Figure 1) was calculated. The 3:4:3 ratio was thus tested by comparison of parts 4:5:6 and 2:5:8 (Figure 1).

Trial 2 tested whether the 3:4:3 relationship was constant across all areas of the slide. Thirty-two smears were utilized. To test whether cell numbers affected cell distribution, the smears were so selected that the cell counts were reasonably spaced within a range from 80,000 to 14,000,000 cells per ml of milk. By use of the substage calibrations the smears were divided into thirds, both horizontally (Figure 1, areas A, B, C) and vertically (areas D, E, F) and counts of 25 equally spaced fields across the entire smear were made through the center of each of the 6 resulting areas. The 3:4:3 ratio was tested by comparing counts of A:B:C and D:E:F.

The pattern of cell numbers throughout the smear was studied in trial 3A using 26 smears each of which was divided into 9 equal parts (Figure 1). The smears were first divided and the counts were made as in Trial 2, except that every field in sequence across the smear was counted

[1]This work was part of a thesis submitted by R. Schneider to the Graduate Division, University of California in partial fulfillment of the requirements for the M.S. degree.

[2]Available from Applied Research Institute, 2 East 23rd Street, New York 10, N.Y.

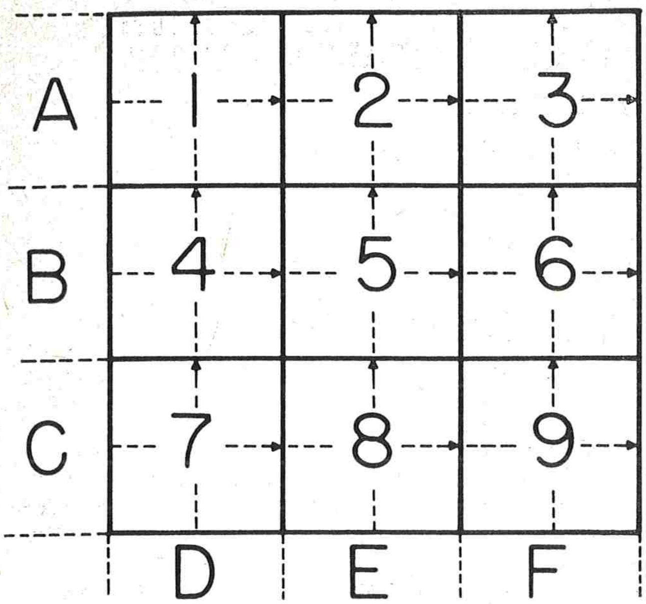

FIG. I.
SMEAR DIVIDED INTO 6 AREAS (A-F) AND 9 PARTS (1-9), SHOWING THE ORIGIN OF AREA ESTIMATES AND OF THE HORIZONTAL AND VERTICAL ESTIMATES FOR EACH PART.

and recorded. The fields in sequence for the 6 area counts on each smear were then divided into equal thirds and the number of cells in each part was totaled. There was thus one horizontal estimate and one vertical estimate from which the per cent of cells in each of the 9 parts was derived for each smear.

Since the tendency of the smear makers had been to start and stop in the upper portion of the smear, the possible effect of this practice was examined in Trial 3B utilizing 4 square smears in which the area of starting and stopping was in a different corner (Figure 1, Parts 1, 3, 7, 9). The smears were made by the same smear maker using the syringe.

In view of the errors in smear making *(8)* and variations in the distribution of cells found in smears 100 mm^2 in area, the possibility that another smear size could produce more accurate and uniform results was explored. Square smears were made covering areas of 49, 72, 100, 144 and 196 mm^2. Smears covering 289 and 400 mm^2 were also tried, but it was concluded that representative smears could not be made that large in size because portions of such large smears tended to dry before all of the spreading took place.

Two trials were conducted. Trial 4A included only smear sizes, 100, 144 and 196 mm^2. Trial 4B included all 5 smear sizes. In both trials, 5 separate milk samples ranging from high to low known cell counts were utilized. A syringe was used by the same smear maker to make 4 smears of each size in pairs from each sample in a set order.

Counts on the smear pairs were made in random order. In trial 4A, 25 field counts of both horizontal and vertical counts through the center were made on each smear regardless of size. The WF thus varied between 2,500 and approximately 5,000, dpending on the size of the smear. In trial 4B, 2 separate series of counts were made on all of the smears using a WF of 2,500 for each series, hence, when the 2 separate series were combined counts with a WF of 1,250 were produced.

To determine if the cell distribution was the same for all smear sizes, the 4 smears made for each size from the highest cell count sample of trial 4B, were counted as outlined for the Trial 3 study above.

RESULTS

From the observations and discussions, variation in criteria for cell recognition could be placed in 5 general categories. These involved the disposition to be made of ghost cells or cytoplasmic masses without a nucleus, cells in various stages of degeneration, nuclear and other particles or portions of cells, clumps of cells, and cells only partially within a field. The criteria for the recognition of cells to be counted was established as follows:

1. All stained material recognizable as containing more than 50% of a cell nucleus was counted as a cell. This applied also to cells only partially seen at the margin of a field.

2. Smaller cell fragments and cytoplasmic material were not counted as a cell.

3. All individual cells in cell clumps or masses were counted providing the total count of the field did not exceed the highest count obtained in any of the other fields without clumps. If the highest field count without clumps was exceeded, a count for that field equivalent to the highest count attained without clumps was recorded.

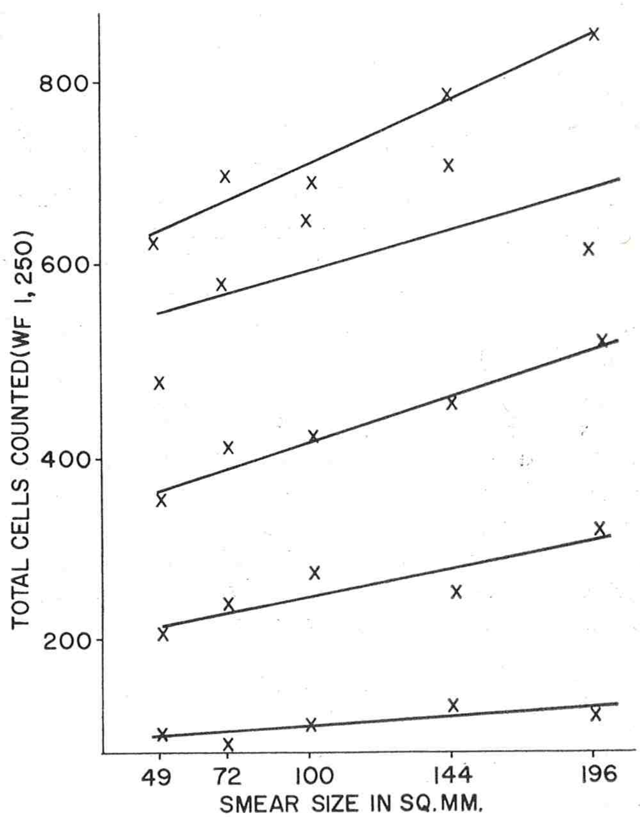

FIG. 2
TRIAL 4B, LINES OF "BEST FIT" VIA THE LEAST SQUARES METHOD FOR 5 SMEAR SIZES AND 5 MILK SAMPLES.

TABLE 1. THE PER CENT OF CELLS FOUND IN EACH AREA ON 32 SMEARS

	Horizontal counts			Vertical counts		
	A[a]	B	C	D	E	F
% of total cells counted[b]	33.4	38.5	28.1	31.8	37.7	30.5
Mean % when equal weight given each smear	31.9	37.8	30.3	31.0	34.8	34.2

[a]Letters refer to area designations in Figure 1.
[b]Chi Square on 3:4:3 ratio prior to conversion to % for each was P>.001.

TABLE 2. THE MEAN PER CENT OF CELLS AND STANDARD DEVIATIONS IN EACH OF NINE PARTS[a] FOR 26 SMEARS

10.4 ± 2.3	11.7 ± 3.3	10.9 ± 2.5
11.2 ± 1.7	15.1 ± 2.1	11.2 ± 3.6
8.6[b] ± 2.5	11.0 ± 1.5	10.0 ± 2.4

[a]Parts refer to those designated in Figure 1.
[b]Significantly different from other outside corner parts P>.01.

TABLE 3. THE EFFECT OF STARTING AND FINISHING THE SPREADING OF A SMEAR IN DIFFERENT CORNERS OF THE SMEAR

Smear	Part[a] started and stopped and the 2 adjacent parts[b]	Opposite 3 parts	% Cell parts Col'm 2	% Cell parts Col'm 3
1	6, 9, 8	2, 1, 4	36.8	28.5
3	2, 1, 4	6, 9, 8	35.4	31.8
2	2, 3, 6	4, 7, 8	33.0	32.8
4	4, 7, 8	2, 3, 6	33.8	32.6

[a]Parts refers to those designated in Figure 1.
[b]The part in which the smear making started and stopped is the center figure.

The pattern of cells found in Trial 1 by counting horizontally and vertically through the central areas of the smears (Figure 1 parts 4:5:6 and 2:5:8) confirmed the presence of a 3:4:3 ratio. No significant variations from this ratio was found in Chi Square tests. The 3:4:3 ratio for distribution of cells through the center was also verified in trial 3A (Table 2) and trial 4B (Table 5c).

The relative inconsistency of the 3:4:3 relationship when comparisons were made of counts across the entire smear (Trial 2) is shown in Table 1. A total of 16,410 cells were counted in the horizontal counts (Figure 1, areas A:B:C) and 16,546 cells on the vertical counts (Figure 1, areas D:E:F) on the 32 smears. It was found that the ratios of A:B:C and D:E:F varied significantly from the 3:4:3 ratio (P>.001). The effect of cell numbers on cell distribution is also illustrated in Table 1. Because smears with fewer cells tended to vary the most from a 3:4:3 ratio, such variability had a greater effect when equal weight was given to all smears.

The mean proportion of cells and standard deviations in each of the nine parts (Trial 3A) is shown in Table 2. Overall, approximately 15% of the cells were in the center ninth (Figure 1, part 5), and generally between 10 to 12% in each of the other parts. It was noticed that on the average there seemed to be more cells in the 4 middle outside parts (2, 4, 6 and 8) than in the 4 corner outside parts (1, 3, 7 and 9). On the 26 smears, the average proportion in each of parts 2, 4, 6 and 8 was 11.3%. The average in parts 1, 3, 7 and 9 was 10.0%. Part 7 varied significantly from the other corner outside parts (P>.01) and if it was excluded, the average for parts 1, 3 and 9 was 10.4%. Hence, on the average, each of the middle outside parts contained about 8% more cells than the corner outside parts, part 7 excepted.

Table 3 illustrates the effect of starting and finishing in different corners. There was always a higher proportion of cells in the total of the parts in which the smear was started and finished and those on either side, as compared to the total proportion of cells in the 3 opposite parts.

Trials 4A and 4B were comparisons of cell counts derived from smears of different sizes. Table 4 indicates the results of counts through the center for all smear sizes. The means of the ratios of the cell counts are also given for the different smear sizes

TABLE 4. TOTAL CELLS COUNTED[a] ON DIFFERENT SIZE SMEARS FOR 10 SEPARATE MILK SAMPLES AND THEIR MEAN RATIOS TO 100 SQ. MM COUNTS

Sample No.	Smear size in mm² 49	72	100	144	196
Trial 1					
1	-	-	851	984	1174
2	-	-	637	677	811
3	-	-	422	471	586
4	-	-	228	251	280
5	-	-	19	23	20
Mean of ratios	-	-	1.00	1.13	1.26
Trial 2					
1	314	349	345	392	429
2	236	292	326	354	308
3	178	202	210	230	264
4	104	121	138	127	163
5	50	44	56	66	62
Mean of ratios	.82	.91	1.00	1.09	1.15
Combined mean of ratios	.82	.91	1.00	1.11	1.21

[a]Cells counted adjusted to WF of 2,500 and rounded to the nearest whole cell.

studied using 100 mm² as the standard smear size. It is seen that the larger the smear, the higher will be the cell count.

Figure 2 shows the counts for each sample and

TABLE 5. THE MEAN PER CENT[a] OF CELLS IN EACH OF THE NINE PARTS[b] FOR DIFFERENT SIZE SMEARS

a. 49 Sq. Mm.

10.2	11.1	9.0
14.2[c]	13.6	11.1
9.5	11.2	10.2

b. 72 Sq. Mm.

9.1	11.7	10.3
12.9	14.4	11.5
9.6	11.7	8.9

c. 100 Sq. Mm.

7.7	12.6	8.8
13.0	16.0	12.1
8.9	12.5	8.5

d. 144 Sq. Mm.

6.9	11.8	8.6
11.7	20.2	12.2
7.8	12.3	8.6

e. 196 Sq. Mm.

10.1[d]	11.1	8.3
11.2	22.8	10.9
7.8	10.6	7.1

[a]Mean of counts on 4 smears for each size.
[b]Parts refer to those designated in Figure 1.
[c]Significantly different from the other middle outside parts P>.001.
[d]Significantly different from the other outside corner parts P>.01.

TABLE 6. PER CENT VARIATIONS IN COUNTS MADE THROUGH DIFFERENT AREAS OF A SMEAR

Area[a]	6 Smear group	32 Smear group	26 Smear group	All smears
A	—	− 2.4	− 1.0	− 1.8
B	+9.5	+15.4	+12.2	+13.5
C	—	− 7.4	−11.2	− 9.1
D	—	− 8.9	− 9.5	− 9.2
E	+5.9	+ 2.6	+13.4	+ 7.3
F	—	+ .7	− 3.8	− 1.3

[a]Letters refer to areas designated in Figure 1.

smear size in trial 4B and the line of "best linear fit" for the counts on each sample computed via the least squares method. It is apparent that the higher the cell count, the steeper is the line of "best linear fit." This increased steepness appears to be due to a relatively constant per cent of change of cell count between the different smear sizes, regardless of sample cell content. Hence, the higher the cell count of a sample, the larger will be the difference in number of cells between smear sizes.

The pattern of cell distribution for different smear sizes is shown in Table 5. As also observed in Trial 3 there is a pattern of cell distribution with the outside corner parts, 1, 3, 7 and 9, comprising one group, the outside middle parts, 2, 4, 6 and 8, comprising a second group, and the center part, 5, comprising a third group. It is seen that with increased size of smears, there is an apparent decrease in cell concentration in the outside parts, with subsequent increase in concentration of cells in the center part.

DISCUSSION

The distribution of cells in smears indicates a tendency for cells to migrate from the outer parts, 1, 3, 7, 9 towards the inner parts, 2, 4, 5, 6 and 8, as the smear dries. The last part to dry is usually part 5, hence it has the most cells. This appears to be true regardless of the size of a smear. This pattern has also been observed for bacteria in milk smears *(2)*.

There is apparently a consistent variation in the distribution of cells in a smear. In general, a 3:4:3 distribution of cells can be expected if a smear is divided into equal thirds and counts are made either horizontally or vertically through the central third (Tables 2 and 5c). If a smear is divided into ninths (Figure 1), then approximately 15% of the cells are in the center ninth (part 5), and generally between 10 and 12% in each of the other outside parts (Table 2), with the outside middle parts containing an average of approximately 8% more cells than the outside corner parts. Since no differences in total count were obtained between smears dried at room temperature and at 37 C it would appear that differences in drying temperature within this range did not greatly alter migration patterns *(8)*.

Table 6 illustrates that counts made through different areas of a smear will not agree. Counts made through the center of the smear (Figure 1, B and E) will generally overestimate cell numbers by about 10.4%. This, of course, is due to the high proportion of cells in the middle ninth (part 5) and to a lesser extent the higher proportion of cells in the middle outside part, 2, 4, 6 and 8.

Theoretically, the area of the smear selected for counting should be based on the pattern of the cell distribution found on smears when the smear is divided into ninths (Figure 1 and Table 2), so representative fields are counted in each part. This, however, is not practical. In the interest of a good routine method that is repeatable and accurate, it is suggested that counts be made through the center as stated by Standard Methods for the Examination of Dairy Products *(1)*. Although counting in this fashion will overestimate by approximately 10%, a downward adjustment of 10% could be made whenever a more accurate estimate is needed. This adjustment could be built into the routine by adjusting proportionally either the WF or the number of fields to be counted. In most instances, this correction can be ignored but it is important that standard counting procedures be followed so that all counts in a group will be comparable.

Application of the Prescott-Breed method to any smear size other than 1 cm^2 (100 mm^2) would produce counts markedly different from those made on 1 cm^2 smears. Within the limits of the sizes examined, if larger smear sizes are counted through the center, the counts will be higher; if smaller smear sizes are used, the counts will be lower (Table 4). The change in cell count with change in smear size is apparently due to the change in the pattern of cells found in smears (Table 5). With increased size of smears, there is a larger proportional concentration of cells in the center of smears, with a corresponding decrease of cells in the outside parts. The pattern of cell migration appears to be the same in all smear sizes, that of movement from parts 1, 3, 7 and 9 into parts 2, 4, 5, 6, and 8, with concentration of cells in the center part, part 5.

Results in Trial 3 had indicated that part 7 was unexplainably significantly lower than the other outside corner parts, 1, 3, and 9, (Table 2). It is noticed in trial 4B (Table 5) that part 7 did not vary significantly from the outside corners for any of the smear sizes, although the method of making and counting smears was not knowingly varied between the 2 trials. There is no reason to expect that part 7 should consistently differ from parts 1, 3, and 9.

Conclusions

1. Uniform criteria are necessary for recognition of somatic cells to be counted.

2. The number of cells counted in any given smear can vary considerably depending upon the area of the smear selected for counting.

3. Cells tend to migrate toward the center of the smear. This resulted in a 3:4:3 ratio for cell numbers in equal thirds of the smear when counted through the center, either horizontally or vertically on smears dried at room temperature.

4. Cell numbers also tend to increase in that portion of the smear where the making of the smear is started and stopped.

5. Higher cell counts are obtained for counts through the center if the smear area is increased. This results from a heightened tendency of cells to migrate toward the center. By the same token, smear areas of less than 1 cm^2 tend to give lower total cell counts by the same counting method.

6. Standardized procedures for counting cells are essential if uniform results are to be obtained. These include the following:

a. Uniform procedures for smear making.

b. Uniform smear size standardized at 1 cm^2.

c. Uniform criteria for cell recognition as described herein.

d. Uniform procedures for field selection. It is recommended that every other field be counted as the objective is moved through the center from one edge of the smear to the other.

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PROGRAM FOR CERTIFYING BAKERY EQUIPMENT UNDER WAY

The Baking Industry Sanitation Standards Committee, through its Office of Certification, began on January 1, 1966 its program to certify bakery equipment conforming to BISSC sanitation standards. Information supplied on registration and application forms furnished bakery equipment manufacturers and others interested forms the basis of certification.

A distinctive BISSC certification symbol has been approved and application for appropriate registration of the symbol has been filed. The BISSC program will require that the symbol be affixed to certified equipment in juxtaposition to the manufacturer's name plate or be a part thereof. Where this is impracticable it shall be stamped, etched or embossed on the equipment.

BISSC was established in 1949 and is comprised of representatives from six national trade organizations, four national sanitarian organizations, and FDA and USDA and USPHS. Twenty-three sanitation standards for bakery equipment have been developed, approved and published to date and a number of other standards are nearing completion. It is planned to continue the program until all bakery equipment and machinery has been covered effectively by BISSC sanitation standards.

HOW THE FOOD SERVICE INDUSTRY LOOKS AT THE SANITARIAN[1]

Vernon E. Cordell

National Restaurant Association
Chicago, Illinois

Please accept greetings from the National Restaurant Association. I recognize you as the misunderstood, underestimated, long suffering, deserving, ground slogging doughboy heroes of the fight to keep our restaurant customers safe and healthy. There isn't a thing wrong with you that a little more cooperation and adequate recognition by both restaurateurs and the general public won't cure. Recognition of trained, qualified public health sanitarians by states and municipalities through registration, realistic pay structures and opportunities for professional improvement is certainly merited. Recognition by the restaurateur of the very important part you play in the successful operation of his business and the protection of both his customers and his employees is certainly deserved. And, finally, the public owes you much for the thorough job you are doing under a myriad of difficulties in safeguarding them from an infinite number of dangers.

You need a good press agent or two. It is my intention to see that you get "good press" as far as the restaurant industry is concerned. If I am to do a good job for both of us I must know that we understand each other so let's talk about the food service industry and you.

Over a half million food service establishments of all types in this country utilize 3,000,000 employees in providing 15 billion meals annually. Thirty-four billion pounds of food is required for these meals, constituting about one fourth of the food produced in the United States. About 375,000 of these establishments are public restaurants employing over 2,000,000 persons.

What a terrific management responsibility and what a multiplicity of exposure to hazards of health and safety! Added to the tremendous magnitude of the industry itself is the fact that no other industry operates with establishments which contain so many varied elements of danger to health and safety. Not only are we faced with the problems of safeguarding perishable food from contamination in storage, preparation and serving and with the protection of both customers and employees from illness and infection, but we must also cope with numerous hazards to life and safety.

Years ago, most Americans ate at home except for the drummer who "took his meals" at the local travelers hotel or boarding house. Now America eats out in ever-increasing numbers—in a hurry by necessity or leisurely for pleasure and adventure—in the city, on the highway, on the ground, on the water, or in the air. All kinds of establishments have sprung up to meet these varied demands. The cafeteria, the drive-in, the sandwich shop, the snack bar, the atmosphere restaurant, supper clubs and theatre restaurants, specialty houses such as pizzarias, barbeque stands, etc. are just some of the many types of establishments which were unknown in earlier days. The kitchens of these are equally varied in many ways. Some restaurant kitchens are small, some are very large, some are simple with little equipment and some filled with complex equipment of many types.

Some Problems of the Food Serving Industry

From all these variations in types of food service and types of facilities, equipment and procedures come increased problems in safeguarding both customers and employees from infection, illness and injury. You as sanitarians and we of the food service industry have justifiable reason to be concerned with food protection, restaurant sanitation and employee hygiene.

The accelerated availability of preprocessed foods of all types, the greatly increased use of perishable foods from distant points, the lengthened lines of food in transit and increased requirements for refrigeration and freezer storage have heightened our dependence on you to insure the arrival of these food supplies at our kitchen door free from harmful contamination of any kind. With your cooperative assistance, we'll then take it from there.

The international situation brings new dangers into the picture. We face the spector of reduced and changing manpower and a reduced availability of equipment. We must move further toward simplified operations which make more efficient use of equipment and greater use of convenience and pre-prepared food necessary. With the increase use of more kitchen-ready foods come changed procedures and new dangers.

We need your help more than ever before to make certain safeness in our food handling and preparation. We look to the team of the public health officer, the sanitary engineer and the sanitarian—all qualified in overlapping fields, to give us the guidance and assist-

[1]Presented at the Interstate Sanitation Seminar, University of North Carolina, Chapel Hill, August 12, 1965.

ance needed to assure the protection of both our customers and our employees. We look to you to determine the causes of illness outbreaks and to guide us in initiating corrective steps or procedures. We hope for equal support from you in disproving cases that are falsely laid at our door.

How can the protection of the dining public be most effectively accomplished? Three paramount points which come to my mind are: *(a)* uniform regulations, *(b)* qualified health inspectors, and *(c)* sanitarians who know the problems of food service operations. Let's take these points one at a time.

UNIFORM REGULATIONS

I believe that effective food protection nationwide can best be accomplished through the application of uniform regulations based on substantiated health requirements understood by both public health officials and the restaurateur.

The model ordinance and code of the U. S. Public Health Service stands as the cornerstone for achieving uniformity, with the National Sanitation Foundation's standards of food service equipment adding essential form to the base structure. The research accomplished and guidance material prepared by these and other organizations and individuals constitute an assist toward reaching our objective.

The National Restaurant Association's meeting last year with the nation's leading public health and sanitarian organizations and other such meetings to come are important to the purpose of achieving meaningful communication with each other, an understanding of mutual problems and objectives and an understanding of what is actually required to successfully achieve the complete protection of the public.

Given the nationwide acceptance of these substantiated requirements, reflected at state and local level in the regulations and ordinances which uniformly state these requirements, we are next concerned about the fairness and impartiality of their application and interpretation. This must be accomplished by a sanitarian who knows exactly what must be done, dealing with a restaurant operator who recognizes its necessity.

The new system of evaluating food protection programs through the use of certified survey officers is believed to be the most effective method of assuring uniformity in the application and interpretation of requirements. It is of great importance to the food service industry that uniformity in regulations be achieved.

The most significant trend within the food service industry is toward multiple unit operations, the franchized operation and food service performed by management contractors. Each of these types has greater capabilities and resources for providing economical and efficient food service to meet the tremendously increased dining-out requirements. The economies and business efficiencies of centralized programming and planning, control over the development and use of food and equipment standards and purchase specifications, and standardization of facilities, equipment, layout, menus and recipes and operating procedures are generally recognized. Well engineered facilities and effective procedures are assured. Competent supervision by qualified, properly trained and motivated supervisors is the final touch. But the operator who tries to extend the efficiencies of the multiple-unit operation faces variations in restaurant sanitation regulations, concepts and interpretations regarding construction, equipment installation and operational procedures which frequently nullify and obstruct his efforts.

DESIRABLE FEATURES

What are the desirable features which should be embodied in food establishment sanitation regulations? I think they can be summed up in this manner:

1. They should consist of provisions which, being self explanatory or backed-up by sound and convincing explanation, are recognized by the operator himself as being necessary for the protection of both the dining public and the establishment's employees.

2. They should contain requirements which are the minimum necessary to adequate protection. Encourage the operator who can afford and see the advantages of making improvements above and beyond the minimum but do not force them on him. Business funds don't grow on trees. Our margins are small and tight and can vanish quickly.

3. They should not include provisions which are more or less stringent than have been substantiated as necessary. Overly stringent requirements, introduced into the documents as additional margins of safety, unnecessarily increase operational costs, make compliance more difficult and undermine mutual trust and understanding bewteen the health department and the restaurateur.

Conversely, provisions which are not sufficient to insure adequate protection not only endanger the safety of all, but deprive the operator of the controls and guidance he needs for effective management. The progressive restaurateur most certainly will deplore slack regulations as he resents unreasonable ones.

4. They should include only provisions which relate to sanitation and food protection. The aesthetic and requirements designed to enhance customer and employee comfort are prerogatives of management. Only in the case of the aesthetic does the health

officer have any concern at all and this is when there is indication of a shabby, ragged, inefficient appearance which suggests an unwholesome and unsanitary operation to the customer.

All of these provisions must, however, be compatible with capabilities of the food service operation. No protection program can be successful unless it is based on proven necessity and it within the realm of practicability. Ordinances built in accordance with these guidelines will, even then, be acceptable only when applied and interpreted with fairness and uniformity and with the exercise of good judgement.

We strongly hope that the complexities which exist with respect to regulations and inspection systems will be resolved to eliminate conflicting and confusing requirements, and to insure a strengthening of food protection program across the country.

QUALIFIED HEALTH OFFICIALS

The protection of the dining public can best be accomplished through the enforcement and guidance activities of qualified public health officials. By this I mean that inspections of our facilities should be accomplished by trained, experienced sanitarians who know their jobs and have the wisdom and good judgement to deal effectively with the food service operator. The man who truly knows his business usually exhibits the flexibility and reasonableness which are necessary to get results.

It is for the reasons mentioned that the National Restaurant Association has gone on record in support of the move to register and certify sanitarians on the basis of qualification. During the past six months we supported the sponsors of such a measure in Illinois and last week we wrote the Governor of that state urging his approval of the bill which recently passed both houses of the legislature. We stand ready to give similar support elsewhere. We hope that legislation for this purpose will not result however, in the permanent inclusion of non-qualified incumbent food establishment inspectors.

We believe that the worth of sanitarians is measured in their knowledge and capabilities, not in mere numbers. One good sanitarians far outweights any number of bad ones. For this reason we feel that a fair share of the tax dollar should go for the protection of the dining public and that the health department pay structure should be adequate to attract and hold the professionally trained sanitarian. It is in the further interest of the public that this man be given the opportunity to improve himself professionally, that he may keep fully abreast of new findings in illness causatives, changes in food service procedures, products and equipment and developments in food protection.

KNOWING FOOD SERVICE OPERATIONS

And finally, the protection of the dining public can be far more effectively accomplished if the sanitarian knows the food service operation and its problems.

What daily thoughts plague the average operator? He thinks constantly of his business—its success and survival. He must face up to his competition. He is constantly sensitive to what he must do to attract and hold his customers. He fears changing situations and conditions which will catch him short. He worries daily over the problems and costs of food procurement; equipment and equipment maintenance; of personnel—meeting the payroll, coping with absences, turnover, training and supervision; and of financing, taxes, insurance coverage and rates and so on. Is it any wonder that the sanitarian frequently finds the operator preoccupied and difficult to approach?

Yet the progressive operator knows that his business success is built on volume of patronage and that, in turn, is built on customer confidence in his establishment and the tangible evidence of management efficiency. He knows that good food in generous quantities, served efficiently and with a smile in a clean, wholesome, sparkling establishment will insure that public confidence and his success. He also knows that sick and absent cooks and waitresses won't help him get that good food out of the kitchen and into the dining room.

How can you reach this busy man? By learning as much as you can about his operation and its problems and by convincing him that you are as important to his business success as anything he is doing. You must approach him through his own point of view by being a helpful partner rather than a policeman.

What are the various thoughts which the average operator may have about the local food sanitation ordinance and about recommendations made during the course of the sanitarian's inspection visits? I think you will find them to be many and widely varied but essentially they boil down to the following:

1. How much will it cost?
2. Are they practicable and within operational capabilities or do they constitute an obstacle to operational efficiency?
3. Are they worthwhile?
4. Are they necessary to the protection of customers and employees?
5. Will they aid in keeping employees on the job?
6. Will they actually help business and improve the operator's image in the eyes of his customers?

No operator has respect for, or will work willingly with, a health department representative whom he feels is finding fault or levying requirements just to prove to his superiors that he is doing a good job. The man who arbitrarily makes unreasonable, overly stringent and costly demands will face rough and unpleasant going. Any businessman, working to succeed, will welcome fairness, honestly and integrity and, particularly, the interested and sympathetic assistance which a qualified official can and should give. When you have convinced him of your objective interest, you will find him a willing listener and eager to benefit from your advice.

We are particularly pleased with the results of one sanitarian's efforts to improve his effectiveness with restaurateurs. Donald Day of Appleton, Wisconsin recently initiated an in-service training program which requires that a sanitarian work as a restaurant employee for one month. It's first phase has already been completed with the training of one of his staff.

The training took place in a supper club, a counter service establishment, a drive-in, a vending operation and a catering service. The total time involved was four weeks. The amount of time spent in each establishment varied depending on the volume of business. A minimum of eight hours per day was spent in each establishment. The work week was varied so that the sanitarian could work on Saturdays. The times of the day were varied so that he would work early hours and also late hours.

The conditions under which the work was performed were duplicated as nearly as possible with those of a regular restaurant employee so that the sanitarian could observe how their work was affected by their physical and mental attitudes. The actual work performed included washing dishes, preparing chicken for freezing, making baked goods, operating French friers, maintenance work, waiting on customers, assisting in catering for a party of one hundred twenty people, and assisting in servicing vending machines—vending hot and cold food, pop and candy.

The employers who took part in this program were pleased in that they felt the department would, as a result, be in a better position to help them with their problems. One reported benefit was increased respect from employers and employees toward the Health Department. Appleton restaurateurs and Public Health people consider this a step forward in strengthening the cooperation of an official agency with industry.

What Should Sanitarians Expect from the Operator

What do you have a right to expect from the food service operator? You should be assured that:

1. He recognizes his obligation to his customers and his employees as far as protection is concerned.

2. He has read and understands local food establishment sanitation regulations and the explanations which make plain the reasons for the various requirements. You must help him on this one. In some states there is such a gallimaufry of regulations that he can't be expected to understand them all.

3. He proves by his actions his willingness to meet the sanitarian at least half way in making food protection work.

Solid understanding must certainly be reciprocal. We recognize that resistance to change and the desire to receive before giving are universay obstacles to understanding. Only through frankness and honesty in discussing problems and their solutions can real progress be made.

We are working with our Association members to motivate and guide them in the direction of their best interests. We are working to help bridge the gap in understanding which exists between some operators and some health departments. With your cooperative assistance we'll both succeed, to the ultimate benefit of restaurateur, sanitarian and American public alike.

DAIRY AND FOOD ENGINEERING CONFERENCES AT MICHIGAN STATE

Michigan State University has scheduled its 1966 Dairy Engineering and Food Engineering Conferences and the programs have been announced. Detailed information is available from the Continuing Education Service at the University at East Lansing.

The Dairy Engineering Conference will be held on March 1 and 2 and is sponsored by the Departments of Agricultural Engineering and of Food Science. The program is being planned around the following topics: New Methods for Handling Milk and Milk Products; Transportation and Trucks; New Equipment and New Processes; Plant Layout Developments; and Closing the Automation Loop.

The Food Engineering Conference is scheduled for April 4 and will emphasize the use of microwave energy in food processing. Microwave energy appears to be on the threshold of a major expansion into many phases of food processing. The 1966 Conference will attempt to present the engineering background necessary to the selection of an energy source and equipment followed by a discussion of the application of microwave energy to specific food processing operations.

GROWTH OF CERTAIN PSYCHROPHILIC BACTERIA IN PASTEURIZED MILK AS INFLUENCED BY PREVIOUS EXCESSIVE PSYCHROPHILIC GROWTH IN THE RAW MILK

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Summary

The effect of excessive psychrophilic bacterial growth in raw milk on the growth of psychrophilic bacteria reintroduced into the milk after pasteurization was studied. The results indicated that excessive psychrophilic growth in raw milk had a stimulatory effect on the ability of *Brevi. lipolyticum* and a psychrophilic isolate to initiate growth after pasteurization and grow more rapidly than in the normal pasteurized milk for one or two days, the effect becoming slightly but insignificantly inhibitory by the end of three or four days. The effect was inhibitory on the growth of *P. fragi* after one, two, three and four days in pasteurized milk. There was a slight but insignificant stimulatory effect on the growth of *P. fluorescens* in pasteurized milk in four days. Analysis of the means of the logarithms of the psychrophilic counts in each series of trials on the fourth day after inoculation indicated a slight inhibitory effect on growth from excessive pre-pasteurization psychrophilic growth. However, this effect was not pronounced enough to be statistically significant.

The importance of psychrophilic bacteria in the dairy industry is linked to their ability to grow at refrigeration temperatures and has been accentuated by increased emphasis on flavor and increased holding times of both raw and pasteurized milk. These organisms invariably constitute a part of the normal flora of raw milk supplies *(14)* and are responsible for the deterioration of quality when the milk is subjected to conditions that permit their growth.

Even though the natural habitat of psychrophilic bacteria is soil and water *(7, 15)*, pipelines, milk cans, holding tanks, pumps, valves, and milking machines have all been cited as sources of contamination of milk. Likewise, the preponderance of evidence indicates that the commonly encountered psychrophiles in milk are destroyed by proper pasteurization. Yet, Elliker et al. *(4)* believe that the presence of psychrophilic bacteria in pasteurized milk may well be the major sanitation problem confronting the dairy industry. Thomas *(14)* cited improperly cleaned dairy equipment as the main direct source of contamination; while Erdman and Thornton *(5)* concluded that the presence of psychrophilic bacteria in freshly pasteurized milk indicated inefficient plant sanitation. Elliker et al. *(4)* concluded that contaminated equipment between the pasteurizer and the final container was the most important source of bacteria in pasteurized milk.

Many reports on the growth of psychrophilic bacteria are available *(2, 3, 6, 8, 9, 11)*. However, the growth characteristics of these organisms have not been fully determined. El-Farekh *(3)* determined the generation time for three common species in milk held at 4 C. Gyllenberg et al *(6)* studying the growth characteristics of the most frequently occurring saprophytic bacteria in milk observed that the rapid growth of pseudomonads was the prerequisite for an accelerated multiplication of acidogenic bacteria. Some dairy plant operators have expressed the opinion that psychrophilic growth in milk prior to pasteurization also influenced the growth of these organisms after pasteurization. Experimental data to further characterize the nature of psychrophilic bacterial growth in milk, particularly regarding the latter thesis seemed to be appropriate.

Experimental Procedure

The four bacterial species used in this study were *Pseudomonas fluorescens, Pseudomonas fragi, Brevibacterium lipolyticum* and an unidentified psychrophilic isolate from bulk raw milk. Stock cultures of these organisms were maintained on Milk-Protein Hydrolysate agar slants held at 5 C. Working cultures were transferred daily in Trypticase Soy Broth and incubated at 21 C. The number of organisms in each working culture was determined by diluting one part of working culture with ten thousand parts of sterile skim milk and counting by standard microscopic procedure *(1)*.

The inoculum for each sample was prepared by suspending 1 ml of the working culture in an appropriate volume of the diluent so that 0.5 ml would provide approximately 1000 cells per ml in the milk sample.

Fresh raw milk for the study was collected aseptically from a bulk farm cooling tank. A Standard Plate Count *(1)* was made on the raw milk using M-PH agar and an incubation temperature of 35 C. The milk sample was then divided into two 50-ml portions, placed in sterile bottles and designated as A and B for comparison. The control (sample A) representing high quality raw milk was pasteurized at 63 C for 30 min in a constant temperature water bath. After pasteurizing and cooling a total baceria count was made and the sample stored at 0 C. Sample B was inoculated with approximately 1,000 psychrophiles per ml, plated for the Standard Plate Count *(1)*, and incubated at 7 C. Growth of organisms in Sample B was determined daily, beginning one day after inoculation, by microscopic examination *(1)* until the count exceeded 400,000 per ml. Sample B was then plated for the Standard Plate Count *(1)* and pasteurized

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TABLE 1. GROWTH OF *Pseudomonas fluorescens* IN PASTEURIZED MILK PRIOR TO AND AFTER EXCESSIVE PSYCHROPHILIC GROWTH IN THE RAW MILK

Trial	Counts[a] after inoculation[b] and storage at 7 C							
	1 day		2 days		3 days		4 days	
	A[c]	B[d]	A	B	A	B	A	B
					(in thousands)			
1	NG[e]	NG	3.0	NG	46	21	2,000	1,400
2	2.3	0.7	170	3.2	29,000	154	50,000	9,500
3	1.1	1.7	14	18	4,300	370	29,000	20,000
4	4.2	3.6	43	2,000	8,100	3,400	27,000	10,000
5	5.9	5.3	640	570	3,000	660	11,000	4,500
6	0.3	0.8	500	490	81,000	130,000	12,000	11,000
7	0.7	0.8	3.4	20	12,000	520	35,000	49,000
8	9.3	10	110	330	10,000	9,200	15,000	43,000
9	0.1	0.1	5,100	480	150,000	150,000	18,000	76,000
10	2.2	2.3	15	2.4	170	140	4,100	32,000
11	2.0	2.2	6.0	9.8	730	4,200	50,000	78,000

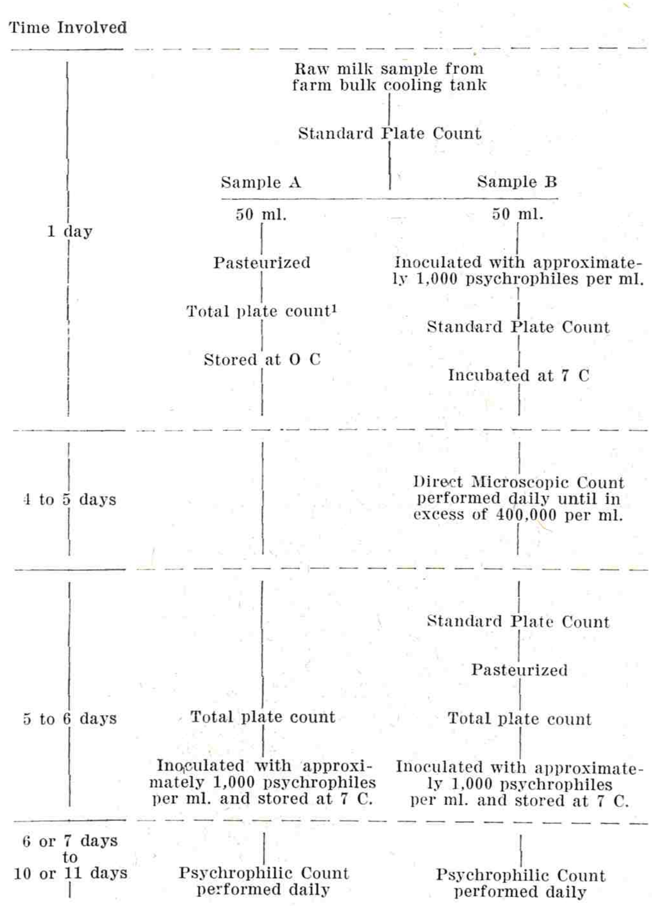
[a]Average of duplicate surface plates with incubation at 7 C for 5 days.
[b]Samples were inoculated with approximately 1,000 organisms per milliliter.
[c]Pasteurized prior to excessive growth and held at 0 C until inoculated.
[d]Pasteurized after excessive growth and then re-inoculated.
[e]No visible growth on agar plates.

at 63 C for 30 min. Total plate counts were then performed on both samples A and B. Sample A was inoculated and sample B re-inoculated with approximately 1000 psychrophiles per ml and both samples stored at 7 C. For four successive days, beginning one day after the final inoculation, psychrophilic plate counts were made on both samples using the surface plate method described by Punch and Olson *(12)* with incubation at 7 C for five days. Figure 1 presents the procedure graphically and the approximate time involved in handling of the designated samples. The logarithms of the psychrophilic counts, four days after the final inoculation, were analyzed statistically using the F test as described by Steel and Torrie *(13)*.

RESULTS AND DISCUSSION

A series of trials was perfomed with each of three pure cultures of psychrophilic bacteria and one psychrophile isolated from bulk raw milk. In the B sample, where psychrophilic growth in excess of 400,000 organisms per ml was desired, some variation in the total count at the time of pasteurization occurred. This resulted primarily from the very slow growth of some of the cultures for one to three days and exceedingly rapid growth during the next 24 hr.

The data in Table 1 represent a series of eleven trials performed with *Ps. fluorescens.* Growth for this species was quite limited at the end of the first day with trials 1, 6, 7 and 9 actually showing a decrease in numbers of organisms in both samples A and B. At the end of the second day considerable growth had occurred in many of the trials, yet, in trial 1B there was still no visible growth on the agar plates. Also in trials 1A, 2B, 7A, and 10B only limited increases



[1]Total plate count differed from the SPC in that plates containing less than 30, colonies per plate were counted.

Figure 1. Experimental procedure used for comparing psychrophilic growth in pasteurized milk samples prior to and after excessive psychrophilic growth in the raw milk.

TABLE 2. GROWTH OF *Pseudomonas fragi* IN PASTEURIZED MILK PRIOR TO AND AFTER EXCESSIVE PSYCHROPHILIC GROWTH IN THE RAW MILK

Trial	Counts[a] after inoculation[b] and storage at 7 C: 1 day A[c]	1 day B[d]	2 days A	2 days B	3 days A	3 days B	4 days A	4 days B
	(in thousands)							
1	0.4	0.3	15	12	25,000	570	110,000	34,000
2	57	4.1	4,700	420	61,000	38,000	180,000	95,000
3	5.0	5.7	16,000	12,000	91,000	79,000	240,000	180,000
4	240	140	8,700	6,700	75,000	46,000	210,000	150,000
5	0.5	5.5	38,000	18,000	170,000	97,000	250,000	140,000
6	5.5	6.0	5,700	1,500	100,000	25,000	180,000	100,000
7	NG[e]	0.6	79	240	28,000	21,000	120,000	92,000
8	0.2	2.2	140	130	26,000	7,500	130,000	56,000
9	18	36	13,000	6,500	130,000	144,000	250,000	270,000
10	88	35	7,600	16,000	171,000	169,000	270,000	350,000

[a]Average of duplicate surface plates with incubation at 7 C for 5 days.
[b]Samples were inoculated with approximately 1,000 organisms per milliliter.
[c]Pasteurized prior to excessive growth and held at 0 C until inoculated.
[d]Pasteurized after excessive growth and then re-inoculated.
[e]No visible growth on agar plates.

TABLE 3. GROWTH OF *Brevibacterium lipolyticum* IN PASTEURIZED MILK PRIOR TO AND AFTER EXCESSIVE PSYCHROPHILIC GROWTH IN THE RAW MILK

Trial	Counts[a] after inoculation[b] and storage at 7 C: 1 day A[c]	1 day B[d]	2 days A	2 days B	3 days A	3 days B	4 days A	4 days B
	(in thousands)							
1	NG[e]	NG	6.5	1.5	180	93	34,000	3,100
2	5.0	17	1,400	3,700	98,000	94,000	110,000	160,000
3	1.7	6.1	50	230	1,000	2,000	30,000	50,000
4	0.1	1.2	380	1,600	48,000	26,000	180,000	110,000
5	0.6	0.8	210	18	7,000	270	150,000	36,000
6	8.7	18	850	1,800	5,100	20,000	85,000	160,000
7	29	21	2,000	1,300	19,000	7,900	98,000	170,000
8	5.4	20	870	1,800	29,000	23,000	240,000	200,000
9	8.9	26	830	1,500	30,000	35,000	230,000	270,000

[a]Average of duplicate surface plates with incubation at 7 C for 5 days.
[b]Samples were inoculated with approximately 1,000 organisms per milliliter.
[c]Pasteurized prior to excessive growth and held at 0 C until inoculated.
[d]Pasteurized after excessive growth and then re-inoculated.
[e]No visible growth on agar plates.

in number of organisms occurred. However, in trials 4B and 9A the number of organisms had increased to over a million. During the following two days the number of organisms in all trials increased rapidly and by the fourth day all counts were over a million. The growth of this species was more erratic than for the other species used and there appeared to be no difference in growth between the samples A and B on any day. The logarithms of all counts obtained on the fourth day were determined and statistical analysis applied using the F test *(13)*. These data are presented in Table 5 and no statistically significant difference at the 0.10 level of probability occurred between the two samples.

Ten trials with *Ps. fragi* are presented in Table 2. Although a wide variation existed in the growth of this species after the first day, growth was generally more pronounced than with *Ps. fluorescens.* After the second day 13 of the 20 samples had counts in excess of a million indicating the very rapid growth of this species. The counts on sample A were greater than those on sample B in the first eight trials on the third and fourth days after inoculation but the reverse was true in trial 9. Also, sample A trial 10

TABLE 4. GROWTH OF THE PSYCHROPHILIC ISOLATE IN PASTEURIZED MILK PRIOR TO AND AFTER EXCESSIVE PSYCHROPHILIC GROWTH IN THE RAW MILK

Trial	Counts[a] after inoculation[b] and storage at 7 C: 1 day A[c]	B[d]	2 days A	B	3 days A	B	4 days A	B
	(in thousands)							
1	250	2,500	29,000	27,000	120,000	120,000	220,000	190,000
2	39	730	45,000	41,000	130,000	100,000	240,000	200,000
3	6,200	6,000	22,000	26,000	110,000	71,000	160,000	190,000
4	440	1,000	22,000	23,000	79,000	100,000	170,000	170,000

[a]Average of duplicate surface plates with incubation at 7 C for 5 days.
[b]Samples were inoculated with approximately 1,000 organisms per milliliter.
[c]Pasteurized prior to excessive growth and held at 0 C until inoculated.
[d]Pasteurized after excessive growth and then re-inoculated.

TABLE 5. LOGARITHMIC MEAN VALUES AND STATISTICAL SIGNIFICANCE OF PSYCHROPHILIC COUNTS FOUR DAYS AFTER INOCULATION OF PASTEURIZED MILK SAMPLES PRIOR TO AND AFTER EXCESSIVE PSYCHROPHILIC GROWTH IN RAW MILK

Organism	A[a]	B[b]	F value[c]	Statistical Significance
Ps. fluorescens	7.21	7.24	0.04	NS[d]
Ps. fragi	8.26	8.06	3.33	*[e]
Brevi. lipolyticum	8.02	7.90	0.25	NS
Psychrophilic isolate	8.28	8.27	0.14	NS
Average mean value	7.94	7.87	0.05	NS

[a]Pasteurized prior to excessive growth and held at 0 C until inoculated.
[b]Pasteurized after excessive growth and then re-inoculated.
[c]The ratio of the variances for among treatments and within treatments.
[d]No significant difference at the 0.10 level of probability.
[e]Significant difference at the 0.10 level of probability.

had a higher count after the third day than did sample B but the reverse was true after the fourth day. In most, but not all, cases throughout this series the sample inoculated prior to excessive psychrophilic growth (sample A) had counts higher than the sample inoculated after excessive psychrophilic growth in the raw milk (sample B). Statistical analysis *(13)* of the logarithms of the psychrophilic counts after the fourth day gave an F value of 3.33 (Table 5) which indicated a significant difference at the 0.10 level of probability. Eight of the 10 trials after 2 days had higher counts in sample A than in sample B indicating that *Ps. fragi* initiated growth in milk, pasteurized prior to excessive psychrophilic growth, at a very rapid rate. Post-pasteurization contamination of milk with this species could lead to lowered quality and possibly off-flavors in two or three days even though the milk was stored at refrigeration temperatures.

The data of Table 3 present a series of nine trials performed with *Brevibacterium lipolyticum*. No growth was evident in either sample A or B in trial 1 but in samples B2, B6, B8 and B9 the counts ranged from 17,000 to 26,000 per ml and sample A7 had a count of 29,000. The counts were higher on the first day after inoculation in the samples inoculated after psychrophilic growth (sample B) than those inoculated prior to excessive psychrophilic growth in the raw milk (sample A) in all trials except 1, where no visible growth occurred, and trial 7. This was true also on the second day after inoculation except in trials 1, 5 and 7. Even though these counts appear to be considerably higher they were not statistically significant at the 0.10 level. Likewise, the mean logarithmic counts (Table 5) after four days incubation were not significantly different *(13)*.

In trials with the psychrophilic isolate (Table 4) counts were quite high even on the first day after inoculation. Also the counts were higher in sample B on the first day than in A. This possibly could appear as a slight stimulatory effect on the initiation of psychrophilic growth in pasteurized milk but there was no significant difference after four days (Table 5).

From the results of this study with four species of psychrophilic bacteria it is evident that excessive pre-pasteurization psychrophilic growth in milk is not stimulatory for post-pasteurization growth of these organisms. In fact with *Ps. fragi* the excessive growth prior to pasteurization proved to be inhibitory. The necessity for sanitary handling of milk after pasteurization to avoid all possible contamination with these organisms becomes apparent from these results as all four species increased sufficiently in two or three days to bring about deterioration of milk quality.

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PUBLIC HEALTH SERVICE REPORT ON FISH KILL

Approximately 18.4 million fish died in 1964 as a result of water pollution, according to a report released by the U. S. Public Health Service. Industrial pollution accounted for about two-thirds of the number. Municipal wastes were responsible for some 22% and toxic substances from agricultural operations approximately 9%. The remainder were killed by various causes including transportaion operations.

This is the largest number of fish deaths reported since the Public Health Service began its annual census in 1960 and represents some 10.5 million increase over the 1963 report. However, it is highly likely that the total represents little more than a sampling of the actual kills. Part of this is due to the differing reporting procedures followed by various states and part to the obvious difficulties in monitoring the country's thousands of miles of fish streams and millions of acres of lakes and marine waters.

About one-third of the fish killed were considered to have some commercial value and about 15% were game fish. The loss of fish is doubly significant in water pollution control and it often signals a hazard affecting other users of water and a danger to public health. A kill occurs because of some sudden and deadly change in the aquatic environment and a stream may be expected to recover its fish population if given sufficient time. Serious kills seldom occur in badly polluted water because there are usually few or no fish in the stream to die.

A total of 485 official reports were received from the states reporting in 1964. Fifteen of the fish kills were classified as major disasters involving more than 100,000 fish each. Over one half of the incidents and two-thirds of the number of fish killed were reported in the July through September period.

Of the fifteen major disasters the largest took place in a stream near New Miami, Ohio, where some 7.8 million fish were reported killed due to industrial pollution. The second largest loss was 2 million fish attributed to pollution from the municipal sewerage system at Santa Barbara, California. The third largest, amounting to nearly 2 million, occurred near Slippery Rock, Pennsylvania, apparently from pollution from mining activities.

A wide variety of polluting substances were cited as the cause for the fish kills. These included drainage from a cannery, accidental spillage of muriatic acid into a storm sewer, acid mine drainage, strip mine pumpings, whey from a cheese factory, wet cement grindings from a cement plant, ammonia from a refrigertion system, excessive wastes from a slaughterhouse, poorly treated city sewage causing low dissolved oxygen and high concentration of ammonia, and miscellaneous contamintion from the use of insecticides and agricultural sprays.

The Public Health Service report indicates the difficulty in obtaining adequate data. Usually a report is received from a State fish and game agency or water pollution control agency investigating an occurrence but other sources and individuals are encouraged to send in data. The report form available to the various states is designed to provide as much significant information as possible.

EVALUATION OF STATE CENTRAL MILK LABORATORIES BY STATISTICAL ANALYSES OF STANDARD PLATE COUNTS

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Summary

Donnelly, C. B. (Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio), James T. Peeler, and Luther A. Black. Evaluation of state central milk laboratories by statistical analyses of standard plate counts.—Standard plate counts reported by analysts in 54 state central laboratories for "normal" milk samples sent out in 1961, 1962, and 1963 revealed that an incubation temperature of 32 C produced more colonies than 35 C, and that the overall variance, s^2, of counts for any sample should not greatly exceed 0.012. Based on this variance, $s^2 = 0.012$, 80% of the analysts should agree within 1.3 standard deviations of the logarithmic mean of 75% of the normal samples. A method for detecting outliers and judging the performance of individual analysts is described.

A procedure of splitting milk samples for agar plate counts by several analysts in different locations was utilized by Breed and Stocking *(1)* almost 50 years ago. As currently used, the split milk sample procedure generally requires that a sample of fluid milk be divided into portions, which are shipped to participating laboratories for examination by the agar plate and other methods *(2)*. Although not a substitute for periodic surveys of laboratory procedures and facilities, many states have found that an effective split sample program is a valuable supplement in improving the accuracy of results reported by milk laboratories. Participation of analysts in the examination of split samples promotes an increased awareness of the need for standardized methods and results in a more critical technique in examining routine as well as split milk samples. For laboratory administrators, the results also identify analysts or laboratories that report extremely high or low counts, and with this information the causes of extreme variation (e.g., media, dilution water, incubation temperature, and reagents) may be more readily determined and corrected.

The Public Health Service conducted its first split milk sample evaluation of state central milk laboratories from December 1957 to April 1958 *(2)*. In these initial evaluations only a small number of insulated shipping cases were available, and so the 42 participating states were divided into five groups and each group examined a different series of samples. From 1958 through 1960 a larger number of shipping cases permitted sending samples to half of the states at one time, and a month later the other half received a different set of samples. Beginning in 1961 all state central laboratories (54 laboratories in 49 states and the District of Columbia) were sent an identical set of the same split samples in a single mailing, and this same procedure was followed in 1962 and 1963. This paper describes the statistical analysis of the standard plate counts for 1961, 1962, and 1963. The growth of bacteria, as indicated by number of colonies, from "normal" milk samples at 32 and 35 C were compared, and variances among analysts over the 3-year period were estimated. In addition, statistical methods for determining the performance of individual analysts and detecting outliers (extreme values) are described.

Materials and Methods

Split Milk Samples.

The samples examined were "normal" milk samples. That is, they were fluid milk samples, which had not been heated in the laboratory and to which nothing had been added except raw milk (to the pasteurized and homogenized milk to provide phosphatase-positive samples) or mesophilic bacteria added to produce a desired range of counts. Six of these samples (duplicate raw, pasteurized, and homogenized milks) with a range of counts varying from 5,000 to 300,000 per ml were sent out in each of the 3 years. The preparation and shipment of the samples was essentially as described in Evaluation of Milk Laboratories, *(6)*. In most instances the samples were received and examined the day after they were shipped. Standard plate counts for each of the 3 years were reported for each sample by approximately 100 analysts who made and counted duplicate 1:100 and 1:1000 plates, which had been incubated at 32 or 35 C. For the statistical analysis, the standard plate counts were transformed to logarithms.

Statistical Methods.

The colony counts of the "normal" milk samples at 32 and 35 C were compared statistically by the Students t test, which tests for average differences between two populations means *(4)*. Variation of results between analysts was estimated by means of well known formulae found in most statistical texts. Methods for detecting outliers and judging performance of the individual analyst, based on the extent of the variation of his results from the logarithmic mean, were developed.

RESULTS AND DISCUSSION

Effect of incubation temperature on standard plate counts.

The standard plate counts reported for 1961, 1962, and 1963 by analysts who incubated their plates at 32 C were compared with the counts reported by analysts who incubated their plates at 35 C to determine whether there was an average overall difference in colony counts of plates incubated at the two temperatures. For this comparison, the counts, transformed to logarithms to the base 10, were assumed to be Gaussian[1] distributed under this transformation. There were 768 observations from data obtained at 32 C, with a logarithmic mean of 2.17162 (geometric mean 148), and a variance of 0.01757 with 767 degrees of freedom. From data obtained at 35 C there were 1,292 observations, with a log mean of 2.11843 (geometric mean 131), and a variance of 0.01335 with 1,291 degrees of freedom. Thus, there was a total of 2,060 observations with 2,058 degrees of freedom. Let $\alpha = 0.01$, and perform the t test as follows:

$$t_{2058} = \frac{\bar{x}_{32\,C} - \bar{x}_{35\,C}}{\sqrt{\frac{s^2_{32\,C}}{n_{32\,C}} + \frac{s^2_{35\,C}}{n_{35\,C}}}} \qquad (1)$$

where:

$\bar{x}$ = Sample mean
s^2 = Sample variance
n = Number of observations in sample

$$t_{2058} = \frac{0.05319}{\sqrt{\frac{0.01737}{768} + \frac{0.01335}{1292}}}$$

$$t_{2058} = 9.25$$

The value $t_{2058} = 9.25$ is significant at the $\alpha = 0.01$ level and in fact would occur less than 1 in 1,000 times by chance *(4)* if the two incubation temperatures actually yielded equal colony counts. It can be concluded that there is more growth, as determined by colony count at 32 C than at 35 C.

Estimate of variance.

Estimates of variation between analysts were calculated from the logarithms of the standard plate counts reported for plates incubated at 32 or 35 C for the six normal samples (duplicate samples of homogenized, pasteurized, and raw milk) for each of the years 1961, 1962, and 1963. Thus, there were 18 normal samples for the 3-year period, which yielded 2,080 observations (standard plate counts), 20 of which were excluded from the calculations because of extreme variation.

[1]The words "Gaussian distribution" are used here in place of the more commonly used "normal distribution" so as not to create confusion between biologically normal samples and normal distribution theory.

TABLE 1. LOGARITHMIC VARIANCE AMONG ANALYSTS AS INDICATED BY STANDARD PLATE COUNTS IN 1961, 1962, AND 1963 FOR THREE TYPES OF MILK

Year	32 C			35 C		
	Homogenized	Pasteurized	Raw	Homogenized	Pasteurized	Raw
1961	0.021	0.005	0.020	0.019	0.007	0.019
1962	0.066	0.018	0.013	0.033	0.009	0.012
1963	0.007	0.005	0.012	0.012	0.007	0.010

TABLE 2. POOLED VARIANCES FOR 1961, 1962[a], AND 1963

Year	Incubation temp. 32 C	35 C
1961	0.015	0.014
1962	0.032	0.018
1963	0.008	0.009
Overall	0.018	0.014

[a]Unadjusted for the 1962 homogenized milk samples.

TABLE 3. POOLED VARIANCES FOR HOMOGENIZED[a], PASTEURIZED, AND RAW MILKS[b]

Milk	Incubation temp. 32 C	35 C
Homogenized	0.031	0.021
Pasteurized	0.009	0.007
Raw	0.014	0.013
Overall	0.018	0.014

[a]Unadjusted for the 1962 homogenized milk samples.
[b]For 1961, 1962, 1963.

The variance of counts among analysts for each type of milk for each year is shown in Table 1. Variances for the homogenized milk in 1962 were higher than the other variances. Except for the homogenized milk sample for 1962, a plot of the observations revealed a single peak around the mean. A plot of the observations for the 1962 homogenized samples was bimodal, but the reason for this was not clear. Part of this variation may have been caused by certain analysts' reporting indicated incubation temperatures of 32 C, who were actually incubating their plates at a higher temperature. Temperature sensitive organisms that grow poorly, if at all, above 32 C were employed in certain special samples in this study, and no growth was reported for these samples by a number of analysts, whose data for the homogenized milk fall around the lower of the two peaks. As already pointed out, plates incubated at 35 C, on an average, yielded fewer colonies than plates incubated at 32 C so that a bimodal plot would be expected if the two groups of observations were mixed together.

The pooled variances for all three types of milk for the 3 years are shown in Table 2. Table 3 shows the pooled variances for the individual types of milk over the 3-year period. Variances reported in Table 2 and 3 are unadjusted for the homogenized milk examined in 1962. Tables 4 and 5 were adjusted by deleting the results for the homogenized milk examined in 1962, and show, respectively, the pooled variances calculated for all three types of milk (except the 1962 homogenized milk) for each of the 3 years and the pooled variances of the individual milk types sent out in the 3-year period.

While the overall estimate of the adjusted variances, 0.012, is the same as that suggested by Donnelly, et al. *(2)*, Table 4 shows a decrease in variance over the 3-year period. In particular, the variances for 1963 were lower than those for the 2 previous years. This may indicate a trend toward better agreement among analysts. Agreement (Table 5) was better among analysts for the pasteurized samples than for either the homogenized or raw samples.

Tests for detecting outliers.

There are a number of methods for rejecting outlying values from a group of observations. The two described here are of interest because there is a prior estimate of variation between analysts. The first method presented is an exact test, but is time-consuming. The second method is a shorter test for detecting outliers.

TABLE 4. POOLED VARIANCES FOR 1961, 1962[a], AND 1963

Year	Incubation temp. 32 C	35 C
1961	0.015	0.014
1962	0.015	0.010
1963	0.008	0.009
Overall	0.012	0.011

[a]Adjusted for the 1962 homogenized milk samples.

TABLE 5. POOLED VARIANCES FOR HOMOGENIZED[a], PASTEURIZED, AND RAW MILKS[b]

Milk	Incubation temp. 32 C	35 C
Homogenized	0.012	0.015
Pasteurized	0.009	0.007
Raw	0.014	0.013
Overall	0.012	0.011

[a]Adjusted for the 1962 homogenized milk samples.
[b]For 1961, 1962, and 1963.

The first method described by Quesenberry and David *(5)* suggested the statistic:

$$b^* = \max_i \left| \frac{x_i - \bar{x}}{S} \right| \qquad (2)$$

where:

x_i = Sample value
$\bar{x}$ = Sample mean
S = Estimate of the standard deviation based on a prior estimate of variance and on the variance of the sample.

TABLE 6. EXAMPLE OF METHOD TO DETECT OUTLIERS

Analyst	SPC/ml	X_i $\log_{10}$ SPC	Analyst	SPC/ml	X_i $\log_{10}$ SPC
1	170,000	5.230	14	180,000	5.255
2	15,000	4.176	15	150,000	5.176
3	130,000	5.114	16	190,000	5.279
4	130,000	5.114	17	130,000	5.114
5	190,000	5.279	18	130,000	5.114
6	140,000	5.146	19	110,000	5.041
7	120,000	5.079	20	110,000	5.041
8	89,000	4.949	21	140,000	5.146
9	140,000	5.146	22	170,000	5.230
10	10,000	4.000	23	130,000	5.114
11	140,000	5.146	24	100,000	5.000
12	130,000	5.114	25	120,000	5.079
13	140,000	5.146			

$n = 25$

$$\sum_{i=1}^{n} x_i = 126.228$$

$$\sum_{i=1}^{n} x_i^2 = 639.520$$

$\bar{x} = 5.049$
$s^2 = 0.091$

The value of b* is compared with a table that gives critical values for different significance levels, α. This procedure is repeated until a nonsignificant test is obtained. The example shown in Table 6 will be tested for outlying values, using $\alpha = 0.01$. Alpha (α) is the probability that a value which actually belongs to the true population will be rejected. For $\alpha = 0.01$, this would be expected to occur 1 in 100 times on the average.

Donnelly, et al. *(2)* calculated an estimate of variance $s^2\nu_1 = 0.012$, $\nu_1 = 20$, where ν_j ($j = 1,2$) is the degree of freedom. The logarithmic variance from the example is $s^2\nu_2 = 0.091$, $\nu_2 = 24$. The value of S in equation (2) is

$$S = \sqrt{\nu_1 (s^2\nu_1) + \nu_2 (s^2\nu_2)} \qquad (2a)$$

$$S = \sqrt{20\,(0.012) + 24\,(0.091)}$$

$$S = 1.557$$

The sample mean $\bar{x} = 5.049$ (Table 6) and $x_{max} = 4.000$ is the observation of analyst No. 10, which is furthest away from the sample mean; therefore,

$$b^* = \left| \frac{4.000 - 5.049}{1.557} \right| = 0.674$$

The value of $b^* = 0.674$ is significant at $\alpha = 0.01$, and the observation of analyst No. 10 is deleted. $\bar{x}$ and $s^2{\nu_2}$ are recalculated; and by repeating this procedure, it is determined that the observation of analyst No. 2 is the only other outlying value. The final estimate of variance is 0.007 with the two outliers deleted.

A second method is to find the observations outside an interval, $\bar{x} \pm 3s$, where s is the sample standard deviation based on a prior estimate of the variation among plate counts of analysts. If $s = 0.110$ (variance, s^2, equal to 0.012), then the interval $\bar{x} \pm 0.330$ will include about 99% of the observations about the mean ($\bar{x}$). Any value above 5.379 and below 4.719 will be out of limits; therefore, observations for analysts Nos. 2 and 10 (Table 6) will be deleted. In this study observations from split milk samples were compared to the interval $\bar{x} \pm 0.330$ to delete outliers. If the true sample variance is assumed to be 0.012 and this variance is used as the acceptable criterion of agreement, true members of the population will be rejected about 1% of the time on the average.

Detecting analysts with questionable numerical results. As has been pointed out, the overall logarithmic variation of the standard plate counts reported in the 1961 through 1963 split milk sample evaluations was 0.012. This variance therefore, will be used as the basis for determining acceptable agreement among analysts.

For the individual samples it is assumed that the logarithmic transformation will result in Gaussian distribution of the sample observations. The authors checked this assumption for several samples by calculating the number of analysts' observations that fell within certain fixed intervals and comparing them with values predicted for the intervals from a table of values of a Gaussian distribution with the same sample mean and variance. The resulting frequencies were compared by a χ^2 goodness of fit test to see whether the observed values were significantly different from the predicted values *(4)*. In all cases tested the χ^2 test was nonsignificant at the $\alpha = 0.01$ level, where α is defined as the probability of rejecting a hypothesis when it is true. Since there was insufficient evidence to the contrary, it was assumed that the samples were approximately Gaussian distributed.

The probabilities that will be quoted are more nearly correct for large sample sizes. In this study the population was composed of all analysts who used a certain prescribed procedure (standard methods, equipment, incubation temperature, etc.). Two methods for detecting observations (outliers) that may represent departures from the population under consideration have been described. These outliers are usually a result of some gross deviations from the true population (i.e., using an incubation temperature of 33.5 C when 32 C is required). A value that is too far away from the sample mean may, however, reflect a departure in procedure by the analyst, or it may represent a chance value that occurred even though the analyst strictly adhered to the procedure.

The purpose of this section is to set up a test that will detect questionable observations that would occur only a small proportion of the time by chance alone. First, limits must be chosen to be used for each sample. This will result in the acceptance of observations within some limits of the Gaussian curve around the mean of each of the samples submitted for analysis. The convention used here will be to express the limits in terms of the standard deviation of an acceptable sample, which we have defined as having a variance of 0.012 (standard deviation, 0.110). The variance, s^2, of a sample can then be calculated, and the predicted number of analysts can be compared with the observed number found by using limits based on the acceptable sample. If the variation of a sample is greater than 0.012, then a larger number of analysts with observations out of limits should be detected.

The limits chosen to test each sample were log mean $\pm$ 1.3, where $s = 0.110$. Hoel *(3)* states that a set of data from a Gaussian population will contain about 95% of the observations of the sample between the limits $\bar{x} \pm 2s$ when the number of observations, n, is large. In a similar manner it can be stated that about 80% of the observations fall in the interval, $\bar{x} \pm 1.3s$, if there are at least 10 observations in each sample. It can be stated, therefore, that for a very large (100 or more) sample of observations with a variance of 0.012 about 80% of the observations will be within the limits $\bar{x} \pm 0.143$ where 0.143 is 1.3 times 0.110. For smaller samples the observed percent may not agree so closely with the predicted value. The predicted and observed values for 32 samples, listed in Table 7, indicate that the predicted values are closer to the observed values when the number of observations is larger.

A major asset of this test is that the actual sample variance does not have to be calculated in order to use the test, inasmuch as the test separates values that are away from the mean from values near it.

The situation in which the analysts submit results for k biologically normal samples may now be considered. If it is assumed that the samples are independent, each with variances of 0.012, a probability of acceptance of analysts can be calculated. In order to calculate this limiting probability (when all the true sample variances equal 0.012), it is necessary to set the number of samples out of k that will be allowed out of limits before it can be stated that an analyst has failed to comply a reasonable number of times.

Let the limit of 25% of the k (75% of samples must be within limits) samples be set as the maximum allow-

TABLE 7. PERCENT OF ANALYSTS ACCEPTED COMPARED WITH THE PREDICTED PERCENT ACCEPTED WITHIN LOGARITHMIC MEAN ± 0.143

Year	32 C source	% observed	Accepted predicted	Year	35 C source	% observed	Accepted predicted
1961	H4[a,b]	79(34)[c]	65	1961	H4	70(77)	68
	H5	74(34)	70		H5	77(77)	72
	P6	97(34)	94		P6	92(77)	89
	P7	100(34)	98		P7	96(77)	97
	R10	71(34)	70		R10	74(77)	71
	R11	79(34)	69		R11	81(77)	72
1962	P7	89(44)	72	1962	P7	90(68)	90
	P8	89(44)	72		P8	88(68)	85
	R12	82(44)	81		R12	87(68)	87
	R13	89(44)	79		R13	85(68)	77
1963	H3	92(51)	92	1963	H3	85(74)	83
	H4	94(51)	93		H4	87(74)	81
	P5	90(51)	93		P5	92(74)	97
	P6	92(51)	98		P6	96(74)	90
	R12	86(51)	84		R12	82(74)	87
	R13	88(51)	89		R13	82(74)	85

[a]H = homogenized milk; P = pasteurized milk; R = raw milk.
[b]Type of milk and sample number.
[c]Number of observations.

able number of observations outside $\bar{x} \pm 0.143$, for any one analyst. The chance of an analyst being within these limits if two or less of eight observations exceed the limits can be calculated as follows:

$$\Pr(x \leq r) = \sum_{x=0}^{x=r} \binom{k}{x} p^x \left(1-p\right)^{k-x} \quad (3)$$

$$x = 0, 1, \ldots, k$$
$$r < k$$
$$= 0 \quad \text{otherwise}$$

where:

x = Number of observations out of limits
r = Number of allowable observations out of limits
k = Number of samples
p = Probability of rejection when $s^2 = 0.012$
$1 - p$ = Probability of acceptance when $s^2 = 0.012$

Substituting in equation (3),

$$\Pr(x \leq 2) = \sum_{x=0}^{x=2} \binom{8}{x} \left(0.2\right)^x \left(0.8\right)^{8-x} = 0.80$$

It can be concluded that 80% of the analysts will be accepted when they are allowed to have observations outside the limits $\bar{x} \pm 0.143$ on two or less samples out of eight. If the variances of the samples are larger than 0.012, then fewer analysts will be found acceptable.

Examples of application of test criterion to split sample survey data.

The method outlined below is based on work in the two preceding sections where it is stated that analysts should agree within 0.143 of the logarithmic mean of the counts per ml on 75% of the biologically "normal" milk samples. The procedure will then accept approximately 80% of the analysts when the logarithmic variance is 0.012 on each of the samples. In addition to other assumptions already mentioned, samples are assumed to be homogeneous in composition and to have been kept at a uniform temperature between 32 and 40 F from the time of their preparation until they are examined. The steps for the statistical analysis are:

1. Using logarithmic tables, look up the logarithms of all the counts per ml reported for a given sample. Calculate the mean of the logarithms for this sample (as illustrated in Table 6).
2. The outliers are rejected by computing the limits (mean −0.330, mean +0.330) and rejecting the numbers that fall outside these limits.
3. Recompute the mean if values have been rejected; if not, use the previous mean to determine the limits (mean −0.143, mean +0.143) and note the analysts that are rejected by the limits in steps 2 and 3.
4. Repeat steps 1 through 3 for each "normal" sample, and list all analysts who fail to agree on 75% of the "normal" samples in some given period (e.g., 9 out of 12 in each consecutive 12-month period).

As a further example of the application of the method, the results of 53 analysts who had performed the analyses on the split samples for the 3 years were examined. There were 17 analysts who reported incubating their plates at 32 C and 36 analysts who reported incubation at 35 C. The data from the two homogenized samples for 1962 were deleted, and the test was applied to the remaining 16 samples. The code number is given in Table 8 for the analysts who were out of limits on at least 5 of 16 samples (more than 25% of the samples). The three listed under the 32 C data represent 18% of the 17, and the six listed under 35 C data represent 17% of the 36, which is in the range of the number we would expect to reject since the overall sample variance for the 3 years was 0.012.

TABLE 8. ANALYSTS WHO SUBMITTED SPLIT MILK SAMPLE RESULTS IN 1961, 1962, AND 1963 AND WERE OUT OF LIMITS ± 0.143 ON MORE THAN 25% OF 16 SAMPLES

Incubation temperature 32 C	35 C
2R[a]	1D
6H	4D
53R	19T
	19M
	27A
	51S

[a]Number denotes the state; letter is the code for name of analyst.

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STUDY INDICATES EXTENDED DANGER OF PESTICIDES

When an insecticide has done its job of controlling insects, rain washes it off the plant and it disappears in the soil. But that's not always the end of the story for many chemicals—members of the DDT family, for example, may be carried in runoff water to the streams and lakes or out to sea. As DDT compounds accumulate in the lake mud, they get into the bodies of small water animals that fish feed upon.

Up to this point water has diluted the chemicals to harmless amounts that cause no worry to man. But from there the life cycle in the lake waters starts to concentrate the DDT —first in tiny aquatic animals, then in fish, and finally in water birds that feed on the fish.

This cycle in Green Bay in Lake Michigan was described by Joseph J. Hickey and J. Anthony Keith, University of Wisconsin wildlife specialists, and by Frances B. Coon of the Wisconsin Alumni Research Foundation, in a report to the American Institute of Biological Sciences holding its annual meeting recently at the University of Illinois, Urbana.

Hickey and his team of researchers sampled lake mud from 33-foot to 96-foot depths in Green Bay and Lake Michigan on both sides of the Door County peninsula to study the accumulation of DDT and its breakdown products. Then they sampled aquatic animals from the mud, fish from gull stomachs and gill nets, and gulls from nesting islands off the main peninsula.

The bottom mud averaged 0.014 part per million of DDT-related chemicals, a level far below the hazardous range. But when they checked Pontoporeia, a small aquatic animal that lives in the mud, they found its level of the DDT complex to be 30 times more concentrated than in the mud, or about 0.42 parts per million.

Two species of fish, chubs and whitefish, taken from deep waters 5 miles off the mainland showed an even greater buildup of the insecticide materials. These and alewives taken from the stomachs of gulls or near gull nests—contained about 10 times the concentration of insecticide as found in Pontoporeia, or about 4 parts per million.

The end of the food chain cycle in the lake is the bird that eats the fish. Here is the greatest concentration of the chemical in amounts that concern wildlife specialists. The researchers found that herring gulls had 27 times as much DDT in the breast muscle as found in one of the species of fish. Ring-billed gulls and old-squaw ducks had concentrations of the chemicals higher than found in whitefish but much lower than in herring gulls. Hickey and his colleagues said that such concentrations of chemicals in herring gulls probably can poison the birds, especially during periods of starvation or other stress. It is also possible that these birds may experience reproductive failures.

There are still many unanswered questions about pesticides in the wildlife cycle. Researchers don't know, for example, the level of chemical contamination in gull diets throughout the year. Most young herring gulls migrate to the Gulf of Mexico for the winter, but a large number of Lake Michigan's adults stay in the Great Lakes Region.

The researchers don't know how often DDT will cause death in a gull. Death usually comes when high concentrations of the chemical get into the central nervous system of an animal. Robins and house sparrows are reported by other investigators to have died when they have 50 to 65 parts per million of DDT in the brain. Apparently healthy gulls in this study averaged 21 parts per million in the brain tissue and 2441 in their body fat.

The researchers don't know how often this supplemental DDT stored in other parts of the body gets into the central nervous system, and they don't know what stress conditions might cause this transfer. In two years of the study, Hickey heard only a few reports of herring gulls apparently dying of DDT poisoning. Hickey and Keith found two dead gulls that had brain levels of DDT 8 times higher than they found in live, healthy birds.

The water of Green Bay isn't typical of Lake Michigan and the other Great Lakes, but the results found in the University of Wisconsin study strongly suggest that similar studies be made in the Great Lakes region.

TWO CDC TRAINING COURSES ON HOSPITAL AND ENVIRONMENTAL SANITATION

The Training Branch, Communicable Disease Center, Public Health Service has announced two training courses for sanitarians to be presented at its Atlanta facilities.

The first course, "The Sanitarian and the Control of the Hospital Environment," is set up for February 7-11, 1966 and is intended for public health sanitarians responsible for curbing infection through environmental control activities in hospitals and similar institutions. The program will be designed for those without experience as well as others who have had previous work in this field.

The second course, "Environmental Control of Communicable Diseases," is scheduled for March 7-11, 1966. It is intended for sanitarians and other public health workers whose responsibilities involve them in environmental aspects of disease control.

Information on both courses may be obtained from the Chief of the Training Branch, Communicable Disease Center, Atlanta, Georgia, 30333.

ASSOCIATION AFFAIRS

REPORT OF THE COMMITTEE ON FOOD EQUIPMENT SANITARY STANDARDS — 1965

The objectives of the International Association of Milk, Food and Environmental Sanitarians Committee on Food Equipment Sanitary Standards are to participate with health organizations and industries in the formulation of sanitary standards and educational materials for the fabrication, installation, and operation of food equipment and to present to the membership those standards and educational materials which the Committee recommends be endorsed by the Association.

The IAMFES Committee, known hereafter as the Committee, has been instructed by the Executive Board to prepare an interim report for 1965 and develop a comprehensive one for presentation at the 1966 meeting. Therefore, the following progress report will only briefly outline the Committee's activities this year in working with two health and industry organizations (National Sanitation Foundation's Joint Committee on Food Equipment Standards and the National Automatic Merchandising Association's Automatic Merchandising Health-Industry Council) and progress in meeting its objectives. It is expected these organizations will be the two groups that the Committee will work with during the coming year.

National Sanitation Foundation

The Committee was represented at the 1965 meeting of the National Sanitation Foundation's Joint Committee on Food Equipment where appropriate action was taken on several proposals and prior to the meeting reviewed and submitted comments on each draft of these proposals. Since the meeting the Committee has also reviewed and submitted comments on proposed changes to existing standards and criteria and the development of new ones.

The Joint Committee recommended that Standard No. 7 on Food Service Refrigerators and Freezers be revised, changing the shelving of prefabricated walk-in refrigerators and freezers from product contact surfaces to splash contact surfaces, because food should not be stored directly on such shelving and that ample protection of food stored within such units should be afforded.

The comprehensive revisions to NSF Standards Nos. 1 and 3 were approved by the Joint Committee. These revisions which have been under development for approximately three years by industry and public health officials were made for the purpose of updating the standards and making them more applicable to public health and industry needs. Standard No. 3 contains the following three significant changes: All dishwashing machines must now be equipped with devices to automatically control the wash and rinse cycles; temperature of the wash water must be maintained at or above 150°F.; and the power rinse water temperature must be maintained at or above 160°F. (former wash and power rinse water temperatures for multiple tank machines were 140°-160°F. and 170°F., respectively). These water temperature changes were based on some of the Foundation's best research work which the Committee has had an opportunity to review. The revision of these two standards becomes effective January 1, 1966.

At the Joint Committee meeting a preliminary draft of the proposed Installation and Layout Manual for Food Service Equipment was briefly reviewed. This Manual is intended for broad usage by many groups and to supplement rather than replace the installation section in the present NSF Standards. The Manual would follow the general format of other NSF Standards and include a check list for field evaluation and illustrations and photographs. Since the Joint Committee meeting, the Committee has reviewed the Manual and offered comments to Mr. Eric Mood, Chairman of the Special NSF Public Health-Industry Committee responsible for the first draft of the Manual.

The Joint Committee also approved minor changes in Standards Nos. 2, "Food Service Equipment" and 8, "Commercial Powered Food Preparation Equipment". It recommended that the Foundation initiate the development of Standards covering kitchen ventilation systems, pot and pan mechanical washers, and refrigerated food market equipment. It also recommended that the Foundation initiate a comprehensive revision to NSF Standard No. 4, "Cooking and Warming Equipment" and Criteria C-1, "Manually Activated and/or Coin Activated Vending Machines". It further recommended that special committees be appointed to study, *(1)* The problems of and develop more definitive requirements for automatic controls and such other matters relating to the general automation of commercial spray-type dishwashing machines and *(2)* The acceptability of wood for limited use as food contact surfaces. A preliminary draft of a proposed revision of Criteria C-1 has been reviewed by the Committee and a recommendation that a separate Criteria be developed for Coin Operated Vending Machines, because of the special problems associated with this type of equipment and the special legislation for such equipment, has been submitted to NSF.

The Joint Committee reviewed the report of the Conference of Municipal Public Health Engineers relating to Mobile Food Service Vehicles. The Foundation staff requested that each member organization study the report and inform the NSF as to the advisability of developing a Standard for such equipment. It was the consensus of the Committee members that, while it was an excellent report and would be very beneficial to a state or local community developing legislation along this line, the NSF should not be developing Standards for an entire food service establishment, as the development of sanitation standards on such a broad scale was the function of public health and related regulatory agencies.

National Automatic Merchandising Association—(*NAMA*)

The National Automatic Merchandising Association's Automatic Merchandising Health-Industry Council (AMHIC) held its ninth annual meeting during October, 1964, and this Association and other public health organizations and the affected industries were represented and participated in AMHIC's deliberations. The afternoon of the first day was reserved for the public health representatives and was used by them to discuss public health objectives and policies to be followed in their work with the entire membreship of AMHIC. The next morning was reserved for these representatives to examine the public health aspects of the vending machines in the Exhibit Hall prior to meeting with the other members of the Council. This was a valuable experience for the Association's representative and enabled the public health members to coordinate and clarify their views on the work of AMHIC.

The Evaluation Manual, an essential tool in evaluating food and beverage vending machines, continues to undergo minor changes in accordance with new knowledge and technological developments. The Manual will now require the manufacturer of packaged candy, cookies, pastry or similar machines to enclose the product vend chute with a rodent-proof cover or to submit such a cover or door as optional equipment when applying for a Letter of Compliance. AMHIC also considered several other changes to the Manual as well as those necessitated by the revision of the Public Health Service Recommended Code and appointed a committee to study these changes and to recommend appropriate revisions to the Manual at the 1965 meeting.

The first draft of the proposed revision of the NAMA Check List for use of the evaluation agencies in determining a machine's ability to comply with the Manual was reviewed by AMHIC. Several changes were made to the Check List at that time; since then, the Committee has reviewed this draft and submitted comments to NAMA. A second draft incorporating recommendations of this and other committees as well as recent changes in the Public Health Service Code is being prepared for review and comment by this and other public health organizations before the next meeting of AMHIC.

The need for exercising some control over machine reconditioners has been evident to the members of AMHIC for some time. In many cases, a machine, which has been examined by one of the NAMA Evaluation Agencies and awarded a Letter of Compliance, is altered during the reconditioning process in such a manner as to violate the public health provisions of the Manual. Therefore, it was recommended that the AMHIC staff explore this problem in depth before the next meeting and submit appropriate recommendations to the members of AMHIC for maintaining the public health status of such machines.

Reports on preliminary studies of labeling of machines and products, ice-making equipment standards, pop-bottled milk, cleaned in-place equipment and machines, automatic reset cut-off controls, and approval of conversion kits were presented to AMHIC. No action was taken on the report on automatic controls since failure to reset a manual cut-off control would not constitute a public health problem or on the report on approval of conversion kits since NAMA and its evaluation agencies cannot at present accept such components as "Auxiliary Equipment". It was recognized, however, that the labeling of machines and food and beverages, standards for ice-making equipment, standards for pop-bottled milk, and a criteria for cleaning machines in place might constitute problems for public health officials and members of the vending industry and, therefore, should be given further study during the next year so that AMHIC could take appropriate action.

At the 1964 meeting of AMHIC, the Chairman of the IAMFES Food Equipment Committee was re-elected Co-Chairman of AMHIC to represent the public health group.

Recommendations

1. The Association reaffirm its support of the National Sanitation Foundation and the National Automatic Merchandising Association and continue to work with these two organizations in developing acceptable standards and educational materials for the food industry and public health.

2. The Association urge all sanitarians to obtain a complete set of the National Sanitation Foundation's Food Equipment Standards and Criteria and a copy of the National Automatic Merchandising Association-Automatic Merchandising Health-Industry Council's Vending Machine Evaluation Manual; to evaluate each piece of food equipment and vending machine in the field to determine compliance with the applicable sanitation guidelines, and to let the appropriate agency know of any manufacturer, installer, or operator failing to comply with these guidelines.

3. The Association urge all sanitarians and regulatory agencies to support the work of the Association's Committee and subscribe, by law or administrative policy, to the Standards, Criteria, and Evaluation Manual for food equipment and vending machines.

Karl K. Jones, *Chairman*
(Indiana Association),
Indiana State Board of Health,
Indianapolis, Ind.

Austin T. Rhoads
(International Association),
National Canners Association,
Washington, D. C.

Francis M. Crowder
(South Carolina Association),
State Board of Health,
Columbia, S. C.

Lloyd W. Regier
(International Association),
University of North Carolina,
Chapel Hill, N. C.

Jerome Schoenberger
(New York Association),
New York Health Department,
New York, N. Y.

Eaton E. Smith
(Connecticut Association),
State Department of Consumer Protection,
Hartford, Conn.

Harold Wainess
(Illinois Association)
Harold Wainess and Associates,
Chicago, Ill.

1965 REPORT OF THE 3-A SANITARY STANDARDS SYMBOL ADMINISTRATIVE COUNCIL

The International Association of Milk, Food, and Environmental Sanitarians is a corporate member of the 3-A Sanitary Standards Symbol Administrative Council. It is appropriate, therefore, that a summary report of the activities of the Council during the past twelve months be presented at Annual Business Meetings of the Association.

3-A Sanitary Standards for Silo-Type Storage Tanks, for Equipment for Packaging Frozen Desserts, Cottage Cheese, etc., for Non-Coil Type Batch Pasteurizers, for Non-Coil Type Batch Processors, and for Dry Milk Sifters, have become effective since the last Annual Meeting of this Association. As was to be anticpated, the taking effect of five 3-A Sanitary Standards has resulted in numbers of inquiries regarding the acquirement of authorizations, in the mailing of application forms, and in the issuance of a respectable number of authorizations to use the 3-A symbol.

Since September 15, 1964, the date of the 1964 Report of the 3-A Symbol Council, three holders of authorizations have elected not to renew them. However, eight authorizations have been issued to manufacturers of equipment covered by 3-A Sanitary Standards in effect on September 15, 1964; and six covering Silo-Type Storage Tanks, three covering Batch Pasteurizers, three covering Batch Processors and five covering Dry Milk Sifters have been issued. Several other applications for authorizations covering Dry Milk Sifters are being processed.

A tabulation of the types of equipment to which authorizations currently in effect follows:

3-A SYMBOL COUNCIL AUTHORIZATIONS IN EFFECT

September 1, 1965

Serial No.*	Type of Equipment	Authorizations
0102	Storage Tanks	17
0203	Pumps	12
0300	Weigh cans	0
0402	Homogenizers	3
0506	Automotive Tanks	17
0600	Electric Motors (Rescinded)	....
0700	Strainers	0
0807	Piping Fittings	12
0902	Thermometer Fittings	1
1001	In-Line Filters	1
1102	Plate-type Heat Exchangers	7
1202	Return Tubular Heat Exchangers	3
1303	Farm Tanks	25
1400	Leak Protector Plug Valves	4
1500	Manually-Operated Milk Dispensers	5
1602	Evaporators	6
1702	Fillers and Sealers	6
1901	Freezers	2
2200	Silo-Type Storage Tanks	6
2300	Filling Equip't. for Packaging	0
2400	Batch Pasteurizers	3
2500	Batch Processors	3
2600	Dry Milk Sifters	2
		135

*Includes amendments in effect.

The correspondence which the Council must carry on increases progressively. In the ten years of its existence 282 formal requests for application forms have been filed; 172 numbered authorizations have been issued. Of these 135 are currently in effect. Taking into account renewals and changes in model listings, over 1200 certificates have been prepared and mailed. The amendments of nine 3-A Sanitary Standards respecting conformance to 3-A Sanitary Standards for Multiple-Use Plastic Materials, which became effective on July 9, 1965, necessitated correspondence with fifty-eight holders of eighty-five authorizations to update their certificates. Many do not use plastic parts but a considerable number of certificates had to be prepared to indicate compliance with the amended 3-A Sanitary Standard. This procedure has been followed whenever an amendment to any 3-A Sanitary Standards alters the significance of certificates of authorization issued prior to the date of effect.

The adoption, in 1962 and in 1963 respectively, of 3-A Sanitary Standards for Multiple-Use Rubber and Rubber-Like Materials, and for Plastic Materials, used as Product Contact Surfaces of Dairy Equipment, created among sanitarians a demand for some means of identifying dairy equipment replacement parts made of either of these materials, by means of the 3-A symbol. However, the By-Laws of the 3-A Sanitary Standards Symbol Administrative Council restrict the issuance of authorizations for the use of the 3-A symbol to manufacturers of EQUIPMENT which conforms to 3-A Sanitary Standards. And, in order to make it clear to those who might apply for authorizations covering only the MATERIAL of which replacements of expendable parts of equipment are made, the By-Laws were amended two years ago, as covered in the 1963 Report of the Council, to the effect that the 3-A Symbol Council is —

> "not to grant authority for the use of the said symbol solely because of conformance to 3-A Sanitary Standards for material."

Valid reasons for this action included: *(1)* the incapability of the 3-A Symbol Council, in the absence of essential facilities, to assure itself of compliance of a specimen of material with the pertinent 3-A Sanitary Standards, nor of continuing compliance by the manufacturer, and *(2)* the reluctance of the Board of Trustees to expose the 3-A symbol to opportunities for mis-use which might seriously discredit its use on equipment.

This was the status until the closing day of the meeting of the 3-A Sanitary Standards Committees in Kansas City, April 1, 1965. At that session Dr. D. F. Siddall, Chairman of the D.F.I.S.A. Committee on Plastics, presented a report in which the design of a distinctive 3-A symbol to be applied to MATERIALS which conform to 3-A Sanitary Standards was presented, and proffered the advisory and consultative services of a committee of plastics chemists to guide the Council in the administration of the use of the symbol on that type of material—plastics. The report proposed that the 3-A Symbol Council undertake the administration of the use of an auxiliary 3-A symbol for materials. Following general discussion of these proposals, the group adopted the Plastics Committee Report.

The organization essential to implement such a proposed extension of administration of the use of another symbol by the 3-A Symbol Council may not be undertaken without the express approval by all of the corporate members. The Dairy and Food Industries Supply Association has indicated its approval of such an extension of Council activity. The Dairy Industry Committee has the question under consideration. The question has formally been submitted to the Executive Board of this Association, and a decision has no doubt been reached, and will be announced, at this Business Meeting. (Editors note: A motion approving this extension of the Councils activities was adopted at the annual meeting of the Executive Board.)

When unanimous approval by the three corporate members of the Council has been granted, several essential steps must be taken:

1. The design of the symbol proposed must be registered with the Trade Mark Division of the U. S. Patent Office. If the proposed design is already registered, or it too closely resembles a registered design, and its use might be confusing, a modification or different design must be developed and submitted for registration.

2. The By-Laws of the 3-A Symbol Council must be subjected to major revision, or a separate section pertaining only to materials must be prepared. The proposed draft must be approved by the corporate members.

3. The application forms, certificates, etc., essential to the mechanics of this extension of administrative activity must be prepared and printed.

4. Details of the liaison between the Council and the advisory committee of chemists must be agreed upon.

None of these steps can be consummated overnight. Registration of the proposed symbol may require months. (Registration of the 3-A symbol now in use required several years). Revision of the By-Laws cannot be completed until registry of the proposed symbol is assured, because one of the Articles pertains to its description.

Pending approval of the proposed extension of activity of the 3-A Symbol Council, involving the mechanics enumerated above, by all of the corporate members, the Board of Trustees has the responsibility of carefully weighing several matters and resolving some questions which informal review of the proposal have revealed, in order to be in position to decide whether to implement the proposal.

The first of these is that the promise of assistance in technological matters, proffered in the Report of the Task Committee on Plastics, obviously applies only to plastics. Rubber is also covered by 3-A Sanitary Standards, and technical problems can be foreseen in the administration of the use of the symbol on parts made of it. But technological assistance has not been proffered to the 3-A Symbol Council by the manufacturers of rubber parts. Any program adopted should apply equally to both materials.

The second question is of far greater import. Of all of the plastic and rubber parts or appurtenances employed in equipment covered by 3-A Sanitary Standards, only two shapes—tubing and drip deflectors—lend themselves to positioning of the symbol on a non-product-contact surface. It is rather certain to be the consensus of the members of this Association that it is a violation of a principle of sanitation to emboss onto or to impress a symbol into a product-contact surface. In numerous instances this would interfere with efficient functioning of the part. The printing of the symbol on a product-contact surface is an untried potentiality, general approval of which is also doubtful; the permanence of printed symbols is highly questionable.

The third question is one of feasibility. Assuming a means of placing the symbol on parts of non-metallic material can be developed, it must be conceded that the identification of very small parts, such as O-rings for shafts of less than 3/8" diameter, would present serious difficulties, and would greatly increase their cost.

It will no doubt be agreed that the making of exceptions would open the way to administrative chaos. If the proposed program is not applicable across the board, without exception, its effectiveness is seriously jeopardized. The Board of Trustees must be permitted to exercise its prerogative of determining that the mechanics involved in the identification of materials are feasible, that manufacturers of parts made of the materials covered by the two 3-A Sanitary Standards will voluntarily participate in the projected program, and that the Council is in position to assume the added responsibility.

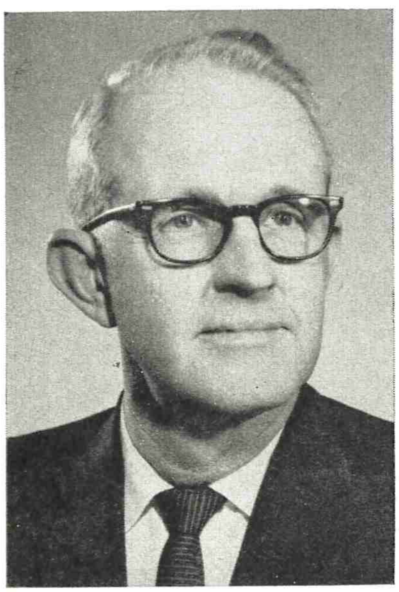
We have now had nearly ten years experience in the administration of the use of the 3-A symbol. We are in position to foresee problems involved in the proposal of the Committee on Plastics of which many of those who express a desire for a means of parts identification probably have no concept.

I therefore appeal to you to give the Board of Trustees time to thoroughly explore the potentialities for an effective program, and not to pressure it into hasty action.

D. C. Cleveland, *Trustee*
M. R. Fisher, *Trustee*
K. G. Weckel, *Trustee*
C. A. Abele, *Sec-Treas.*

NEWS AND EVENTS

JIM SMATHERS COMPLETES TWENTY YEARS OF SERVICE



James B. Smathers on October 25 completed twenty years of service with the Maryland and Virginia Milk Producers Association. He is Field and Quality Control Supervisor and Managing Editor of Milk Producer News, a monthly publication of the Association.

Beginning as a fieldman for the Association he has contributed a great deal to the present high quality of the milk supply for the Washington market. Of particular note was his promotion of the bulk tank program. The Association was one of the first producer organizations on the east coast to undertake this method of handling milk. Through his constant efforts and leadership in the development and use of pipeline milkers, milking parlors and feed lot handling the Washington area has kept abreast of national trends in modern milk production methods.

Jim is well-known and active in IAMFES affairs and presently is Co-Chairman of the Dairy Farm Methods Committee. He is a Director on the Board of the National Mastitis Council and currently is active with the Maryland and the Virginia Mastitis Councils. Jim is a past president of the Virginia Dairy Fieldmen's Association and is a member of a number of state and national organizations.

Jim Smathers is a native of Kentucky and received a B. S. in Dairy Science and Farm Economics from the University of Kentucky. He has been extension dairyman for that University, also fieldman for the Pet Milk Company in Wisconsin and fieldman for the Evansville Milk Producers in Indiana.

NEW REGISTRATION LAW IN SOUTH DAKOTA

An Act "relating to the preservation and protection of the public health and providing for the registration of sanitarians" has been passed by the South Dakota Legislature. It further provides for the establishment of a Board of Registration and defines its powers and establishes the qualifications for sanitarians.

The Board recently appointed by the Governor consists of Howard Froiland, Chairman, Charles E. Carl, Secretary, Herman Bauder and Donald Spiegel members. All are presently active in sanitation and public health. A fifth member, required by the new law to be a public-spirited citizen, is John Trucano. Registration of sanitarians began January 1, 1966.

THE PROBLEM OF SEDIMENT IN MILK

Ben Luce
Washington State Department of Agriculture
Olympia, Washington

I believe it is one of the two major problems of the Dairy Industry today, second only to Mastitis. However, ignoring the problem, as we have done for the most part since the advent of the bulk tank, or sweeping it under the rug, does not correct it or make it go away.

Milk, unlike most agricultural products, is not protected by a skin, shell, or peeling. We cannot clean milk with water and a scrub brush as we can an egg or potato. It is, therefore, vital that we keep milk clean and free of any contamination. It is ridiculous to try to justify or to ignore any extraneous material or excessive leucocytes in milk. Filtering is anything but the answer, as it only makes the particles finer and the damage has already been done in a liquid product such as warm milk. One only needs to observe the final several gallons of milk being pumped out of many of our farm tanks to realize the seriousness of the situation. Any visible sediment in the tank, especially at this time, after the three to five minute agitation necessary to get a representative sample for butterfat test, indicates gross contamination of the milk. This sediment is certainly not road dust and I shudder to think of the permanent damage that would be done if Reader's Digest decided to make a "Spectacular" out of this.

Prevention of this problem is simple, but it requires constant vigilance on the part of the milker to see that all visible dirt is removed from cow's tails, bellies and flanks and the teats and udders of each cow are thoroughly cleaned before each milking. If teats are not thoroughly cleaned, the milking machine will wash them with warm milk — right into the milk supply. After teats and udders have been thoroughly washed with clean, warm water and sanitizing solution, they should be dried with individual paper towels. Clipping or singeing the long hair off udders and flanks is required and makes the cleaning job easier. The individual loose stall housing system is also a tremendous help in keeping cows clean and free of injury and disease.

It is my opinion that interest and attitude of the milker is the most important factor in the production of clean milk. In my experience, the dairy owner invariably does a better job than the hired man or teenager. It is my belief that the dairyman that will be successful and prosper in the long run, is the one with the greatest desire to do a better job of milking cows and supplying better milk to the market so milk and dairy products will maintain their rightful place on today's food table.

USPHS VENDING SANITATION CODE REVISED

The 1965 Revised Recommendations of the Public Health Service for the Vending of Food and Beverage have been issued. This is the first revised edition of the basic federal sanitation guidelines since they were established in 1957.

The vending industry has undergone phenomenal growth both in volume and in versatility of operations and new technology and methodology has made it imperative that the original code be revised. The new standards embody the best information currently available on sanitary practices applicable to design, construction, maintenance and operation. The revisions as well as the original code are the result of a cooperative effort by local, state and federal agencies and the vending industry represented primarily by the National Automatic Merchandising Association.

While the basic requirements and format of the 1957 Code remain substantially unchanged, the new version contains much upgrading and updating and reflects many industry recommended improvements based on eight additional years of operating experiences. Major revisions include entirely new regulations for the heating of foods within the vending machine and also new temperature limits for potentially hazardous foods. New maximum cold temperatures and minimum hot temperatures for food storage now conform to federal requirements for other food establishments. Better provisions for servicing the machines are established and new standards assure improved handling of food and beverage products including the reconstituting of milk or milk products.

The 1965 Ordinance and Code covering the Vending of Food and Beverages is Public Health Service Publication No. 546 available from the Government Printing Office.

SOLID WASTE DISPOSAL ACT SETS UP NEEDED PROGRAM

The Solid Waste Disposal Act of 1965 (P. L. 89-272), which was signed into law by President Johnson on October 20, represents the first major national effort to bring under control a mounting public health, economic and blight problem.

Section 202, Findings and Purposes, contains the principal reasons given by Congress for passing the legislation. They are:

1. The amount of solid waste continues to increase and also to change in character.

2. In addition to the conventional forms of solid waste, there are new types resulting from the demolition of buildings, construction of highways, and industrial, commercial, and agricultural operations.

3. The situation within metropolitan and urban areas is becoming extremely complicated from the standpoint of managing, financing, and solving technical problems related to the disposal of solid wastes.

4. Present methods of disposal produce scenic blight, air, water, and land pollution problems, accident hazards, and the whole gamut of public health problems, including insect and rodent vectors of disease.

5. Certain waste materials having economic potential are not being salvaged in an attempt to conserve the natural resources of this Nation.

6. There is a compelling need for Federal help and assistance.

Based on these findings, the Congress designed the Act to satisfy two basic purposes or objectives, namely:

1. To initiate and accelerate a national research and development program for new and improved methods of proper and economic solid-waste disposal, including studies directed toward the conservation of natural resources by reducing the amount of wastes and unsalvageable materials and by recovery and utilization of potential resources in solid wastes, and

2. To provide technical and financial assistance to State and local governments and interstate agencies in the plan-

ning, development, and conduct of solid-waste disposal programs.

Under the Secretary of Health, Education, and Welfare, the Public Health Service is now mounting a program designed to accomplish these purposes. The objective is to improve the quality of our environment.

Under the Section 203, Definitions, the problems of solid wastes resulting from the extraction, processing, or utilization of minerals or fossil fuels—where such wastes may be controlled within the processing facility—are the responsibility of the Secretary of Interior. This recognizes the involvement of the Bureau of Mines in connection with the problems of mineral wastes. Section 203 also defines wastes as garbage, refuse, and other discarded solid materials, including solid-waste materials resulting from industrial, commercial, and agricultural operations, and from community activities.

Section 204, Research, Demonstrations, Training, and other Activities, is probably the most important single Section of the Act. This Section constitutes the basis on which the Public Health Service will initiate a research program, conduct demonstrations, initiate training activities, and related actions necessary for the implementation of the Act. In addition to imposing basic responsibilities on the Service, it provides for the cooperation with, and financial assistance to, appropriate public authorities, agencies, institutions, private agencies and institutions, and individuals in carrying out work on the multi-faceted aspects of solid-waste disposal.

One of the mechanisms authorized to obtain the help and assistance of these outside groups is grants-in-aid to public or private agencies and institutions, for research, training projects, surveys and demonstrations, including the construction of facilities. Support can also be provided through the mechanism of contracts, which has proven to be a useful tool in initiating research projects in support of program needs. One of the overriding requirements of Section 204 provides that no grant shall be made to cover more than two-thirds of the cost of construction of any facility covered by the Act.

Section 205, Interstate and Interlocal Cooperation, places the Federal Government on record as supporting the interstate and interlocal activities in connection with solid-waste disposal. Recognizing that the problem is no respecter of political boundaries should encourage the enactment of improved State and local laws governing solid-waste disposal.

The second most significant section of the Act is Section 206, Grants for State and Interstate Planning. This Section provides for grants to State and interestate agencies of not to exceed 50 percent of the cost of making surveys of solid-waste disposal practices and problems and of developing solid-waste disposal plans for such areas. Here is the mechanism to be used to develop the long-range plans for solid-waste disposal needed in many areas.

A number of conditions are imposed on the making of such grants. For example, they must be made to a single State agency which has the sole responsibility for carrying out such a program; the plan must involve consideration of the public health problems and such related factors as population growth, urban and metropolitan development, land-use planning, air and water pollution control; and the plan must be developed in a manner consistent with the development of other related State, interstate, and local plans. Here the Congress recognized the fact that planning must be done on a total basis and that the solid-waste plans must, in fact, be consistent with the needs of the community.

The Congress thus has committed the Federal Government to the responsibility for the leadership of a national solid-waste program. This responsibility, which also requires the Federal Government to cooperate with the State and local agencies, includes research, demonstration, training and planning. In other words, the Solid Waste Disposal Act has given the Nation the tools with which to identify the problem at the community level and to develop the means for bringing it under control.

PERSONNEL CHANGES AT NSF

Dr. Henry F. Vaughan, President of the National Sanitation Foundation, following a meeting of the Board of Trustees, has announced several appointments and changes in the staff of the Foundation and Testing Laboratory.

Mr. Robert M. Brown, formerly Director of Environmental Health for the Maryland State Health Department, joined the staff on September 1, 1965. At the Trustees meeting he was elected a member of the Board and also Secretary-Treasurer of the Foundation and Testing Laboratory. He will also serve as Director of the Division of Planning, one of three new divisions established in the administrative organization of the Foundation.

The Division of Communications will be under the direction of Mr. Tom S. Gable who has been associated with the Testing Laboratory since June, 1958. The Division of Research will be directed by Mr. Brian L. Goodman who joined the staff in January, 1965 as director of a research study on packaged sewage treatment plants. A new addition to the staff of the Testing Laboratory in August, 1965, is Mr. Marshall Gish, formerly of the California State Health Department.

The previous election of Mr. Charles A. Farish as Executive Director of the Foundation to replace the late Mr. Walter F. Snyder was announced in the November, 1965, issue of the *Journal.*

CONFERENCE ON SOLID WASTE MANAGEMENT

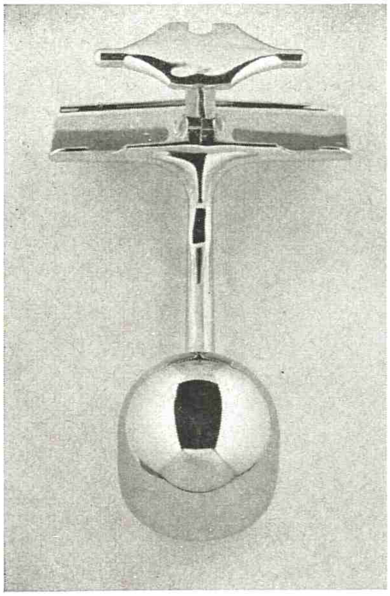
A National Conference on Solid Waste Management will be held by the University of California on its Davis Campus, April 4-5, 1966, under a grant by the Division of Environmental Engineering and Food Protection, Public Health Service, U. S. Department of Health, Education, and Welfare. The two-day conference is expected to attract more than 800 professional workers from governmental agencies and private industry.

According to Wesley E. Gilbertson, Chief of the Division of Environmental Engineering and Food Protection, stimulation of additional activity in solid waste management is a matter of urgency. One of the purposes of the conference, he said, is to appraise, evaluate, and give direction to a new concept in solid waste management—a growing national public health problem.

Samuel Hart, Ph.D., Associate Professor of Agricultural Engineering at the Davis Campus, and Professor P. H. McGauhey, Director of the Sanitary Engineering Research Laboratory at the University's Berkeley Campus, will set up the conference. Because attendance will be by invitation only, inquiries should be addressed to Dr. Hart at his Davis Campus office.

INFORMATION FROM INDUSTRY

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



NEW MILK DISPENSER VALVE

A newly designed valve and ball weight available for both Manhattan and Super milk dispensers has been introduced by Norris Dispensers, Inc., 2720 Lyndale Ave. South, Minneapolis, Minn. 55408. The redesigned valve and ball weight is practically indestructible. Increasing the diameter of the valve arm and incorporating the valve axle as a part of the valve body gives extra strength and durability. The unit has a highly polished chrome finish for easier cleaning.

Norris also announces a new case storage milk cooler, Model SC-600(2), equipped with casters and designed for transmitting cases of milk from the loading dock to be held in storage in the serving area of the food establishment.

WYANDOTTE BULLETINS

Twenty-one products for all types of plant clean-up operations are described in "Wyandotte Products for Dairies," a new 70-page brochure released by J. B. Ford Division, Wyandotte Chemicals Corp., Wyandotte, Michigan. The brochure covers spray and CIP cleaning high pressure portable equipment, alkaline and acid cleaners, sanitizers and special products.

New bulletins are also available on Wyandotte Simbol, a heavy duty chlorinated CIP cleaner having an added ability for brightening stainless steel, and Wyandotte Keego, a versatile alkaline cleaner for high pressure spray cleaners, steam guns and spray washers.

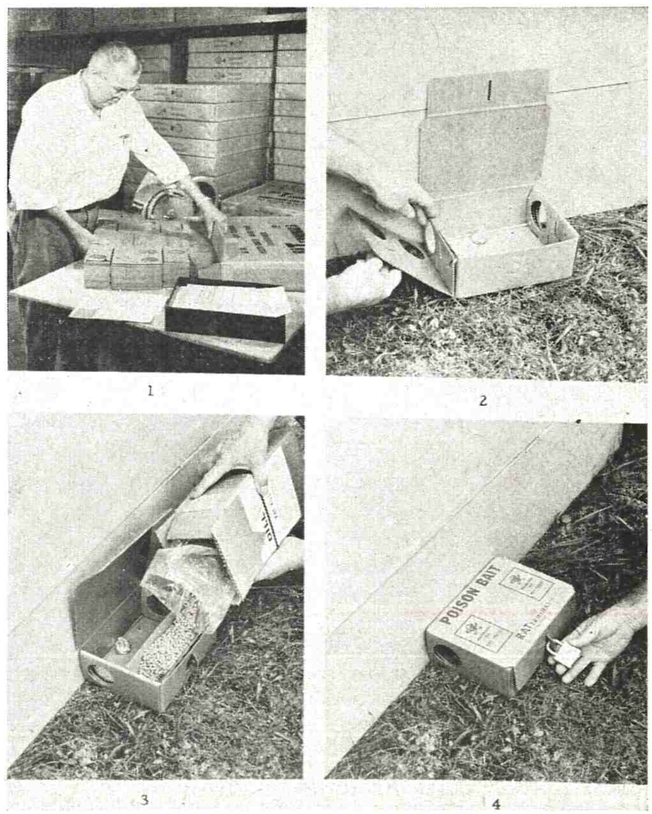
Wyandotte also has two folders of particular interest to sanitarians. One is entitled "A Complete Program for Egg Washing and Sanitizing" and the other is "Wyandotte Cleaning Products and Services for the Meat Packing Industry".

FOOD GRADE PVC TUBING

"Clearflo" transparent, flexible PVC tubing is available in industrial and food grades from Newage Industries, Inc., Jenkintown, Pa. The food grade is made of FDA approved materials. The tubing is non-toxic, chemical resistant and suitable for use handling, refrigeration, laboratory and research work. Repeated sterilization is possible.

DISPOSABLE BOOTS

Disposa-Boots supplied by the Anderson Box Co., P.O. Box 1052, Indianapolis, Ind., are disposable polyethylene boots which can be slipped over regular shoes and discarded after use. Disposa-Boots eliminate the need for cleaning and sanitizing shoes where transmission of contamination through visits to certain areas is a possibility. These disposable boots are available in two sizes in quantities of 100 at nominal cost.



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The theme of the conference was progress in the development of a means of processing milk into some form in which the delicate flavor and texture of the fresh product can be retained through extended refrigerated or unrefrigerated storage. One of the featured speakers was the Nobel Prize winner, Professor Arturri I. Wirtanen of Helsinki, Finland who discussed his fascinating research in the production of so-called "zero milk" by cows on an essentially complete synthetic diet as a means of determining the origin of milk flavors. Other representatives of industrial, academic and governmental research organizations discussed fundamental and practical problems now under investigation to improve the quality of milk concentrates. Topics covered foam-spray drying of milk, HTST sterilization of fluid milk concentrates, continuous vacuum-foam drying, dehydrated dairy products in bakery goods, low-fat cheese, improved butteroil and genetic variants of milk proteins.

It was generally agreed by the conferees that to gain substantial acceptance for use as a beverage, milk concentrates and powders on reconstitution must be closer to fresh milk in flavor and texture than is presently available from processed products.

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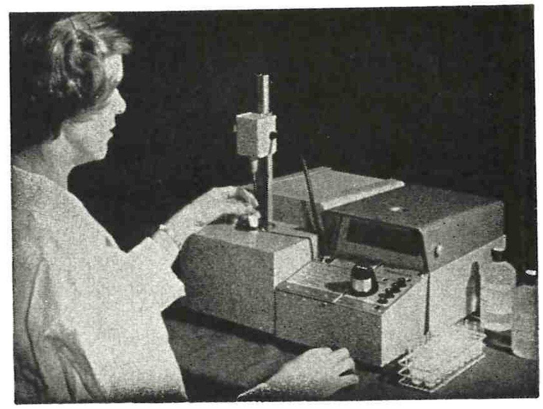

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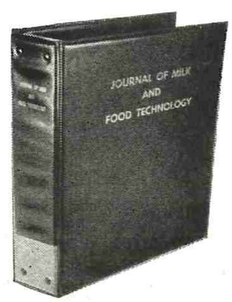

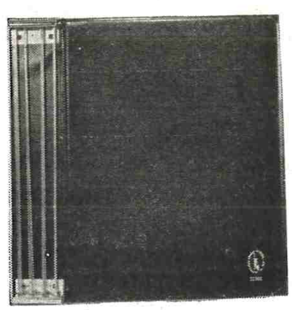

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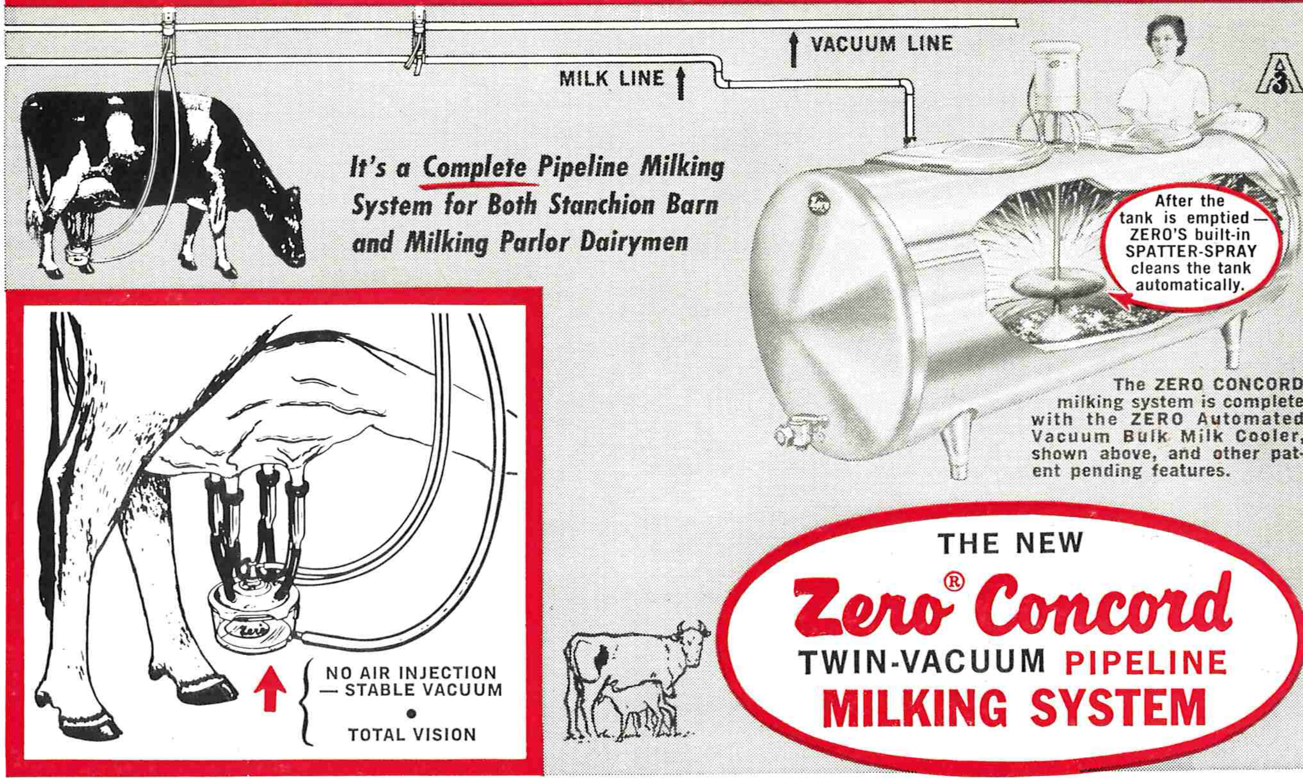

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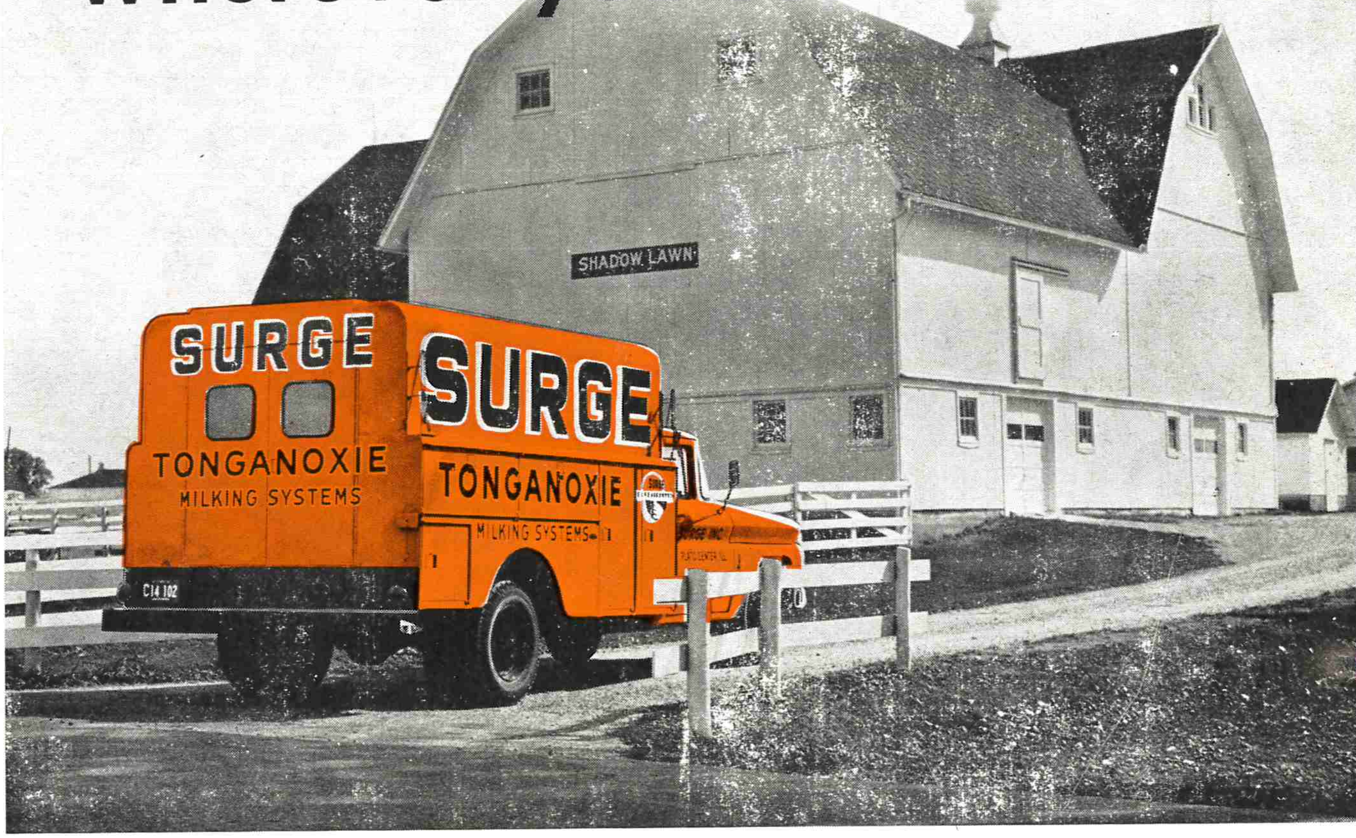

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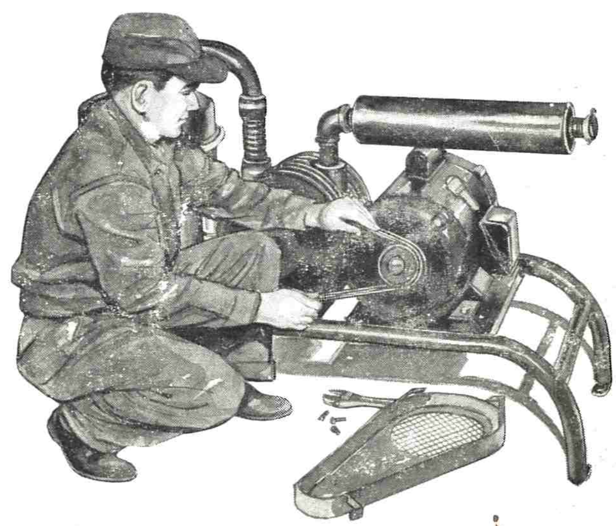

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