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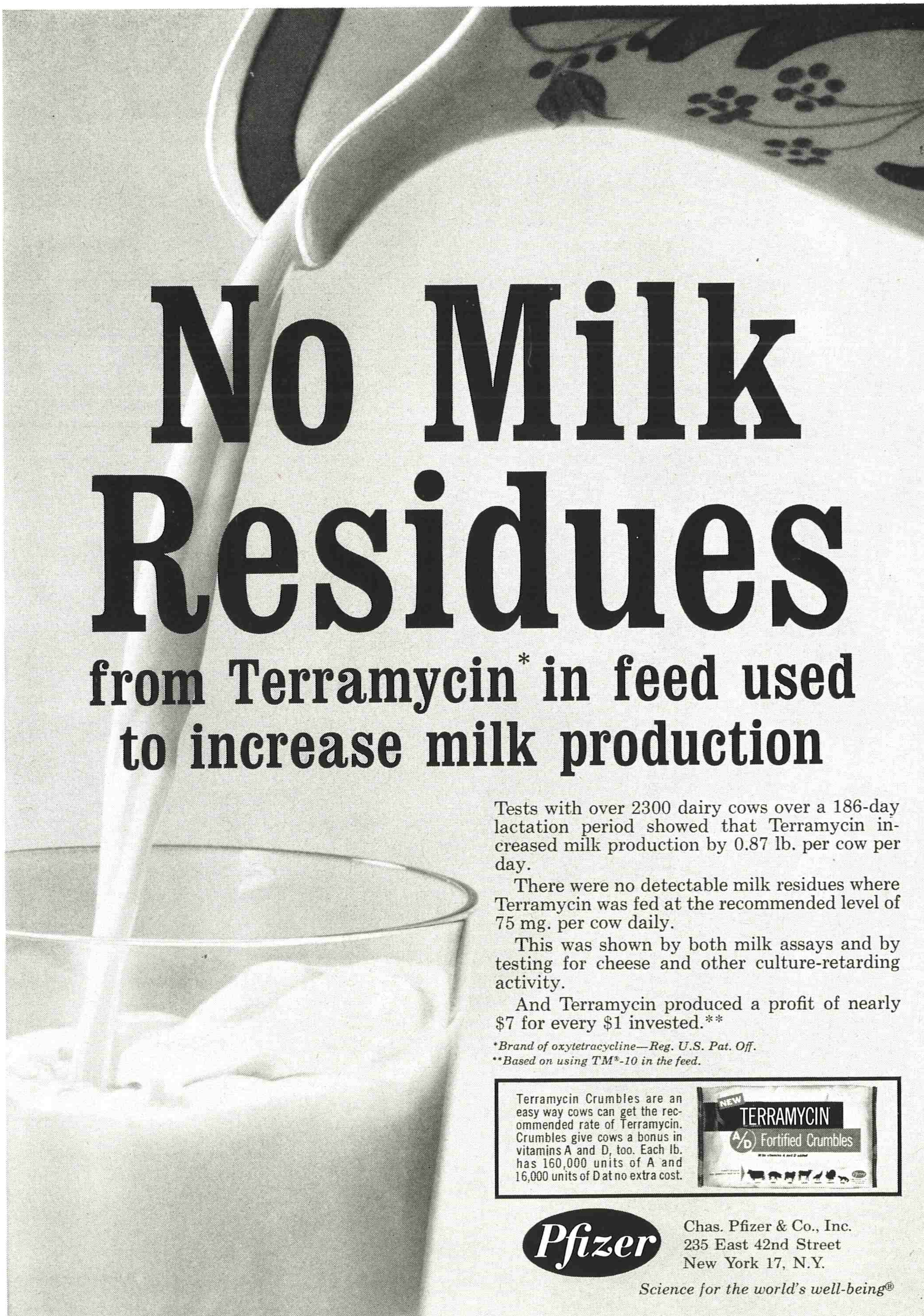
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EDITORIAL

A Case For Fee Financing

Why do some sanitarians consider all expenses incurred by milk plants and producers' organizations a justifiable part of the cost of milk to the consumer while at the same time objecting to inspection fees to provide public health protection and quality control?

Before discussing the fee method of financing the inspection program to assure a safe, wholesome and quality product in a city, one might ask whether the expenses of quality control work done by milk plants, field men and laboratories are justifiable and whether such costs, large or small, are absorbed in the plant's profits or paid by the consumers who purchase the products? If you agree that the consumer ultimately pays the bill, then we are in agreement on one point.

In a competitive situation the proportionate amount of expenses for equivalent quality control services will be large for a small plant and smaller for a large plant whose profits should increase with volume. Under a fee system each plant pays on the basis of the volume of milk received and the proportionate cost is the same. Under our system the fee ranges from 4c to 5c per hundred pounds of milk received depending upon the inspection costs and the amount received. Under a fee system one sanitarian goes down the country road and works with all dairy farmers in an area or county. Under an industry inspection plan how many field men from different plants or producers' organizations travel the same road seeing some farms and passing others by? It will depend upon how many milk plants obtain milk from that area. Now, which plan increases or decreases the travel and time necessary to get the job done?

Most would agree that the *quality of the job that is done* is the main issue. How can sanitarians who find it difficult to standardize themselves on requirements and procedures be expected to do an adequate job of standardizing many industry field men in one milk shed into doing an adequate job of quality control and public health protection? However, when adequate money is not available for public health protection and quality control derived from general taxation, the official inspection agency is forced to put part of the burden for this work on industry. Under a fee system if you are doing an adequate job some milk plants will have few field men, some none; some milk plants have laboratories and some no laboratory. The field men's primary responsibility will be supply procurement and assistance to producers while the inspection agency's primary responsibility will be public health protection and quality control.

Is it fair to expect city taxpayers to shoulder the costs of inspection services for milk sold outside of that city, or, is it not more equitable for those who actually consume the products to foot the bill through a fee supported inspection system? When a city inspection service is financed from the general tax revenue, all expenses are paid by that city's taxpayers and when a milk plant sells beyond that city's incorporated limits the consumer served and protected pay no part of the costs. Under an inspection fee system industry pays the costs and passes it on to all consumers in proportion to their purchases of the product.

Today we have three categories of inspection services. First, those with adequate funds; second, those with inadequate funds; and, third, possibly a few who are spending too much for the service rendered. For that second group, we should tell the dairy industry in the locality that more services are needed. If industry will spend less money on their own services and give more money to the official inspection agency it can then make adequate visits with less mileage, less time, and a saving to all concerned with better final results.

Let's face the facts, the USPHS Code requires a *minimum* of one inspection each six months. This minimum is intended to apply only to a plant or producer who on his own initiative consistently complies with regulations and requirements. Now, how many trips over months or years are involved with some plants and producers before one can safely approve them on a basis of one inspection in a six month period? Only you can find the answer to this question in your own program. Surveys are supposed to help in this direction and have made some progress but during recent years with a policy of one survey every two years damage has been done. Changing to a continuous survey system making visits at least every six months would prove helpful and force more money to be spent in some inspection areas. The writer believes that many areas could provide better public health protection and quality control on an efficient basis with little, if any, additional overal costs (Health and Industry) if they had an inspection fee system to reduce mileage, man hours of work, laboratory expense, and other costs.

Milton R. Fisher,
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FACTORS AFFECTING THE VISUAL METHOD OF DETECTING ANTIBIOTICS IN MILK[1]

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(Received for publication November 1, 1960)

A green turquoise dye mixed with several antibiotics and used in intramammary infusions seems to provide a satisfactory marker for the visual detection of antibiotics in milk. The dye appeared in milk, coloring it green or turquoise, for approximately the same length of time as did penicillin, aureomycin, terramycin, or polymyxin, but slightly longer than did streptomycin. There was an inverse relationship between the milk yield of the animal and the number of milkings for which antibiotic and the dye appeared in milk. The age and the breed of the animal did not seem to affect the number of milkings for which antibiotic and the dye appeared in milk. During the storage of a mixture of the dye with antibiotics for 14 weeks, the dye exerted no appreciable detrimental effect upon the stability of the antibiotics. The dye does not seem to cause any apparent ill-effect upon the milk yield or the udder tissues of the animal. When the dye mixed with antibiotics was injected, the milk secreted following the injection did not contain any green color. Therefore, this "marker" technique cannot be applied successfully for the detection of antibiotics in milk if the antibiotics are injected.

The methods presently available for the determination of antibiotics in milk, namely, the disk assay method (1, 2), the dye reduction method (10), and the acid inhibition method *(4)*, require 2½ to 6 hours or more for completion. Although these methods or their modifications are being used routinely in several laboratories, there is still a great need for more rapid or instantaneous methods for the detection of these drugs in milk. Consideration has been given to adding (as markers to antibiotic preparations) several dyes *(6, 12, 16, 17)*, fluorescent materials *(8, 9)*, and radioactive chemicals which would be readily detectable in milk, thus giving an indication of the presence of antibiotics.

Hargrove *et al. (8, 9)* have reported that the use of the combination of uranine and oil-soluble fluorescein as a marker was very effective. However, the marker was visible to the naked eye only for 48 hours, and after that it required the use of an ultraviolet light. Also, Corbin *(5)* has suggested a spectrophotometric method to evaluate the Hargrove method quantitatively. Smitasiri *et al. (17)* have reported that although the fat-soluble chlorophyll used at the concentration of 0.5 to 1.0 ml. per quarter appeared in milk for 5 to 10 milkings, it needed further examination, since it caused the appearance of heavily stained particles in milk. Dalgaard-Mikkelsen and Rasmussen *(6)* and Rasmussen and Simesen *(12)* have shown that when the green S dye mixed with penicillin was infused into the cows' or goats' udders, the dye was secreted in milk for as long as the antibiotic appeared in milk.

In a study along these lines, conducted at the University of Nebraska and reported previously *(16)*, an edible food dye, commercially known as Edicol Supra Green BS, was used successfully as a marker in the penicillin preparation. It was observed that when the dye was mixed with penicillin and infused into an udder, it formed a kind of complex with the antibiotic and appeared in milk, coloring it green or turquoise, for almost the same length of time as the penicillin appeared in the milk. When 100,000 units of penicillin mixed with 100 mg of the dye were infused, the milk secreted possessed a green color for 4 to 6 milkings. The color intensity of the milk showed a direct relationship with the concentration of the antibiotic in the milk. The dye did not diffuse from one quarter to another. The present work was conducted, therefore, to study the factors which affected the secretion of the dye in milk and to determine whether the dye could be used as a marker with other antibiotics.

Experimental Procedure

The technique followed in this work was essentially the same as that described in detail in a previous publication *(16)*. In brief, healthy, lactating animals were infused with an antibiotic mixed with the green-turquoise dye, commercially known as C. I. Food Blue 3 or edicol supra green BS (Old Index No. 737 and New Index No. 42045). Chemically, it was sodium salt of di(p-dimethylamino phenyl)-2-hydroxy-3: 6-disulfonaphthylmethanol anhydride. A weighed quantity of the dye was dissolved in five to ten milliliters of pyrogen-free water containing a known quantity of an antibiotic and was infused following the afternoon milking. After the infusions, milk samples were collected from each quarter at each regular milking at 12-hour intervals. The milk samples were assayed for

[1]Published with the approval of the Director as paper No. 941, Journal Series, Nebraska Agricultural Experiment Station, Lincoln, Nebraska.

the antibiotic concentration and the color intensity. The antibiotic concentration was determined by the disk assay method *(1, 7)* as well as by the acid inhibition method. The color intensity of the milk was measured visually in the whole milk and photometrically in milk serum. For visual color measurement, one part of colored milk was diluted with normal milk until the green color was no longer perceptible to the naked eye. The number of parts of normal milk required to dissipate the color in one part of colored milk is termed the "visibility index." For photometric determination, a colored milk serum was prepared by treating the milk with trichloroacetic acid, and the color was measured at 640 mμ in a Coleman Spectrophotometer. However, when the color concentration in milk fell below the visibility index level of two, the color intensity in the serum could not be determined accurately.

RESULTS AND DISCUSSION

Effect of Milk Yield Upon the Length of Antibiotic and Dye Secretion.

In a previous study *(16)* it was observed that following the infusion of a dye and penicillin mixture, the milk secreted contained the antibiotic and the color for almost the same length of time. However, there were some cow differences, in that the number of milkings for which the antibiotic and dye appeared in milk following the infusion of the penicillin-dye mixture varied between different animals. Trials were made, therefore, to determine the effect of milk yield upon the length of time for which both the antibiotic and dye appeared in milk. Twenty different milking animals, whose milk yield varied between 10 and 70 lbs. of milk per day, were selected and infused within each quarter with 100,000 units of penicillin aqueous suspension mixed with 100 mg of the dye. Following the infusions, milk samples were collected separately from each quarter and assayed for the antibiotic and the dye. Throughout the study most of the animals were used only once except in a few cases in which the animal was used the second time. In these cases, however, the animals were not used for the second time for at least two months.

The data relative to the effect of milk yield upon the length of time for which both the antibiotic and dye appeared in milk are presented in Table 1. It was observed that when animals giving 10-20 pounds of milk daily were infused with an antibiotic and dye mixture, the antibiotic appeared in milk for 4-10 milkings, with an average of 7.2 milkings, and the dye appeared in milk for 5-10 milkings, with an average of 7.4 milkings. However, in the case of animals giving 61 to 70 pounds of milk a day, the antibiotic

TABLE 1. RELATION OF MILK YIELD TO THE SECRETION OF THE ANTIBIOTIC AND DYE IN MILK

Number of trials[a]	Milk yield per day (lb.) (range)	Number of milkings: Penicillin detected Range	Penicillin detected Ave.	Dye detected Range	Dye detected Ave.
7	10-20	4-10	7.2	5-10	7.4
7	21-30	5- 8	6.9	5- 8	6.8
6	31-40	4- 8	6.8	4- 8	6.6
3	41-50	3- 6	5.0	4- 6	5.1
2	51-60	2- 5	4.2	2- 6	4.4
2	61-70	2- 4	2.9	3- 4	3.2

[a]Each trial with four quarters.

was completely excreted within 2 to 4 milkings and the dye within 3 to 4 milkings. The data indicate that the level of milk production significantly affected the duration of excretion of the antibiotic and the dye, in that the higher the yield the fewer the number of milkings for which the antibiotic and the dye appeared in milk.

Effect of Breed and Age of Animals Upon the Antibiotic and Dye Secretion.

Another phase of this investigation was to determine the effect of age and breed of the animal upon the duration of secretion of the antibiotic and the dye. Animals representing four breeds, Holstein, Guernsey, Jersey, and Brown Swiss, ranging in age from 2 years 10 months to 9 years 10 months and yielding 20 to 30 pounds of milk a day were used for this work. The data are presented in Table 2. It may be noted that irrespective of the breed or age, the dye could be detected visually in milk for either the same number of milkings as did the antibiotic or for only one milking more or less than did the antibiotic. There was no apparent relationship between breed and the number of milkings which showed the presence of the antibiotic and the dye, nor did the ages of the animals show an effect upon the period during which the dye and antibiotic appeared in milk.

Secretion of the Dye and Antibiotic Following Intramuscular Injection.

In mastitis therapy certain antibiotic preparations may be injected rather than infused. One hundred mg of the dye and varying concentrations of penicillin (ranging between 200,000 and 1,000,000 units) were mixed and injected into the animal. It was observed that the milk secreted did not possess any green color, but, as should be expected on the basis of the results of Randall *et al. (11)*, the milk did contain the antibiotic for 6 to 8 milkings, and the concentrations of the antibiotic excreted were relatively lower than when the antibiotic was infused.

Excretion of Antibiotic and Dye Concentrations in Milk Following Intramammary Infusions of Different Antibiotics.

While penicillin is by far the most common therapeutic agent used in mastitis treatment, there are available approximately 1500 formulations for mastitis treatment manufactured by about 35 companies. Therefore, in order to determine the length of time for which the green color and different antibiotics appeared in the milk, animals were infused into each of the four quarters with either aureomycin, terramycin, polymyxin, or streptomycin mixed with the dye. Four to six trials using different animals were performed with each antibiotic.

In Table 3 are presented data relative to the number of milkings in which the dye and the antibiotic appeared in the milk. The results of a similar study with penicillin, conducted previously, have been included in the table for the sake of comparison. Using average figures, it was observed that in the case of aureomycin, the antibiotic appeared in milk for six milkings and the dye for seven milkings; in the case of terramycin, the antibiotic appeared for five milkings and the dye for six milkings; in the case of polymyxin both the dye and the antibiotic appeared for seven milkings; and in the case of streptomycin, the antibiotic was completely secreted in four milkings and the dye in six milkings. The secretion of aureomycin, terramycin, polymyxin, or streptomycin and the dye followed a similar trend in all the trials,

TABLE 2. EFFECT OF BREED AND AGE OF THE ANIMALS UPON THE SECRETION OF THE ANTIBIOTIC AND DYE IN MILK

Animal No.	Breed	Age yr.	Age mo.	Milk yield per day (lb.)	Number of milkings: Penicillin detected[b]	Number of milkings: Dye detected[a]
1	Holstein	4	5	21	6	7
2	Holstein	3	6	25	5	5
3	Holstein	3	11	25	5-6	5
4	Holstein	5	9	27	5	6
5	Holstein	8	10	30	5	5
6	Guernsey	5	5	28	4-6	5-6
7	Guernsey	7	11	25	6-7	6
8	Jersey	3	11	28	3-5	3-6
9	Jersey	9	10	31	5-7	5-6
10	Brown Swiss	2	10	30	5-6	6
11	Brown Swiss	3	1	19	6	7

[a]The spread, e.g. 5 to 6, in the number of milkings in which the antibiotic or the dye could be detected represents the spread obtained in different quarters of the same animal.

as was observed in the case of penicillin *(16)*.

In general, the dye appeared in milk for approximately the same length of time or for one more milking than did aureomycin, terramycin, or polymyxin, but appeared for two milkings longer than did streptomycin.

The length of period for which aureomycin, terramycin, polymyxin, and streptomycin were secreted in milk seems to be in agreement with the observa-

TABLE 3. SECRETION OF ANTIBIOTIC AND DYE CONCENTRATIONS IN MILK FOLLOWING INTRAMAMMARY INFUSIONS OF DIFFERENT ANTIBIOTICS AND DYE MIXTURES

No. of milkings	Penicillin Conc.[a] unit/ml.	Penicillin V.I.[b]	Aureomycin Conc. μg/ml.	Aureomycin V.I.	Terramycin Conc. μg/ml.	Terramycin V.I.	Polymyxin Conc. μg/ml.	Polymyxin V.I.	Streptomycin Conc. μg/ml.	Streptomycin V.I.
1	14.00	1800	9.50	1300	34	2000	21	500	28	700
2	0.95	95	0.78	190	8	110	4.5	88	1.1	120
3	0.45	20	0.50	45	0.6	15	0.5	31	0.7	20
4	0.11	2	0.20	17	0.1	5	0.2	1	0.6	4
5	0.10	1	0.15	2	0.1	1	0.3	2	0.0	2
6	0.00	0	0.10	1	0.0	1	0.25	1	0.0	1
7	---	---	0.00	1	---	---	0.2	0.5	---	0.0
8	---	---	0.00	0	---	---	0.0	0.0	---	0.0

[a]Conc. = Concentration of the antibiotic (units or μg per ml.).

[b]V.I. = Visability index which denotes the number of parts of normal milk mixed with one part of colored milk to dissipate the color.

TABLE 4. ANTIBIOTIC STABILITY DURING STORAGE OF ANTIBIOTIC : DYE MIXTURES

Mixture No.	Antibiotic and vehicle[a]	Initial conc.[b]	Final concentration (units or μg) Room temperature storage 6 wk.	10 wk.	14 wk.	Stored in refrigerator 6 wk.	10 wk.	14 wk.
1	Penicillin-aqu.	300,000	250,000	260,000	240,000	302,000	300,000	294,000
2	Penicillin-oil	300,000	295,000	295,000	290,000	300,000	----	301,000
3	Penicillin-ointment	100,000	102,000	102,000	99,000	----	----	----
4	Aureomycin-oil	409,000	405,000	400,000	402,000	400,000	406,000	404,000
5	Streptomycin-oil	103,000	98,000	97,000	95,000	100,000	102,000	101,000

[a]All mixtures contained 100 mg. of the dye per dose or per 100,000 units or μg.

[b]Units or μg.

tions of Randall *et al.* *(11)*, Schipper and Petersen *(13, 14)*, and Hargrove *et al.* *(9)*. The fact that the dye appeared in milk for two more milkings than did streptomycin may be due to the fact that the sensitivity of the standard disk assay method for streptomycin in milk was 0.3 to 0.6 $\mu g/ml$ and, therefore, the milkings containing lower concentrations gave negative results.

Effect of the Dye Upon the Stability of Antibiotics During Storage.

Since mastitis preparations are customarily stored under various conditions between their manufacture and use, consideration was given to determining the effect of storage upon the stability of the antibiotic potency in the presence of the dye. Three different antibiotics studied were penicillin, aureomycin, and streptomycin, and the vehicles in the antibiotic preparations were aqueous suspension, oil and ointment for penicillin, and only oil for the two other antibiotics. The dye was mixed with each antibiotic, and the mixtures were stored at either room temperature or in a refrigerator. The antibiotic potency was determined at the end of 6, 10, and 14 weeks of storage. The results are presented in Table 4. It was observed that during storage for 14 weeks, the antibiotics mixed with the dye did not lose their potency appreciably except in the case of mixture No. 1 which was an aqueous suspension of penicillin and was stored at room temperature. This seems to be due to the fact that penicillin is unstable in aqueous solutions at room temperature *(3, 15)*. Similar mixtures when stored in a refrigerator did not lose their antibiotic activity. Also, the dye did not show any antagonistic effect upon any of the other antibiotics in oil whether stored at room temperature or in a refrigerator. On the basis of these results, it is felt that the dye does not affect the antibiotic potency during storage.

The U. S. Food and Drug laws do not permit the presence of antibiotics in milk or milk products intended for human consumption. This is because the antibiotics in milk not only render the milk unsuitable for the manufacture of cultured products but they also might sensitize the consumer or cause other harmful effects. Therefore, they require that the antibiotic be clearly labelled as to the length of time the milk from the treated cow should be withheld from the market. This withholding period is established individually for each mastitis preparation by the Food and Drug Administration on the basis of the data supplied by the manufacturer relative to the length of time the antibiotic is excreted in the milk following the last treatment. Antibiotics not excreted in the milk need not be labelled, and drugs excreted for more than 96 hours may not be used *(18)*. As observed in this study and as reported previously by others, a withholding period established for any antibiotic on one set of animals may be too long for high milk-producing cows and too short for low milk-producing animals. Therefore, a method of detecting the antibiotics on the basis of this "marker" technique should be acceptable not only to the plant and regulatory personnel but also to the producers who thus need not be subjected to financial losses any longer than necessary.

Before any dye can be considered for practical application, it must be non-toxic to the animal as well as to the human being, be visible in milk in very low concentrations, be excreted for the same length of time as are antibiotics and be inexpensive. During the course of this study, the dye when infused with an antibiotic did not affect the milk yield of the animal adversely, nor did it cause any apparent ill-effects upon the tissues or health of the animal. It seems to form a complex with the antibiotics and is excreted for almost the same length of time as are penicillin, aureomycin, terramycin, and polymyxin. Also, it may be pointed out that this dye belongs to the group of certified food colors in England and in other countries and apparently would not cause any ill-effects if ingested in small quantities by human beings. On the basis of the above results, its use as a marker in mastitis preparations is worthy of consideration.

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RAPID ANTIBIOTIC ASSAY METHODS USING *BACILLUS STEAROTHERMOPHILUS*[1]

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(Received for publication November 13, 1960)

Presence of antibiotics in milk has become of increasing concern in recent years. Detection of antibiotic-containing milk by a test which would yield results in a minute or less would be extremely desirable wherever milk is received. Such a test probably would be chemical, rather than biological, but this type of test has not been devised. The rapid growth of *Bacillus stearothermophilus* at elevated temperatures and its high sensitivity to penicillin and some other antibiotics, as demonstrated in this study, indicated its potential usefulness as a test organism for detection of antibiotics.

Many procedures for detection of antibiotics utilize inhibition of growth of organisms commonly thought of as lactic acid bacteria. Neal and Calbert *(12)* used *Streptococcus thermophilus* as the test organism with 2, 3, 5-triphenyltetrazolium chloride (TTC) as the indicator. The indicator was reduced from colorless to pink by active cells. Prouty *(13)* recently modified this test to use a longer incubation period. Friedmann and Epstein *(4)* used resazurin and a rapidly growing strain of *Streptococcus cremoris* in their estimation of nisin. A method using methylene blue reduction by *Bacillus subtilis* for quantitative assay of penicillin in body fluids was described by Reid and Brewer *(14)*. Hirsch *(6)* used *S. cremoris* and methylene blue for assaying nisin. Galesloot and Pette *(5)* estimated the nisin content in cultures, starters and cheese with *S. cremoris* and litmus. *Lactobacillus bulgaricus (15)*, *Streptococcus lactis (10)*, and *Streptococcus agalactiae (2)* also have been employed as test organisms for the detection of antibiotics. *B. subtilis* has been used extensively in the disc assay method *(1, 3, 8, 11, 16)*. Johns *(7, 8)* and Witter and Tuckey *(18)* have evaluated some of the variables in the disc assay procedure as modified by Arret and Kirschbaum *(1)*. Test procedures in which these organisms are employed usually require from 2.5 hr. to overnight incubation before results are available.

METHODS AND RESULTS

The *B. stearothermophilus* culture used in this investigation is a rapidly growing strain of ATCC No. 7954 maintained for many years in the Iowa State University culture collection. A culture of this number recently obtained from the American Type Culture Collection was not as satisfactory for use in these assays. The organism was maintained by transfer on slants of Stock Culture Agar (Difco), with incubation at 55°C for 18 to 24 hr and interim storage at 4°C.

The broth culture used for testing was prepared by growing the organism at 55°C on Stock Culture Agar slants for 24 hr. Broth (20 g Baltimore Biological Laboratory trypticase, 10 g Difco yeast extract, 0.5 g glucose and 1000 ml distilled water) in 5-ml quantities was inoculated with a small loopful of material from the actively growing slant culture and incubated at 55°C for 30 hr. Then 100 ml of broth was inoculated with 0.1 ml of the broth culture. This culture was grown at 55°C in a water bath for 17 hr with aeration (Marco air pump, model A, J. B. Maris Co., Bloomfield, N. J.), using pressure equivalent to about 35 to 40 mm of water, as indicated by a manometer. A small vibrator-type air pump, as used in aquaria, also was found suitable. Each propagation unit was made up of glass tubing having an inner diameter of 3 mm, a No. 6 rubber stopper and a 500-ml Erlenmeyer flask. The air outlet (bent tubing) was left open during actual aeration. The unit was autoclaved at 121°C for 15 min. The aeration apparatus is shown in Figure 1. Non-aerated cultures at 55°C were found to grow relatively slowly and therefore were not used in this study.

In using the dye-reduction procedure, milk samples to be tested, as well as control samples of non-homogenized whole milk, were pipetted in 10-ml quantities into test tubes. These were steamed about 7 min or could be immersed for 2 or 3 min in boil-

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[1]Journal paper No. J-4008, of the Iowa Agricultural and Home Economics Experiment Station, Ames, Iowa. Project No. 1194.

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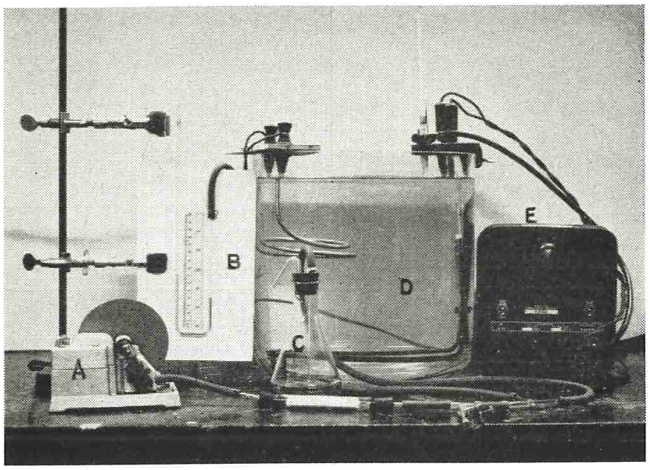

Fig. 1. Apparatus for growing broth cultures of *B. stearothermophilus*: *A* air pump, *B* manometer, *C* aeration flask, *D* water bath, *E* thermoregulator relay.

ing water to prevent inhibition apparently due to naturally occurring substances. Samples should be cooled immediately in water to approximately room temperature to minimize destruction of any antibiotic substances.

Because of some variation of growth in the broth culture, the size of the bacterial inoculum may need to be adjusted for maximum sensitivity. However, 17-hr cultures usually were found to have Klett-Summerson turbidity readings ranging from 95 to 135, using a tube 14 mm in diameter and a filter with maximum transmission at 640 mμ. With these cultures, an inoculum of 0.5 or 0.6 ml resulted in optimum sensitivity in the TTC test. The tubes containing milk plus culture were agitated vigorously to distribute the cells evenly and incubated in a water bath at 61 to 62°C. This temperature range was chosen not only because it gave good results, but also because of the frequent use of 61.7°C[1] for laboratory pasteurization studies. Incubation at 65°C also was satisfactory, but 70°C proved to be too high. The milk samples plus culture were incubated for 20 min before addition of 0.5 ml of a 1% aqueous solution of TTC (Eastman Kodak No. 6533) as indicator. Indicator addition at the beginning of incubation or before the 20 min period had elapsed reduced the sensitivity of the test. After addition of indicator, the tubes were inverted twice and returned to the bath for an additional 10 to 20 min for color development, being careful to protect the samples from any undue exposure to light. The color of the tubes then was compared immediately with the color developed in a control tube known to be free from antibiotic substances. With a 17-hr culture, 0.002 unit of penicillin G per ml of milk and 0.3 μg. of oxytetracycline per ml were the lowest levels consistently detectable. Preliminary experiments showed that addition of 0.5 or 0.6 ml of resazurin, prepared from certified tablets, to each 10 ml milk sample seemed as adequate for detecting penicillin as did TTC.

The activity of the test culture can be preserved for at least 4 or 5 days, and possibly longer, by placing 0.5-ml. portions of steam-treated homogenized milk in test tubes with approximately 0.5 or 0.6 ml of a 17-hr broth culture. These then are immersed in 95% ethyl alcohol precooled at −16°C and stored at this temperature in a freezer. When used in the TTC test, 10-ml milk samples previously steamed are added to the culture. Except that the tubes are agitated after 1 or 2 min to disperse the culture after thawing, the remainder of the test procedure is the same as that used with the fresh broth culture. Procedures permitting satisfactory laboratory preparation of test organism to be sent out for field use would be desirable.

Tests were conducted to determine the levels of dihydrostreptomycin, neomycin sulfate, potassium penicillin G, streptomycin sulfate, oxytetracycline hydrochloride and tetracycline hydrochloride detectable with TTC. All initial dilutions were made with diluents as prescribed by "Tentative methods for the detection of antibiotics in milk" *(17)*. When necessary, secondary dilutions were carried out with reconstituted skim milk. The required amount of antibiotic solution was pipetted into test tubes and made up to 5 ml with inhibitor-free skim milk, then 5 ml of raw milk were added, followed by a vigorous agitation of each sample to obtain an homogeneous distribution of the inhibitory substance. Controls of the same raw-skim milk ratio were included in each set, which consisted of five or six tubes. Samples were steamed and cooled to room temperature. The inoculum was 6% of a 10-hr culture. Preincubation was for 25 min with 10 min for TTC reduction. Results are shown in Table 1. The minimum detectable concentrations given very noticeably inhibited the reducing ability of the test organisms. Later trials indicated that the procedure finally adopted for running the test and presented in this paper would detect 0.002 units of penicillin G in 1 ml of milk.

In the disc assay procedure, the 17-hr culture was used as a source of inoculum. The medium for plating the organism was of the same composition as the broth, except for the addition of 1.5% of agar. Preliminary testing showed that variations of inoculum

[1]The Eleventh Edition of Standard Methods for the Examination of Dairy Products calls for laboratory pasteurization at 62.8°C.

Table 1. Minimum Levels of Antibiotics Detected Using the TTC Reduction Method With 10-hr. Cultures and 1:1 Whole-skim Milk Medium (average of two trials)

Antibiotic	Manufacturer	Amount detected (μg./ml.)
Dihydrostreptomycin sulfate	Abbott Lab., Chicago, Ill.	15
Neomycin sulfate	The Upjohn Co., Kalamazoo, Mich.	3.75
Streptomycin sulfate	Eli Lilly and Co., Indianapolis, Ind.	8.4
Oxytetracycline hydrochloride	Chas. Pfizer & Co., Inc., New York, N. Y.	0.2
Tetracycline hydrochloride	Lederle Lab. Division, American Cyanamid Co., New York, N. Y.	0.15
Potassium penicillin G	Abbott Lab., Chicago, Ill.	0.002[a]

[a]Units per ml.

from 6 to 10% gave similar zone sizes for a given concentration of penicillin G. This was observed with cultures having turbidity readings of 70 and 95 with the Klett-Summerson colorimeter. Six ml of seeded agar were added to each flat-bottomed dish. Although 5 ml of agar per plate gave larger zones for a given concentration of penicillin G, dry spots were noted occasionally with this volume of agar. Single 0.5-in sterilized discs were used, since double 0.5-in discs were not found to improve the sensitivity of the test. Filter paper circles may be inserted under the covers of the plates to prevent condensation of moisture which may drip onto the agar surface while the plates are being incubated. After 75 min at 62°C the plates were removed and examined for zones of inhibition. This method was sensitive to oxytetracycline in amounts as small as 1 μg per ml and to penicillin G at 0.005 unit per ml. The milk must be heated to destroy inhibitory substances normally found in it, in the same way that it is heated for the TTC reduction test with *B. stearothermophilus,* or false zones of inhibition may appear on the plates.

Zones of inhibition may be observed after 75 min of incubation at 61-62°C, when prepared plates are held at 4°C for 4 days prior to use. However, the activity of the organism did not persist for more than 24 hr. when plates were stored at room temperature, although the organisms do not grow at this temperature.

In later studies on the disc assay procedure 10 g of Tryptose (Difco) was substituted for 10 of the 20 g of Trypticase with the result that the test could be read about 30 min earlier in many instances, because of the more rapid growth of the test organism. Very satisfactory results have been obtained by floating plastic petri dishes containing the test material on the surface of a water bath at 62°C.

Extension Service personnel tested 50 field samples with the *S. thermophilus* TTC reduction test *(12).* Out of these, 18 either strongly or weakly positive results were obtained. These samples in turn were examined with the *B. stearothermophilus* TTC reduction test and the *B. subtilis* disc assay. Two strongly positive results were noted with *B. stearothermophilus,* while only one of these two samples noticeably inhibited *B. subtilis.* This was the only positive result with *B. subtilis.* In a number of cases apparently false positive results have been obtained with the *S. thermophilus* TTC reduction test, as they could not be confirmed by any of the other tests.

In another instance, 18 milk samples from two cows under treatment for mastitis were taken over a period of several days. The samples were held frozen and then analyzed for inhibitory substances with the *B. stearothermophilus* TTC reduction and disc assay procedures, as well as the *B. subtilis* disc assay method. All samples gave strongly positive results with both *B. stearothermophilus* methods. However, two samples obtained some time after the last treatment gave negative results with *B. subtilis.* These findings suggested that the test procedures developed in this investigation are more sensitive than the *B. subtilis* technique under actual use conditions.

The high sensitivity of *Bacillus stearothermophilus* to many antibiotics and the relatively short time required to run either a TTC reduction or disc assay test suggest a method by which a large number of samples might be screened effectively by conducting a relatively small number of tests. Equal portions of the milk samples, probably at least 10, from several producers might be pooled and thoroughly mixed. A 10 ml. volume of the pooled milk would be examined. Should a positive test result, the milk from each producer then would be examined individually to determine the contaminated sample or samples within that group.

Quite possibly the disc assay procedure in its rapid form could be developed quantitatively to be used on body fluids, fermentation mixtures and a variety of other applications where an index of antibiotic concentration would be desired in minimum time. Possibly other strains of this species would show greater sensitivity to antibiotic other than penicillin and tetracyclines. These aspects of the problem have not been explored.

SUMMARY

A rapid-growing strain of *Bacillus stearothermophilus* ATCC no. 7954 was found to be a suitable test organism for detecting antibiotics in milk when used in the 2, 3, 5-triphenyltetrazolium chloride reduction method and the disc assay procedure. Suitable techniques were developed and optimum conditions were determined.

The organism has the advantages of fast growth rate, high sensitivity to penicillin G, high growth and testing temperatures (55 an 62°C., respectively), and the capability of being preserved under refrigeration.

The method was applied satisfactorily to a limited group of producer samples and also to milk from individual cows treated for mastitis with a representative antibiotic-containing preparation.

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WASTE TREATMENT BY STABILIZATION PONDS[1]

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A waste stabilization pond can be defined as an earthen structure of regular and controlled shape, depth, and marginal area, specifically designed and constructed as a waste treatment device. The terminology applied to this treatment facility varies with individuals and different areas of the country; however, the broad term, waste stabilization pond, is considered to most accurately describe the physical and functional mechanisms of such installations. A more specific term often applied to municipal installations is sewage stabilization pond. The term, stabilization pond, is considered to be synonymous with oxidation pond and stabilization lagoon in the broad application of this method of waste treatment.

The first published observations of waste stabilization by photosynthesis in the United States were made in the Southwest where sunlight and open water are available throughout the year. The City of San Antonio is reported to have utilized the stabilization pond principle as early as 1901.

In the Northern Great Plains, the first deliberately designed stabilization pond was constructed at Maddock, North Dakota, in 1949. Studies of this installation showed favorable results which led the North Dakota Department of Health to endorse the use of stabilization ponds as an acceptable method of waste treatment.

The first stabilization pond installation serving a South Dakota community was placed into operation at Lemmon in 1951. Prior to that time, the State of North Dakota had several satisfactorily operating installations. The success of these early installations attracted much attention in the neighboring states, and their use spread rapidly throughout the midwest area. This method of waste treatment is becoming increasingly popular in South Dakota, and there are now 77 installations treating domestic and organic industrial wastes. Acceptance of this method of waste treatment is demonstrated by the fact that no conventional treatment plants have been built in any municipality in South Dakota under 5,000 population during the last five years.

Rapid acceptance of stabilization ponds in South Dakota can be attributed to a number of important advantages of this treatment method over the conventional processes. A majority of our municipalities have a population of less than 2,500, which size range is particularly adaptable, from an economic and operational standpoint, to the use of stabilization ponds. Significantly reduced costs for sewage treatment has made it possible to finance construction of collection systems in practically all of the smaller municipalities in South Dakota. In addition to reduced costs of construction, operation and maintenance of the treatment facilities, a major advantage of particular importance to pollution control agencies is that the degree of treatment remains at a high level even if the pond is neglected from an operational standpoint. Widespread use of stabilization ponds has unquestionably been a significant factor in accelerating the water pollution abatement program in South Dakota.

Many areas of investigation and development remain to be studied to derive the full advantages of the pond method of waste treatment. Such deficiencies in available data and experience are certainly recognized in our area as new and unexplained conditions develop.

Mechanism of Treatment

Stabilization ponds may consist of single or multiple earthen cells receiving untreated or partially treated sanitary or industrial wastes in which stabilization is accomplished by a "self purification" process. Sedimentation occurs after the wastes enter the pond, and settleable solids together with some precipitated suspended and colloidal particles settle to the bottom. Benthic decomposition of the settled organic matter produces an inert residue and soluble organic nutrients which diffuse into the overlying water and are available for consumption by algae. Algae utilize these nutrients and produce free oxygen through photosynthesis. The oxygen is utilized by bacteria in the bacterial decomposition of the settled organic matter and remaining colloidal and suspended matter. A continuous and simultaneous cycle of bacterial-algae interaction thereby takes place under proper conditions. The above conditions exist during open water seasons when sunlight furnishes the energy for photosynthesis and wind accomplishes a mechanical distribution of dissolved oxygen and essential nutrients.

[1]Presented at the 47th Annual Meeting of the International Association of Milk and Food Sanitarians, Inc., October 26-29, 1960, at Chicago, Illinois.

Under ice and snow cover, the pond becomes anaerobic. Accompanying low temperature reduces the rate at which decomposition takes place. Ice and snow cover reduce sunlight to the point where algal activity is negligible, and subsequent lack of oxygen together with low temperatures inhibit biological activity. During the period of ice cover and anaerobic decomposition, the accumulated gases are restrained under the ice. The melting ice of the spring furnishes good quality dilution water and the transition from anaerobic to aerobic conditions generally occurs in a matter of days.

PERFORMANCE

Early studies in South Dakota indicated that stabilization ponds treating raw sewage would perform satisfactorily. Laboratory studies were made on an experimental installation at Wall, South Dakota, in August of 1952. Results showed that the Biochemical Oxygen Demand (BOD) was reduced from an average value of 320 parts per million (ppm) to 30 ppm, a reduction of about 94 percent. Dissolved oxygen values remained at a high level even during the night. Studies were again made in 1953, and the results were similar to those obtained in 1952. During the 1953 studies, the most probable number (MPN) of coliform organisms was reduced from an average of 17 million per 100 ml in the raw sewage to 30-230 per 100 ml near the overflow of the primary pond. The stabilization pond was performing very satisfactorily even though some design features of the installation were not ideal.

Extensive field studies of installations in both North and South Dakota were made cooperatively by the Public Health Service and the two states during 1955 and 1956. Physical, chemical and biological phenomena were observed and correlated with structural design, operational practice and climatological features. Results of this study have been published (1957) in two volumes entitled "Sewage Stabilization Ponds in the Dakotas," a Joint Report With the North and South Dakota State Departments of Health; U. S. Department of Health, Education, and Welfare, Public Health Service. The summary of the report includes the following statement on performance of the five installations studied:

"Treatment obtained during both open water and ice cover is very good. Reduction in concentration of BOD ranged from 74 to 98 percent during the open water seasons and from 70 to 96 percent under ice. One installation had an average depth of only 14 inches, and when frozen to a depth of 11 inches, had a concentrated liquid depth of three inches on the bottom; this concentration resulted in somewhat less reduction of BOD, 44 percent. Reduction in bacteria, as determined by coliform density (MPN), were greater than 99 percent more than 50 percent of the time and, except for one sampling period at two installations, were 95 percent or greater at all times."

The degree of treatment obtained in stabilization ponds is therefore considered to be equivalent to that obtained from most conventional secondary treatment plants. From the standpoint of the pollutional load discharged to a water-course, it is significant to calculate organic reductions in pounds rather than in concentration. Losses in liquid volume through seepage and evaporation significantly reduce the organic load discharged.

APPLICATION IN SOUTH DAKOTA

All of the stabilization ponds in South Dakota have been installed as permanent waste treatment facilities, and a majority serve as a complete treatment unit. Stabilization pond installations have demonstrated an ability to effectively treat raw sewage under proper loading conditions with no adverse effects. The treatment provided by an installation meeting recommended standards of design is considered to be equivalent to, or better than, that of most conventional secondary treatment plants.

The demonstrated capacity of stabilization ponds to treat raw sewage has resulted in construction of an increased number of such installations. With few exceptions, it is more economical for the smaller municipality to provide additional pond area rather than primary treatment. Many Imhoff tanks have been by-passed when a stabilization pond was constructed in order to eliminate the odors generally associated with such units and also to decrease operational requirements. The ability of stabilization ponds to effectively treat raw sewage has been the significant factor in reducing costs of the smaller installations far below that of conventional plants providing a comparable degree of treatment.

Stabilization ponds are operating in all sections of South Dakota ranging from the sparsely populated western area to the more densely populated agricultural eastern area. The use of stabilization ponds is not considered limited to sparsely populated areas where low value land is available. For the smaller installations, the aggregate cost of construction and operation of stabilization ponds in high value land areas has generally been found to be significantly less than that of conventional treatment methods. The final choice of treatment method should necessarily be reached by a thorough study of local conditions and economic considerations.

A total of 77 stabilization ponds having a design population of 88,413 persons are presently in operation in South Dakota. The water surface area represented by these installations is 801 acres. Of the total number of stabilization ponds in operation, 61 serve municipalities, one serves a State institution, 10 serve Federal installations, 3 serve private installations, and 2 treat organic industrial wastes. Significant dairy plant wastes are treated in conjunction with domestic wastes in seven of the municipal installations.

Dairy wastes are being treated effectively in conjunction with domestic wastes by stabilization ponds. Organic loadings have been maintained at a level comparable to that recommended for normal municipal installations. A summary of the basis of design for these installations is shown in the following table:

BASIS OF DESIGN

DAIRY & MUNICIPAL WASTE STABILIZATION PONDS

City	1960 population	Design BOD (lb./day) Domestic	Dairy	Total	Area of pond (Acres)	BOD Loading (lb/acre)
Castlewood		85	100	185	16.0	11
Freeman	1140	150	120	210[a]	8.3	25
Humboldt		92	112	204	12.3	17
Parkston	1517	220	130	350	15.5	22
Redfield	2934	450	100	550	30.2	18
Scotland	1079	220	48	268	13.1	20
Volga		144	360	390[b]	21.0	19

[a]Existing conventional plant removes sixty pounds BOD/day.
[b]Existing conventional plant removes 114 pounds BOD/day.

Design loadings for all these installations except Castlewood are in the range of 20 pounds BOD per surface acre per day. A more conservative design was used for the Castlewood pond since it was the first application of a stabilization pond for treatment of combined domestic and dairy wastes in South Dakota. Loadings in the magnitude indicated have resulted in no serious odor problems except in those installations where abusive wastes such as whey and buttermilk have been discharged to the system. The gross organic load from such discharges together with a high sulfate concentration in the water supply created serious odor problems at a number of the installations. Diligent operation of the dairy plant and control by municipal ordinance to prevent such discharges is as necessary for satisfactory stabilization pond operation as it is for a conventional plant.

The discharge of such strong wastes actually creates a lesser problem with a stabilization pond than a conventional plant even though the odor problem may make the situation appear more serious. Reasonably high removals of BOD are accomplished by stabilization ponds even under such adverse conditions and the recovery period to normal operation is generally short. Some problems have been experienced with filling and maintaining an adequate liquid level in the stabilization pond; however, such difficulties have generally been attributed to unsatisfactory soil conditions.

Meat processing wastes from two plants are being treated effectively and economically by stabilization ponds. A loading of 50 pounds BOD per surface acre was used as the basis of design for these installations. A loading of this magnitude is significantly higher than that recommended for treatment of dairy and municipal wastes. Experience has shown that a stabilization pond treating only meat processing plant wastes will operate satisfactorily and provide a high degree of treatment at a loading of 50 pounds BOD per surface acre per day. Meat wastes appear to be characteristically well suited for treatment by stabilization ponds. The sulfate concentration of the water supply has also been found to be an important consideration in the design of stabilization ponds particularly when the higher organic loadings are to be applied.

Field and laboratory studies of one of the installations treating wastes from a small packing house showed that the stabilization pond was operating at a loading of 95.0 pounds BOD and 11.6 pounds total nitrogen per acre per day without creating nuisance conditions. At this loading, the BOD reduction under summer conditions was 72% resulting in an average effluent BOD of 150 ppm. Additional pond area has since been provided for this installation.

DESIGN CRITERIA

Factors which affect the treatment process in a stabilization pond include *(a)* the strength and volume of waste, *(b)* the type of waste, *(c)* loading per unit of surface area, *(d)* chemical quality of the water supply, *(e)* sunlight, *(f)* temperature, *(g)* depth, and *(h)* inlet and outlet structures. In addition to these items, selection of a site for a stabilization pond must be based on availability of suitable land at an acceptable location. Soil characteristics are also an important consideration in the selection of a site.

Minimum design criteria for stabilization ponds were first developed in South Dakota in 1953. On the basis of experience and additional data on performance, several revisions have been made to the original standards. South Dakota also participated with the other Missouri Basin States in the development of uniform design criteria for the Basin.

The basic consideration in the design of stabilization ponds is the organic loading that can be applied to satisfy all conditions. Such conditions are considered to encompass two main objectives in South Dakota; *(a)* to provide an adequate degree of waste treatment, and *(b)* to provide such treatment without creating nuisance conditions.

Experience with the early installations in our State has indicated that providing one surface acre per 100 population equivalent (15-20 pounds BOD) will satisfy both of the above conditions. The surface loading is based on a liquid depth of 3 to 5 feet. Such a recommended loading is considerably more conservative than that suggested by some of the other states. Loadings have been held low not particularly for increasing treatment efficiency but to prevent occurrence of nuisance conditions. The lack of odors has become an important factor in the rapidly increasing use of stabilization ponds in South Dakota.

Climatic conditions are necessarily an important consideration in design in our area. Ice cover normally exists from December 1 to March 15. With the loadings recommended, recovery is rapid following ice breakup resulting in only brief periods when odors might occur. The more heavily loaded ponds require increasingly longer periods to revert to the aerobic state.

Experience in South Dakota indicates that the sulfate content of the water supply should be taken into consideration in determining the organic loading of stabilization ponds. A high sulfate content is definitely conducive to more serious odors, and this effect would necessarily be more pronounced in the heavily loaded ponds. There is also some evidence indicating that high sulfate concentrations have a deleterious effect on the efficiency of the stabilization process. Further investigation of this effect on over-all pond operation is required to develop design recommendations; however, observations and experiences to date indicate that sulfate concentrations in the range of 500 ppm do not cause serious problems. Many of the municipalities in South Dakota served by stabilization ponds use water with sulfate concentrations in excess of 1000 ppm. Operational problems have occurred at sometime in almost all instances where the sulfate content was at this level. Such problems were not necessarily limited to those installations having loadings higher than recommended or those treating industrial wastes.

The choice between use of a single cell or multiple cells depends on local conditions, downstream water uses, size of the installation, and other general considerations. Should it be considered necessary to provide one or more cells in series with the primary cell, it is recommended that the loading of the primary cell not exceed the recommended value of 15-20 pounds BOD per surface acre.

Loading based on surface area with controlled depth is considered to be the significant basis for design. Should it be desirable to reduce the size of the primary unit, smaller cells operating in parallel are recommended. Multiple cell design has distinct advantages in many instances. A number of stabilization ponds have been built using a two-level bottom. Approximately one-half the pond is designed for a liquid depth of 3 feet and the remainder for a depth of 5 feet. Such a design has the advantage of alleviating filling problems without increased expenditures for dividing dikes and additional appurtenances.

Location of stabilization ponds with respect to habitation and the municipality is often a subject of discussion. The revised design criteria presently used in South Dakota specifies no minimum distance that a pond should be located away from built-up areas. A study and evaluation of local conditions similar to that necessary to locate a waste treatment plant of any type is considered to be the most practical approach. The results of a 1956 court action in South Dakota regarding the location of a proposed stabilization pond installation may be of interest. The nearest contents of the pond were proposed to be within approximately 500 feet of a residence, and the owner brought suit to prevent construction of the installation. After hearing testimony for 2 days, the court ruled against the property owner. The installation was placed into operation in early 1957 and no further legal action has been initiated.

COSTS

The average construction cost based on 62 installations with a total design population of 83,811 and varying in design population from 200 to 10,600 is $11.00 per capita. The range of such costs is from a minimum of $3.27 per capita to $37.94 per capita. The construction cost in terms of water surface averaged $1185.00 per acre with a range from $634.00 to $3690.00 per acre. Land costs are extremely variable and dependent on local conditions. The data shows an average land cost of $2.58 per capita based on land purchases by 46 municipalities with a total design population of 63,582 persons. The total approximate average cost of providing sewage stabilization ponds in South Dakota is indicated to be $13.58 per capita.

The equivalent of complete treatment was therefore provided at approximately the same or at a lesser cost than that of conventional primary treatment. When operation and maintenance costs over an extended period also are considered, the savings in cost through use of stabilization ponds becomes even more pronounced.

OPERATIONAL PROBLEMS

Odor problems have occurred in a number of the installations in South Dakota. A serious odor problem developed in one of the earliest installations in the state serving the City of Kadoka. The most serious conditions prevailed during the summer season when it would be expected that stabilization ponds would perform at peak efficiency and be capable of assimilating heavy loads. Studies indicated that the loading was in the order of 20 pounds BOD per surface acre per day. Sulfides continued to be produced through the open water seasons indicating that anaerobic decomposition was taking place. The municipal water supply has a sulfate concentration of 1038 ppm and total dissolved solids of 1841 ppm. Investigations resulted in no specific conclusions on the cause of the unsatisfactory conditions. A second cell was constructed in early 1956 to provide a loading of approximately 12 pounds BOD per surface acre. The installation has functioned without serious nuisance conditions since that time although some odor problems have been reported.

Problems with odors have also been experienced particularly during the spring transition period from ice to open water in a number of other installations. Particular difficulties have been experienced with those installations treating dairy wastes in conjunction with domestic sewage. Investigation of these problems has shown that abusive wastes such as buttermilk or whey have been discharged to the system. Experience has shown that stabilization ponds can effectively treat dairy wastes under proper loading conditions. It is also significant that the most serious problems occurred where the municipal water supply contained sulfates in the order of 1000 ppm.

Control of weeds during the initial filling period often causes operational problems. Proper design and construction can alleviate this problem to a large extent. Some success has been demonstrated in controlling aquatic vegetation by applying some of the newer types of herbicides or soil sterilants.

Sealing of the bottom and embankments is essential when ponds are constructed of pervious soil. Heavy growths of vegetation have developed in some installations constructed in porous soils resulting in greatly increased maintenance requirements.

Operational problems have been limited to a small number of the total installations in operation. Some odors are experienced during the transition period from ice to open water in almost all installations. The recovery period is necessarily of longer duration for the more heavily loaded ponds. Alternate freezing and thawing further aggravates the recovery process. Ponds have been placed into operation in early winter with no difficulties experienced. Insect breeding in properly constructed and maintained ponds has presented no serious problem. There was one instance of a high mosquito population at a pond that developed a dense cover of vegetation before acquiring an optimum depth of water. Since an adequate water level has been maintaind and vegetation brought undr control, the problem no longer exists.

Conclusion

Waste stabilization ponds have become an answer to the rising costs of sewage treatment for a great percentage of the municipalities in South Dakota and in many other areas. Further application of stabilization ponds as a complete treatment device for many organic industrial wastes will bring about further advances in water pollution control. Stabilization ponds have fulfilled a long recognized need for effective treatment at reasonable cost for the smaller municipalities and industries.

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SPRAY RESIDUES ON FRUITS AND VEGETABLES[1]

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An amendment to the Federal Food, Drug and Cosmetic Act, adopted by the Congress in 1954, sets up a procedure whereby the toxicity of pesticide chemicals used on raw agricultural products can be evaluated, their usefulness determined, and safe tolerances set for residues, or for the establishment of exemptions from the necessity of tolerances when such are not necessary to protect public health.

The administrative procedure under this act is that a registrant of a pesticide under the Federal Insecticide, Fungicide, and Rodenticide Act, which is administered by the U. S. Department of Agriculture, may initiate proceedings by filing a petition with the Secretary of Health, Education, and Welfare, requesting the issuance of a regulation establishing a tolerance for the pesticide or exempting it from the necessity of a tolerance, and by requesting the Secretary of Agriculture for a certification that the pesticide is useful in treating an agricultural commodity. The registrant submits, as a part of the application, information showing the name, chemical identity, and composition of the pesticidal chemical; the amount, frequency, and time of application; toxicity information; amount of residue remaining in or on food; residue removal methods; and other grounds to support the petition.

Following certification by the Secretary of Agriculture that the product is useful, the Secretary of Health, Education, and Welfare is required to publish a regulation establishing a tolerance or exempting the pesticide from the necessity of a tolerance. This regulation is based upon the data supplied by the petitioner and other data before the Secretary.

The Secretary has a limited time — 90 days — after the application is filed to issue a regulation, and any interested person has an opportunity to file written objections after publication of the tentative regulation. As soon as practicable after the expiration date for filing objections, the Secretary of Health, Education, and Welfare publishes a final regulation which is subject to review by the courts.

In 1959, the Congress amended the Federal Insecticide, Fungicide and Rodenticide Act by declaring that nematocides, plant regulators, defoliants, and desiccants are "economic poisons" for the purposes of that act. This makes them "pesticide chemicals" when used on raw agricultural products and hence subject to the tolerance procedures of the pesticide amendment.

After a tolerance has been set, no one may ship in interstate commerce any raw agricultural product which contains residues of pesticide chemicals in excess of the tolerances which have been set under the fore-going procedure. At last count, approximately 3,000 tolerances have been set for various pesticide chemicals used on raw agricultural crops.

Although these amendments are to federal laws and apply only to raw agricultural products shipped in interstate commerce, they have a tremendous impact on state food control programs. It is only necessary to recall the effect of the "cranberry episode" on all of the states to recognize what happens when a product in interstate commerce violates the federal act. Although most of the states produce no cranberries, they all found themselves involved in surveying cranberries shipped into their respective jurisdictions, sampling them, and arranging to take regulatory action where necessary. They also found themselves besieged by consumers asking for some assurance that the cranberries those consumers had purchased and used recently would not cause them to become ill. This is an extreme case. Nevertheless, it illustrates the point that whether or not a state wishes to do so, it is inevitably required to institute a program that will assure the safety of raw agricultural products consumed in that state.

Even when raw agricultural products produced in a given state are shipped in interstate commerce, there is a need for a state program. For example, early this year a greenhouse operator, whose place of business is in Indiana, treated his crop of Bibb lettuce with pentachloronitrobenzene, a fungicide. This was a chemical for which no tolerance had been set under the federal act. Therefore, no residues could remain on the harvested crop of Bibb lettuce. This company shipped its Bibb lettuce all over the United States. Most of it was shipped in interstate commerce. Samples obtained by the Food and Drug Administration possessed residues of this fungicide. Although this company made exhaustive efforts to remove traces of

[1]Presented at the 47th Annual Meeting of the INTERNATIONAL ASSOCIATION OF MILK AND FOOD SANITARIANS, INC., October 26-29, 1960, at Chicago Illinois.

pentachloronitrobenzene from its Bibb lettuce, it was unsuccessful.

Although the Food and Drug Administration could, and did, institute seizure actions against violative shipments in interstate commerce, the time consumed in making necessary laboratory analyses to confirm the presence of the fungicide resulted in many shipments being distributed and consumed before libel action could be instituted against them. A few were seized when the consignees agreed to hold their shipments until laboratory analyses could be completed.

This illustrates one of the difficult problems associated with determining the legality of fresh fruits and vegetables. These products are perishable; they move to market rapidly, are distributed within a day or two, and are usually consumed within three or four days of their shipment. Laboratory tests designed to detect pesticide residue as low as one part per million are time consuming. In the case of pentachloronitrobenzene, it takes about two days to complete and confirm an analysis. Therefore, even if the sample is obtained immediately upon the arrival of the shipment at its point of destination, it still may have been distributed and consumed before confirmatory analysis can be obtained and legal action against a violative shipment instituted. This was the case with the Bibb lettuce.

Another problem – the Bibb lettuce was transplanted into growing beds at predetermined intervals so it would mature in orderly procession. It was necessary for the grower to cut, ship, and market this Bibb lettuce as it matured. The Bibb lettuce would not wait or slow down its growing cycle, so the grower was forced either to abandon his considerable crop or make what analysis he could and hope his cleaning procedures had resulted in removing residues. As it turned out, his analytical procedures were not sensitive enough and his cleaning methods were not effective. Every lot examined by the Food and Drug Administration continued to show residues. This situation then had all of the elements of another cranberry episode. The Food and Drug Administration could not take action against this grower's Bibb lettuce until it had entered the channels of interstate commerce. After shipment in interstate commerce, the U. S. Food and Drug Administration could not take regulatory action until each individual shipment had been sampled and evidence collected that would support libel action. Since violative shipments, in many instances, were distributed and consumed before regulatory action could be instituted under the federal law, the consuming public was being exposed to a product which contained a pesticide chemical prohibited by the act.

We, in Indiana, certainly did not want the state to become the focal point of another "cranberry episode." The Food and Drug Administration did not want to issue a public warning as had been found necessary in the case of the cranberries. The only legal remedy remaining to the Food and Drug Administration was to institute injunctive proceedings in the Federal District Court to prohibit further shipments of Bibb lettuce contaminated with pentachloronitrobenzene. This legal recourse would have taken too long. Before it could have been completed and an injunction issued, thousands of pounds of Bibb lettuce could have been shipped. The Cincinnati District office of the Food and Drug Administration appealed to us to take what action we could under our state law to prevent further shipments of Bibb lettuce by this grower.

Our uniform law does not contain a provision similar to the Miller Amendment to the federal act and procedures similar to those set up under the Miller Amendment have not been adopted in our state. However, there is a section in our Food, Drug and Cosmetic Act which provides:

"Any dairy product, meat, meat product, seafood, poultry, confectionery, bakery product, *vegetable, fruit or other perishable articles* which are unsound, or contain any filthy, decomposed or putrid substance, *or that may be poisonous or deleterious to health* or otherwise unsafe, is hereby declared to be a nuisance. Whenever the Secretary or any of his duly authorized agents shall find in any room, building, vehicle of transportation or other structure, or on any premises any such perishable food or food product as aforesaid the Secretary or his authorized agent shall forthwith condemn or destroy the same or in other manner render the same unsaleable as human food."

Using this section of the law as our authority, we notified the management of the greenhouse company of the alleged violative condition of its interstate shipments of Bibb lettuce. We prohibited him from making any further shipments until we had satisfactory assurances that the Bibb lettuce did not contain any residues of pentachloronitrobenzene. We further required him to institute laboratory testing procedures at his plant which would assure him and us that no violative shipments would be made either in interstate or intrastate commerce.

He immediately discontinued shipments and assured us that he would do everything necessary to assure the freedom of his further shipments from residues. Despite all of his efforts to remove residues, he was unsuccessful. Every lot of Bibb lettuce examined continued to show residues. As a final action, he voluntarily destroyed the remainder of his crop of Bibb lettuce under our supervision. The loss totaled approximately $100,000.

Since that time, we have been concerned with the absolute need to set up a state program to prevent the marketing in intrastate commerce of fresh agricultural products that contain excessive amounts of pesticide chemicals. Although the Miller Amendment has been a part of the federal law since 1954, very few of the states have such a program. The difficulties attendant to setting up such a program are many. Among the principal ones are:

1. Most state laws, except those enacted during the past two or three years, have no provisions comparable to the Miller Amendment or the recent Food Additives Amendment, or the Color Additives Amendment enacted by Congress this year (1960). Most of the uniform state laws are similar to ours in that they have a provision which prohibits the use of any poisonous or deleterious substance in or on a food unless the use of that poisonous or deleterious substance is necessary in the manufacture of the food or cannot be avoided by good manufacturing practice. The difficulty here is that it is necessary for the state agency to first be able to prove in court that the substance is poisonous or deleterious; second, that it is not needed in the manufacture of the food, or that its use can be avoided by good manufacturing practice. Unless these things can be proved in a court of law, there is nothing to stop the producer from using these substances. Some of the state uniform laws authorize the adoption of federal regulations when they are promulgated under the Federal Food, Drug and Cosmetic Act. There is a great deal of controversy among lawyers as to whether or not this provision would authorize a state, without amending its law, to adopt tolerances or exemptions from tolerances as they are promulgated under the federal act. In many instances, it is felt that an amendment to the state law may be necessary.

2. Without prior knowledge of its application, there will be a great deal of difficulty to determine what pesticide or spray residue the laboratory should look for in a given sample of a raw agricultural product. Approximately 3,000 tolerances have been set for over 200 pesticides ranging all the way from Aldrin to Ziram. In order for the laboratory to test a submitted sample, it is necessary for that laboratory to know what pesticide has been or may have been used. This, in turn, means that a great deal of field work must be instituted so prior knowledge may be obtained. It means that field men from the state agency must visit the producing farms, greenhouses, or orchards, and determine what is being used, when, and how much. Although the pesticide manufacturer is required to label his products with adequate directions for use, including information as to which crop it is to be used on, and when, and in what quantity, there is no valid assurance that the agriculturists will use it according to directions or limit it to the crops on which it safely may be used. It becomes necessary for the fieldmen to determine, insofar as possible, what insecticide the agriculturist is using, on which crop, and what prohibited insecticide may have been used. All this must be done during the growing season, but samples of the finished agricultural products cannot be obtained until the time of harvest or after shipment. Where a violation is suspected, the sampling of the mature raw agricultural commodity must be prompt or the product will have been shipped, distributed, and consumed.

3. Most state laboratories, including our own, are not staffed with adequate personnel or laboratory equipment to make the necessary tests. Some states have made a great deal of progress. Others have not. In Indiana, we are beginning to acquire the know-how and some laboratory equipment. Until our laboratory is set up to do the work, it is necessary for us to rely on the good offices of the laboratories of the Food and Drug Administration to make many of the necessary tests. Their facilities are limited, too, and they can provide us with only limited assistance.

4. In many instances, exact procedures for detecting minute quantities of prohibited pesticides, or residues in excess of established tolerances, are not completely defined or are lacking. The chemical manufacturers and the Food and Drug Administration are doing extensive research in this field. New and improved methods are being developed every week, but the fact still remains that many presently developed laboratory procedures are not specific enough or sensitive enough to detect some of the residues.

5. Finally, there is the need to train state fieldmen until they acquire a knowledge of what to look for and how to look for it when inspecting agricultural producing areas for the use or misuse of pesticide chemicals. This includes a knowledge of what pesticide is permitted to be used on what crop, when it should be used, and how much and under what conditions. He must also be able to work with the farmer, orchardist, and greenhouse grower from an educational standpoint and assist them in controlling the use of insecticides so as to assure a safe, legal crop. To do otherwise would arouse the resentment and suspicions of agricultural growers and result in an unnecessarily large number of samples being sent to the laboratory.

It has been our experience that most agricultural growers are concerned lest their crops contain illegal residues or prohibited pesticides. They have welcomed our assistance and cooperation. Most of them, based on the discussions we have had, are trying to adhere strictly to the label directions on the insecticide packages. Purdue University, the county agricultural agents, and the Farm Bureau have stepped up their program of informing and advising agricultural growers how to use and limit the use of agricultural pesticides.

Food processors, too, are concerned lest the raw agricultural products they use in their processing contain excessive residues or prohibited pesticides. Some food processors are requiring guarantees from their suppliers that the ingredients they furnish comply in all respects with the applicable tolerances or exemptions from tolerances of the federal act. The National Canners Association set up its own recommended program for its members. Indiana fruit and vegetable canners this year took over their own spraying programs. They no longer permit contract growers to spray tomato crops. Those who bought open-market tomatoes for their canneries required the grower to furnish evidence of what pesticide was used, in what quantities and when, on the growing tomato crops. Those that took over their own spraying programs set up exact spraying schedules and kept complete records of what chemicals were used.

We met with canners, railroad and highway department representatives to discuss the problem of accidental contamination of growing crops from drifting sprays of 2-4-D. In spite of the care that was instituted in the spraying of highways and railroad rights-of-way, some damage from 2-4-D was caused to tomato acreage in Indiana as the result of the reactivation of 2-4-D when volatile esters were used. Although these esters may have been sprayed safely and on days when there was no wind to cause drift, residues became reactivated during a succeeding rain and the drift affected nearby fields of growing tomatoes. A law is now being prepared for introduction into the 1961 session of the Indian Legislature which will prohibit the use of volatile esters of 2-4-D. Canners whose crops were affected by the 2-4-D spray immediately notified their state association secretary or our office and refused to use any of the tomatoes produced by vines that survived.

It seems to me that it is incumbent upon state regulatory agencies to assess their problem in the light of the implications of the federal law. There is no doubt that a public health problem exists. The great majority of agriculturists agree that we must continue to use insecticides if we are to produce foods in adequate amounts which are acceptably free from filth and rot. At the same time, insecticides are poisonous. If they were not poisonous, they would not kill insects. They may exhibit poisonous properties either acutely or chronically, or both. In the case of an acutely toxic insecticide a single dose or a few doses close together could cause poisoning.

As a general rule, a food control official is not particularly concerned about the acute toxicity of an insecticide because the quantities which remain in or on foods are too small to cause an acute poisoning. But we are concerned about chronic poisoning resulting from the long-time consumption of minute amounts of poison which eventually may build up to produce a serious physiological condition. This is, of course, cumulative poisoning. It is the kind of poisoning that is of the greatest concern and one we must guard against from residues of insecticides in the food supply.

We should remember, too, that the newer insecticides are much more potent than those that were used in former years. This potency is demonstrated by the fact that much smaller amounts are necessary to kill insects than were used when sodium and calcium arsenate, cryolite, and other simple inorganic substances were used. Furthermore, the trend in the newer insecticides is to increase toxicity and potency. As resistant strains of insects appear, the search is on for insecticides with greater killing power to control them. It is apparent, therefore, that the residue problem will become more extensive and more complicated in the future. States should plan now to amend their laws where necessary and to set up effective programs which will assure the consumer a safe, adequate food supply. It is not sufficient to depend on the Food and Drug Administration. A greater proportion of fresh fruits and vegetables are consumed in the state of origin than most any other food. This proportion is not subject to the federal law and can be regulated only by a state program. It is a difficult task but not insurmountable. Much of the difficult work has been done – that of evaluating the toxicity of these chemicals and setting tolerances for their safe use. States can take advantage of this by adopting these tolerances or amending their laws so they can be adopted and then setting up a program to administer them.

INDUSTRIAL USES OF WELDED PIPELINES[1] –

EXPERIENCES AT SAFEWAY STORES

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In 1947 Safeway Stores built a cottage cheese plant in Hanford, California, adjacent to an older evaporated milk operation. All milk receiving was done in the evaporating plant. The two plants were approximately 200 feet apart. It was necessary to transfer milk from the evaporating plant to the cheese plant. The unusually long sanitary pipe lines required would impose a serious and expensive cleaning problem, if assembled in the conventional 10-ft. long sections. It was felt that the long lines involved were ideal for a test of the theory of permanent sanitary pipe lines.

Our original concept, when considering permanent lines, was that the ideal would be a line welded throughout of stainless steel tubing and using butt welded fittings for all elbows, tees, valves and other connections.

In 1948, 1600 feet of welded lines were installed in this plant. It took 8 man-hours to clean the caps on the inspection crosses, valves, prepare the lines for circulation, and complete the actual cleaning. With the take-down lines, it would have required at least 24 hours of labor to disassemble and hand-clean them.

I was assigned as foreman of this new cheese plant in 1948. One of my primary jobs was to work out a satisfactory procedure for cleaning and sanitizing permanent lines, as well as try to get a satisfactory method of determining bacterial counts on the interior of the line. Initially, flake caustic and muriatic acid was used for cleaning. I assure you lines were clean – we ate through some of them! Since the initial installation thirteen years ago, we have gone through countless experiments and developments with the permanent pipe line system. Today, all of our plants except Ft. Worth, Texas, have welded pipe lines; all plants have automatic CIP systems.

During the 13 years of development, some things became evident:

1. *Welding Procedure.* When we first began welding lines together, stainless steel rod was used, which deposited a good-sized welding bead inside the line. The bead had to be ground out and polished. To eliminate this, our engineer in Hanford developed a welding jig and used heli-arc welding. This fused two pieces of pipe together in the presence of argon, an inert gas, without any welding rod. This allowed faster welding without a noticeable internal bead. Consequently, the need for grinding and polishing was eliminated. In recent years, several small portable welding jigs have been developed, which makes it possible for more welders to qualitfy for installing welded pipe lines.

2. *Weld Inspection.* We tried various methods of inspecting interior welds. This has included X-raying, boroscope, flashlight and mirror, etc. None of these processes were satisfactory because it was difficult to interpret what we saw. We found that the best protection was to have a responsible welder do the job. Our Hanford engineer said this: "It is the welder's sole responsibility to do a good job on sanitary tubing. He knows better than anyone else how good that job is. It is mandatory that the welding operator at all times, realizes that, under no circumstances, can he use any so-called short cut in his work. If there is any doubt about the condition of a weld, cut it out and do it over." This should be the guiding rule.

3. *Rough Welds.* We were quite concerned about a smooth interior surface on the first installations. I'll have to admit, however, that some rough welds did slip in and, in some cases, cracks developed in the lines. The immediate thought would be that here is a prime source for contamination. However, this was not the case. It was found that there was actually more turbulence and scrubbing action at every point in the line where there was a protuberance or a crack. This can be demonstrated quite simply by running water over a smooth surface and then laying some obstruction in the path of the water stream and seeing the turbulence that is created at that point.

4. *Cleaning Lines.* At first, lines were brushed with a power brush or by placing a small round brush in the line and circulating it through the system. Again, it was found that neither of these processes were necessary, inasmuch as high velocity, proper temperature, and strength of cleaning solution did an effective job.

5. *Crosses.* For many years, crosses were installed at every change of flow direction so that the line

[1]Third in a series of papers given in a panel discussion on "Industrial Uses of Welded Pipelines," presented at the 47th Annual Meeting of the International Association of Milk and Food Sanitarians, Inc., October 26-29, 1960 at Chicago, Illinois.

could be inspected. Initially, this type of installation was necessary in order to prove to ourselves and others that these lines were getting cleaned properly. Eventually, the crosses and caps gave trouble because they were dead ends and, consequently, a source of contamination. Yes, we had a definite procedure that all caps were to be removed and cleaned daily. However, we are human and there was an occasional slip which brought about some high counts. It also became apparent that sanitarians were not interested in looking into our pipes after the first few months of operation. Experience showed that, to get maximum benefit from welded pipe lines, it should be a completely closed system, free from every possible source of contamination. This meant replacing the crosses with welded ells and eliminating as many tees and valves as possible. Our new plant in Los Angeles, opened in 1957, was so equipped. An article on this plant was written up in *Food Engineering* in 1957.

In 1958, new plants were opened in Omaha, Oklahoma City, and Bellevue, Washington. Complete welded pipe systems were installed on an experimental basis and research programs were set up cooperatively with University of Oklahoma, University of Nebraska and Washington State College. The study of the Oklahoma City plant was published in the April issue of the *Journal of Milk and Food Technology.* I believe the studies of Omaha and Bellevue will be published in the near future.

C.I.P. Systems

The success of permanent pipe lines is dependent upon how well they can be cleaned and sanitized. During the past 10 years, our plants have experimented with numerous pumps, cleaning compounds, range of temperatures, and velocities. Out of these experiments has evolved a system which we feel is adequate and yet not too complicated. The cleaning system consists of two tanks, one for rinse, one for the cleaning solution; in some cases, a third tank is added for acid solution. Tanks are equipped with steam coils and controllers, so that any desired temperature can be maintained in these tanks. A recording thermometer is placed on the return lines to the washing solution tank, so that time and temperature for each circuit can be recorded.

In most plants, a 10-HP industrial type pump, with stainless steel casing and impeller, is used. The size of the pump depends on the amount of pipe to be cleaned; as you know, it must deliver a flow of 5 ft per second. We have found that the 10-HP pump is more than adequate but can be throttled down if the pressure is too great. We would rather be on the safe side on velocities.

The entire cleaning operation is controlled by a program timer. There are several different makes on the market. The Taylor Flexo-Timer and Wizard Process Planner are used in our installations. All Valves for the CIP system are air-operated and tied in to the program timer.

This is the sequence used in cleaning a permanent line:

1. Lines are rinsed with tepid water until the return water becomes clear – each plant has its own timing. This rinse goes down the sewer.
2. The valve to the cleaning solution tank is opened and the lines are circulated for 10 to 15 minutes. Temperature range is between 140° and 160°F.
3. The lines are rinsed again for a pre-determined length of time to insure complete evacuation of all cleaning compounds.
4. Lines are not sanitized until the following morning, just before use.

Installation of Permanent Lines

This is what we would consider a satisfactory procedure for installing permanent pipe lines:

1. Make a drawing showing the complete processing room layout with all equipment located accurately.
2. Draw in sanitary and CIP lines with all the fittings complete to every piece of equipment. Trace all the circuits so that you will know exactly how each piece of equipment or line is to be cleaned.
3. Draw an isometric diagram of sanitary and CIP lines so there will be no question from the installing engineer as to how it is to be done.
4. Confer with the responsible sanitarian on this layout. Go over it in detail and get his understanding and approval before work is started.
5. If you do not have your own engineers, obtain a competent company to do the installation. This is very important because not every welder, even though he has worked on stainless steel, can do a good job of layout and welding of sanitary lines.
6. Have a responsible man on the job to supervise the installation. We also recommend that the sanitarian come in as often as possible to inspect the installation as it progresses.
7. Install a completely automatic CIP system, as outlined previously.
8. Check the lines during the installation for proper slope and proper welding procedure.

Summary

Results of our experience over the past 13 years indicate that a completely permanent sanitary milk line with welded ells and joints is entirely feasible. This type of installation is more efficient, saves on labor and product, gives better control over the end product, and gives a lower finished product bacteria count.

Rough welds or internal cracks in a sanitary milk line have never been a source of contamination *when the welded pipe is cleaned and sanitized in the proper manner*. Turbulence developed at the point of a rough weld causes an extremely strong scrubbing action that leaves the rough portion as clean or cleaner than the smooth surfaces of the pipe.

The success of a permanent pipe line is dependent upon how well it is cleaned and sanitized. Therefore, we recommend minimizing the amount of human error that can be allowed in the CIP system. The automatic program timer, temperature and time recorders, automatic temperature controllers, automatic cleaning solution controls, are necessary for the best cleaning processes. With these controls, the sanitarian can interpret results of the CIP system quickly. A recording chart with time and temperature is available, which shows what happened on every line circuit. The solution tank can be calibrated in 10-gal increments so that he can determine the flow velocity merely by timing how long it takes to return ten gal to the cleaning solution tank. Strength of cleaning solution can be checked with a pH meter, conductivity meter, or titration. If the CIP system is working satisfactorily, then the interior of the permanent welded line will be absolutely clean. Inspection ports can be installed throughout the system, but one becomes bored by looking into these ports because nothing is seen but clean surfaces.

We have conducted numerous experiments in the past. We are ready today to conduct any additional experiments which responsible sanitarians believe necessary to establish qualified information on welded permanent pipe lines.

The CIP system is the heart of a permanent line installation. To know and control the CIP system is to know and control the sanitation of the complete permanent pipe line installation. It is our recommendation that primary emphasis and control by sanitarians be placed on the CIP system. One can check recording charts, check velocities, swab lines, check solution strength, and, also, check the bacterial counts of cleaning solutions.

It is recognized that the permanent pipe line system is not suited to all milk plants. The use of permanent pipelines should should be restricted to those companies willing to install a complete set of permanent lines with automatic CIP system. This will give sanitarians control which they would not have with a manual operation.

I want to extend an invitation to all of you to visit any of our plants and inspect the welded line system. Plants are located in Washington, D. C., Oklahoma City, Omaha, Denver, Salt Lake City, Phoenix, Los Angeles, Oakland, Portland, Oregon, Seattle and Fort Worth, Texas. Fort Worth does not have welded lines but has an automatic CIP system.

INDUSTRIAL USES OF WELDED PIPELINES[1] –

REGULATORY ASPECTS

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In 1957 our department was approached by a local milk plant desiring to replace the approved welded cross tees with heli-arc welded elbows in some of their milk piping system. This, of course, was contrary to the local regulations as well as the PHS Recommended Milk Ordinance and Code, both of which this plant had to comply with. This request was discussed with the PHS Regional Office and with their sanction and complete cooperation a study was outlined and carried out to evaluate the public health aspects of such a system under actual processing usage.

This particular plant fortunately lent itself exceptionally well to such a study and plant management proved to be most cooperative. This was a relatively large plant having two basically identical short time systems side by side. In this study one of the short time units remained unchanged with approved fittings and welded cross tees. On the second unit all connecting piping between the balance tank, regenerator, metering and booster pumps, holding tube and homogenizer was welded by the heli-arc process. Neither holding tube proper was changed. Nine analogous points were selected in the two systems for monthly bacteriological and physical examinations. These examinations were made in the conventional system by swabbing or looking through inspection ports or dismantling joints. In the welded system these examinations were made by disconnecting the pipe system from the piece of equipment to which it was attached by conventional threaded fittings where a welded joint was sufficiently close to the pipe end to permit swabbing and visual examination. At several of the chosen points where the welded joint could not be otherwise reached or viewed the pipe was sawed in two parts adjacent to the weld for such examinations.

All of the welds in this study were made with a hand held welding arc. Due to the inexperience of the welder some of the early welds appeared to be rather rough and were at that time judged to be poor. No boroscope or other means of examining the welds were used in this study and the hidden welds were not seen until the pipe was sawed in two after approximately 30 days of use. As the study progressed and the pipes were sawed and rewelded, the quality of the welds showed great improvement. However, the bacteriological results of the swabs taken from the early welds which were judged as poor on viewing showed that they presented no public health hazard. It was our inexperience that judged them as poor. This study continued for twelve months. During the first two months both systems were cleansed in the usual manner and sanitized with chlorine solution. During the remainder of the study, the systems were sanitized with hot water after cleansing. No appreciable difference was seen through use of either method.

The results of this study convinced us that the heli-arc welded pipeline system for processing milk when properly constructed and maintained presented a safe means of conveying milk during processing. The Public Health Service has, as a result of this and other similar studies, accepted the heli-arc welded pipelines in plants under their surveillance and participating in the Interstate Milk Shipper's Program with the provision that a means such as a boroscope or x-ray be used to examine each weld as fabricated.

Our experience has been only with the boroscope which has proven entirely satisfactory. In most cases the fabrication of a welded pipeline system is done on the job and the use of x-ray equipment using radioactive materials is not desirable in the immediate area where food processing is being carried out. Further, the x-ray technique of examining welds shows only welding failures and not the actual surface characteristics of the resultant weld as does the boroscope. Prior to application the regulatory agency should attempt to gain some experience with the examining instrument to be used so as to place the proper interpretation on what is seen.

What is considered an acceptable weld in a milk pipeline? Every regulatory person who is confronted with the responsibility of accepting or rejecting these welds should familiarize himself with the answer to this question, otherwise he may find himself jeopardizing the public health of his community or be at

[1]Last of a series of four papers presented in a panel discussion on "Industrial Uses of Welded Pipelines," presented at the 47th Annual Meeting of the International Association of Milk and Food Sanitarians, Inc., October 26-29, 1960, Chicago, Illinois.

loggerheads with the plant manager or engineer who is familiar with the answer. The heli-arc method used in welding stainless steel milk pipelines is, very basically, the fusion by heat in the presence of argon gas without the addition of other metal, of the ends of two perfectly fitting stainless steel pipes. The resultant weld is used without any polishing or grinding and when acceptable will show a slight convexity on the interior milk bearing surface where the ends join which will grade off smoothly to each section of the pipe. Following around the inner periphery of the weld will be slight undulations (ridges and valleys)which will grade into each other smoothly. The occurrence of blind pockets in the welds caused by overlapping or sagging of the molten metal during welding and which can collect milk solids is not satisfactory. There will also be found occasionally a weld with skips of as much as one-eighth inch on the interior surface where the pipe ends failed to join resulting in straight walled con-cavities or pits. Also small pin or blow holes sometimes occur particularly where the beginning and end of the weld come together. Both of the foregoing must be rejected.

Within the past few months a welded pipeline system has been completed in a milk plant in our city consisting of about 1,700 linear feet of piping with 150 elbows and 65 three-way valves. A boroscope was used in fabricating this pipeline and a number of defective welds were found during fabrication. It was found that it was not necessary to saw out these condemned welds and start over. By placing them back in the automatic welding rig and re-welding over the original defective weld an acceptable weld was obtained in nearly every case. Frequently this overwelding resulted in a smoother weld than was obtained on many of the original acceptable welds.

The regulatory agency should not have to inspect every weld in the fabrication of a heli-arc welded pipeline system. To do so would put a large burden of man hours to be supplied by the agency especially if the system is of any magnitude. Sufficient time spent by the agency in the first stages of the fabrication to give assurance that a satisfactory job is being done and that the mechanics doing the job are competent followed by spot checks should be adequate. Local knowledge of the integrity of the milk plant management would dictate the frequency of inspection probably needed to assure a satisfactory job.

The fact that the welded pipeline was inspected and approved as it was fabricated and that it is cleaned in place in an approved manner with proper cleaning controls does not mean in any sense that no further supervision by the regulatory agency is needed. It would be an unusual pipeline installation where there were no valves from which the plug could be removed or which was not connected to a piece of equipment by a threaded fitting or clamp coupling which could be disjoined to give access to portions of the interior on the line for swabbing or visual examination.

Newly installed welded pipeline systems should have rather frequent bacteriological examinations at the outset until there is assurance that the cleaning and sanitizing procedures are adequate. It would be wise also to check the system for any changes in slope due to inadequate or faulty anchoring. The frequency of inspections should then be maintained at the same level as for any other type of pipeline installation.

In conclusion let me repeat that a heli-arch welded pipeline system properly constructed and maintained is safe for handling milk and milk products during processing.

NOTICE!

Annual Meeting Plans For August 14, 15, 16, 17 In Georgia

HAVE BEEN CANCELLED

THE MEETING WILL BE HELD AT A LATER DATE AND IN A DIFFERENT LOCATION

Please Watch For Future Announcement In The Journal

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NEWS AND EVENTS

NATIONAL MASTITIS COUNCIL REPORTS ON MEETING

The National Mastitis Council met in Chicago, March 17, 1961. President Metzger read the minutes of January 20th meeting which were unanimously approved.

Treasurer Van Buskirk read the treasurer's report showing a balance on hand, February 28, 1961, of $444.17. Unanimously approved.

Following a review of applicable titles, *National Mastitis Council* was voted as a more fitting name for our organization.

H. L. Thomasson, Executive Secretary of the International Association of Milk and Food Sanitarians, indicated that his organization would continue to support the activity of the National Mastitis Council in achieving its goal and would remit to treasurer Van Buskirk monies received from sale of copies of Proceedings of the National Mastitis Action Conference.

President Metzger read a letter from Dr. A. C. Fay who was unable to attend meeting. Dr. Fay urged the acceleration of momentum developed at last fall's conference and previous meeting in order to fully capitalize enthusiasm generated for Council activity; special attention to wider publicity through appropriate Journals to establish prestige of program as nationwide project; contact with new Secretary of Agriculture to acquaint him with objectives of the Council. Dr. Fay's letter suggested pertinent and specific objectives for an immediate and effective long range program, which were welcomed by the members.

President Metzger read Mr. Ernest B. Kellogg's letter of February 13th suggesting further and careful consideration of pros and cons of incorporation as a non-profit organization. The members appreciated the excellent points raised by Mr. Kellogg. Following a full discussion of advantages and disadvantages, the committee voted unanimously to accept Mr. R. H. Dastrup's proposal for a constitution and by-laws with such revisions as should be made by a committee appointed by President Metzger, consisting of Mr. Don Hirsch, Dr. John Flake, Mr. Van Buskirk, Mr. Willits and Mr. Dastrup, moving to incorporation soon as practical.

President Metzger presented special problems concerned with having officials of Departments of Agriculture function as committee chairmen. In view of problems presented, the members unanimously approved the appointment of Dr. James Hay as Chairman of Council Research Committee. Ned Bayley, Max Decker and Dr. Manthei were appointed as consultants to Dr. Hay. Dr. Hay will appoint regional group leaders to facilitate operation of research committee.

It was agreed that the first order of business for the new research committee was the cataloguing of what has been and is being done in the area of Mastitis research. The work of Dr. W. H. Plastridge, as reported in the Journal of Dairy Science, provides an excellent base. The secretary will obtain reports of research conducted since that contained in the report of Dr. Plastridge, thus providing a comprehensive background for evaluation and formation of an objective research program.

At the request of President Metzger, Secretary Willits suggested that an annual budget of from $15,000 to $25,000 would be required for the operation of the Council covering expenses for committee travel, office rental, equipment and supplies, full time secretary, telephone and public services, stationery, postage and miscellaneous costs. Mr. Willits will provide the committee with details of a minimum annual operating budget as soon as firm estimates can be obtained.

Dr. W. G. Evans agreed to assist Dr. Hodges and Dr. Decker in operation of Programs and Procedures Committee.

A list of possible subscribers to the Council's operating budget will be prepared by the secretary. One national producer organization has already indicated a substantial forthcoming subscription. Dr. William Moseley of Moseley Laboratories of Indianapolis, presented a recent and informative field study of a cooperative endeavor with Mr. John Schlegel of an attempt to evaluate several tests for Mastitis on Mr. Schlegel's herd in Indiana. Dr. Moseley's report points the need for evaluation of acceptable diagnostic methods.

A report of the National Mastitis Council activity to date, for mailing to all who attended the Mastitis Action Conference in October and those who indicated interest in the activity of the Mastitis Action Committee but could not attend conference, is being prepared.

The next council meeting to be designated by President Metzger and members.

Respectfully submitted
G. W. Willits
Executive Secretary

ENVIRONMENTAL HEALTH CENTER

Plans for a National Environmental Health Center to attack environmental health hazards such as air and water pollution are developing in Washington.

Rep. John Fogarty (D., R.I.), chairman of a House Appropriation Subcommittee on health, recently disclosed that his proposal for such a center has reached the "blueprint stage."

In a speech in Kansas City, Rep. Fogarty declared this center would be comparable to the National Institutes of Health, and "should have over 30 different types of laboratories where physicists, chemists, radiologists, biochemists and other scientists would do research. The problem they might solve by such research would help all communities to have better and cheaper control of their environment. The center should be equipped with greenhouses and with a farm of experimental animals so that, by testing pollutants on lower forms of life, we could learn more about their effect on man. Scientists from all parts of the world should be trained in this center."

The congressman said the proposed new center should be the hub for an expanding national program, provide grants to universities and other research installations, and "serve as a clearinghouse and coordinating unit . . ."

Meanwhile, the Administration is backing drives in Congress to step up funds for pollution-curbing activities. The measure, approved by the House Public Works Committee would increase from $50 million annually to $100 million the federal share of the water pollution control program and broaden federal enforcement authority.

Reprinted from the Journal Amer. Med. Assoc. April 1961.

MASTITIS AND VIRUS APPEAR RELATED

A double-barrelled scientific attack on two of the major herd health problems affecting the nation's dairy herds is underway at Cornell's Veterinary Virus Research Institute. Helping to finance the program are members of dairy cooperatives, feed suppliers, milk distributors, and other organizations involved in the dairy industry.

In a progress report today, Institute Director Dr. James A. Baker outlined two key discoveries by Institute researchers which may open the door to significant progress controlling mastitis and abortions in dairy cattle. Mastitis is an expensive and stubborn problem on dairy farms, Dr. Baker said.

As new information, Institute investigators have isolated a virus, as yet unnamed, which has produced mastitis in controlled experiments. By using this virus as a vaccine to inoculate dairy cattle, it has been possible to produce immunity to it.

"This is only the beginning of our investigations," emphasized the Institute director. "We must now determine whether we get the same results under actual operating conditions on the farm. In addition, we must determine whether this organism is sufficiently prevalent on farms to justify a general vaccination program."

Dr. Baker also pointed out that experiments are being conducted at the Virus Institute to develop a practical and effective multiple-shot vaccine that would enable a farmer to have his cows immunized through a single injection against three diseases: leptospirosis, infections bovine rhinotracheitis, and virus diarrhea. The latter one is associated with virus-produced cattle abortions.

The Virus Institute, founded in 1950 as a unit of Cornell University and the New York State Veterinary College, is a small-animal and farm-livestock-disease research center, the aims and purposes of which are to "investigate and evaluate the economic losses due to animal diseases, and to search for and develop methods of disease prevention and control." However, enlarging the incomes of dariy farmers is a major over all objective of the Institute, Dr. Baker says.

The following organizations are helping to finance the cattle virus research program at the Institute: Beacon Milling Co., Cooperative GLF Exchange, Dairymen's League Cooperative Association, Eastern Milk Producers Cooperative Association, Grandview Dairy, Metropolitan Cooperative Milk Producers Bargaining Agency, Metropolitan Dairy Institute, Mutual Federation of Independent Cooperatives, National Dairy Products Corp., and the Niagara Frontier Cooperative Milk Producers Bargaining Agency.

NON-FAT MILK SOLIDS GETTING ATTENTION

Today we are fat conscious and count calories to keep fat off our bodies. The per capita consumption of cream has decreased 30% in the last 15 years. The consumption of skimmilk is increasing rapidly. Why strive to produce more milk fat when the public does not want more fat and it is unwilling to pay the cost of its production? Let us strive instead to increase production of those milk constituents which the consumer does want.

The dairy industry is at an important crossroads. The road of the past and present has been and is based on a pricing system and, oonsequently, breeding systems geared to butterfat. The other road, a newer one, is built on the nutritional aspects of milk, particularly the non-fat portion and is receiving increasing attention.

A committee of the American Dairy Science Association on milk solids research work was established in 1959. This committee has a representative of each of four regions of the country, Southern, Northeastern, North Central and Western. This committee is working; a) as an interim committee until formalization within some framework of the Land Grant College Association has been accomplished; b) to promote the formalization of the interregional effort; c) to have each representative of the committee work with project leaders to implement and coordinate the cooperative effort in his region; d) to implement and coordinate the cooperative effort nationally; e) to develop standardized procedures for nationwide determination of systems and collection and processing of data.

We must change the basis of payment for milk products. Each method of payment, for protein and for total solids, has its own advantages. We should study all aspects of the problem before choosing one method over the other. Before we adopt any test to be used as a basis for payment, we must be sure that it is highly reproducible in different laboratories. It is generally recognized that the dairy production people are just a trifle late in getting their program under way. For example, in Holland where the calorie counters are far less numerous than in America, milk is now sold on the basis of both protein and fat content. They are equipped to test more than 5,000 samples of milk for protein content in one day by a staff of seven persons. The laboratory has a capacity of 15,000 samples a day.

Evidence has been summarized from published studies which bear on the genetic and environmental influences on SNF composition of milk. Reports concerning the influence of season and climate, stage of lactation, and age of cow appear to be consistent enough to point out the general nature of the relationships. There is a pressing need for solid information on the nutritional influences on SNF, both from a fundamental and from a practical standpoint. The reasons for specific nutritional and physiological responses still are largely unexplained.

Breed and sire differences for SNF constituents, broadly suggesting that part of the variation in milk composition is genetic, have been known for some time. Within the past 5 yr. preliminary estimates of genetic parameters, e.g., heritabilities and genetic correlations, have suggested that selection for SNF constituents should be effective. However, more precise information is sorely needed regarding the magnitude of both genetic and environmental parameters, so as to assist in developing breeding plans as soon as the long-range market requirements for individual SNF constituents are known.

Symposium: Milk Solids-Not-Fat - Participants: G. W. Trimberger, Chairman, and B. L. Herrington, Cornell University, Ithaca, N. Y.; J. E. Legates, No. Carolina State College, Raleigh, N. C.; S. N. Gaunt, Univ. of Massachusetts, Amherst, Mass.; R. E. Erb, U. S. Ashworth, and L. J. Manus, Washington State Unv., Pullman, Wash.

AFFILIATE COUNCIL VALUABLE TO ASSOCIATION

Once each year *we secretaries* have the opportunity to meet and discuss our mutual activities created in the operations of the affiliate which we serve. The exchange of ideas at this time has proved very beneficial to myself and to many of the secretaries. We also can serve as a Steering Committee to the Executive Board of our Association. These suggestions of the Affiliate Council are recognized by the Executive Board, and I understand from our Executive Secretary "Red" Thomasson that these suggestions are always carefully considered.

The International Association of Milk and Food Sanitarians is an Association of Affiliates. The Affiliate Council is the place for each affiliate to express its opinion, and to be referred from the Affiliate Council to the Executive Board. The Constitution of IAMFS provides that each secretary is an official delegate to this council. In case the secretary cannot attend, the affiliate may appoint a delegate to represent them. For the good of our Association it is almost imperative that every affiliate should be represented at the Annual Council of Affiliates meeting. This year the Council of Affiliates will meet on Tuesday - August 15 at the annual meeting. I have been assured by the Program Committee that the council will have as much time for its meeting as it chooses.

It is, therefore, important that each affiliate should plan now to see that a delegate is present at this year's meeting. The Affiliate Secretary is the preferable delegate, but an alternate is acceptable.

The items which the affiliate wishes to have discussed on the floor of the Council of Affiliates meeting should be sent to the President of the Council of Affiliates at once so that an agenda can be prepared for this meeting. In turn it is hoped that the President can send to each secretary or delegate the agenda before the actual meeting date.

R. M. Parry, D.V.M.
Secretary, Affiliate Council

PAPERS PRESENTED AT AFFILIATE ASSOCIATION MEETINGS

Editorial Note: The following is a listing of subjects presented at recent meetings of Affiliate Associations. Copies of papers presented may be available through the Secretary of the Respective Affiliate Associations.

Washington State University and
University of Idaho
30th Annual Institute of Dairying
Washington Milk Sanitarians Association Meeting
March 7, 8, 9, 1961
Secretary, Washington Association: William R. Knutzen, 125 Ferry Terminal, Seattle, Wash.

Incidence of Mastitis in Washington Herds - Dr. F. W. Crews, Lab. Supervisor, Div. of Animal Industries, State Dept. of Agric., Olympia.

Evaluation of Mastitis Tests - Dr. Guy Roger Spencer, Chairman, Veterinary Pathology, Wash. State Univ.

Effect of Milking Machines on Mastitis in Dairy Herds - Daniel Noorlander, Bou-Matic Milkers, Inc., Ontario, Cal.

Symposium - Regulatory Developments and Problems in Bulk Milk Procurement.

Moderator: Ken Gross, Dairy Specialist, Agric. Ext. Service, Dept. of Dairy Science, Wash. State Univ.

Tank Calibration - George W. Sayers, Dairy Calibration Service, Seattle.

Driver Training - William Knutzen, State Dept. Agric.

Sediment - Dr. J. O. Young, Food & Dairy Technology, Oregon State College, Corvallis.

Bacteriological Problems - C. C. Prouty, Assoc. Professor, Dept. of Dairy Science, Washington State Univ.

Rancidity Problems - Dr. T. L. Forster, Assoc. Professor, Dept. of Dairy Science, Washington State Univ.

Panel Discussion: Federal, State and Local Labeling Requirements.

Moderator: Dr. Alex Swantz, Administrator, Federal Milk Marketing Administration, Spokane.

Panel Members: Ben Luce, Chief Dairy Inspector, State Dept. Agr., Olympia; Kenneth L. Pool, State San. Supervisor, Idaho State Dept. Health, Boise; Kenneth E. Carl, Assistant Chief, Div. of Foods and Daries, Oregon State Dept. Agric., Salem; L. O. Tucker, State Dept. Health, Seattle.

Pesticides in Milk and Dairy Products - Dr. William Roth, Ass't. State Chemist, Univ. of Wash., Seattle.

Dairy Diet Products and Their Impact on the Industry - Dr. Morrison Lowenstein, Research Manager, Crest Foods, Chicago.

Diversification in the Dairy Industry - John T. Willemsen, Manager, University Creamery and Instructor, Dept. Dairy Science, Univ. of Idaho.

Economic Trends in the Dairy Industry - Ervin L. Peterson, Exec. Dir. Milk Industry Foundation, Washington, D. C.

IOWA ASSOCIATION OF MILK SANITARIANS
20TH ANNUAL MEETING
March 28, 1961
Secretary: R. A. Belknap, State Dept. of Health, State Office Bldg., Des Moines, Iowa

Farm Sewage Disposal Systems - Jack Clemens, Public Health Engineer, State Dept. Health.

Loose Housing Construction and Maintenance - Robert Mather, Surge Co., Chicago, Ill.

Progress of the Manufacture Milk Law (H.F.259) - Earl Wright, Extension Dairyman, Iowa State Univ.

Grade "A" Dry Milk Products - H. E. Thompson, U. S. Public Health Service, Kansas City, Mo.

NEW AQUATIC WEED KILLER DESTROYS WIDE VARIETY OF FARM POND WEEDS

Ridding farm ponds of water weed infestations and algae has received a welcome helping hand in the development of a new contact action herbicide called Aquathol, which will be commercially available to farmers for the first time this spring and summer. The new product is effective against a variety of aquatic weeds at recommended doses which are far below concentrations harmful to fish and fish food organisms.

Aquathol, which has been registered with the U. S. Department of Agriculture, was developed by Pennsalt Chemicals Corporation, Agricultural Chemicals Division, working in close cooperation with government and private research laboratories over a period of 5 years.

The new product destroys certain underwater weeds and floating weeds by fast, contact action as compared to certain other herbicides which, when absorbed into the system of weed plants, kill by slow hormonal action.

Among the weeds which are effectively controlled with Aquathol are horned pondweed, coontail, water stargrass, milfoil, bushy pondweed, bassweed, curly leaf pondweed, floating-leaf pondweed, sago pondweed, flat-stem pondweed, burr weed, duckweed. In northern areas, pithophora, cladaphora, and spirogyra algae also can be controlled with Aquathol.

In addition to its effectiveness and speed in clearing farm ponds of weeds, the new product has the advantage of ease of application, quick action, safety, economy, and most important short residual life.

The average Aquathol dosage for most of these aquatic weeds is at 1 and 2 parts per million strength - well below the point of toxicity to fish. Test finding indicate that more than 20 times the maximum recommended dose would be necessary to approach the level which would be harmful to most fish.

The active ingredient in Aquathol is water soluble and breaks down biologically in a short time. Because of this chemical property, there is no danger of residual accumulation or toxic build up when the product is used as directed. When applied at normal rates, residue disappears in several days. The time required for complete removal of all traces of the herbicide is determined by such factors as the types of weeds being treated, degree of infestation, and water movement. Water from treated pond may be used for irrigation, agricultural sprays or domestic purposes after a short period.

Aquathol is available in both liquid and granular form. Liquid Aquathol, packaged in easy to handle 5-gallon cans, is recommended for treating entire ponds, or for sections of pools and ponds where water is relatively motionless. It can be used full strength from the container or diluted in water, depending on the application equipment used.

Aquathol G, the granular form, is convenient to handle in areas where a slight movement of water occurs.

Because of the extremely low concentration of Aquathol needed to kill weeds, a five-gallon can will treat a one-half acre pond approximately four feet deep at 2 ppm – enough to destroy many common water weeds.

Information on Aquathol, including how to determine dosages, water area, and depth is available from the Agricultural Chemicals Division, Pennsalt Chemicals Corporation, 2901 Taylor Way, Tacoma, Washington.

STANDARD FOR RAW BREADED SHRIMP PROPOSED

The Food and Drug Administration published on Friday, March 31 an industry proposal to adopt a definition and standard of identity for frozen raw breaded shrimp.

The National Fisheries Institute, Inc., Washington, D. C., and the National Shrimp Breeders Association, Inc., Chicago, jointly filed the proposal which FDA published in the Federal Register. All interested persons are invited to file their views and comments with the Hearing Clerk, Department of Health, Education, and Welfare, Room 5440, 330 Independence Avenue, S. W., Washington 25, D. C., by May 30, 1961.

The Federal Food, Drug and Cosmetic Act requires that any standard adopted must be one that will promote honesty and fair dealing in the interest of the consumer.

The industry proposal would require that frozen raw breaded shrimp (prawns) contain not less than 50 percent by weight of shrimp material, as determined by a specified method. The term "shrimp material" would mean the headed, peeled and deveined tail portion of a shrimp, with or without tail fin and the immediately adjacent shell segment. The shrimp material could be in either of the following optional forms: fantail or butterfly (deveined and split); round or round fantail (deveined but not split); butterfly, tail off (deveined and split, tail fin and shell segments removed), round, tail off (deveined but not split, tail and shell segments removed); and tidbits (parts of tail portions, but free of tail fin and shell segments).

The proposal also specifies the optional ingredients which could be used in preparation of batter and breading for coating of the shrimp material.

The name of the frozen breaded shrimp product prepared from each of the optional forms of shrimp material specified is listed in the proposal.

The proposal would also require the label to bear the name of the optional form of the food and a listing of the optional ingredients used in the preparation of the batter and breading. If a spice is used to impart a color, the label would have to declare it as both a spice and a coloring.

UNIVERSITY OF MASSACHUSETTS, TO CONSTRUCT NEW FOOD SCIENCE CENTER

A major new teaching and research center devoted exclusively to food science studies will soon be under construction at the University of Massachusetts.

When completed, the 40,000-square-foot addition, together with present facilities, will house the University's program in food technology and as such will constitute the largest and most modern food science center on any campus in the East.

The new building, designed for both teaching and research, will have fully-equipped laboratories, classrooms, offices, as well as a modern experimental pilot plant. An adjunct facility, now nearing completion, is a connecting low-temperature laboratory, which is devoted exclusively to refrigeration and freezing and provides the food technology department with all the equipment needed for controlled low-temperature studies.

The new construction will permit the University to undertake an expanded program of research and teaching in food chemistry, biochemistry, food microbiology, as well as the processing, handling, and packaging of food. Newer methods of instrumentation in analysis, colorimetry, quality evaluation and process control will be possible with the modern equipment to be installed in the proposed plant.

Planning of the center reflects the trend toward a more basic approach to food science than has hitherto been the case. The new facility will emphasize fundamental scientific research as the effective means of solving problems in food technology. Already established in the present research program, the concept will be carried over into the expanding program of student training for work in food science, now a highly complex field demanding professionals with a great degree of proficiency in research.

14.2 PER CENT INCREASE IN FARM TANK INSTALLATIONS IN 1960 REVEALED IN SURVEY

A preliminary report on the sixth annual Farm Milk Tank Survey, now being completed by Dairy Industries Supply Association and National Association of Dairy Equipment Manufacturers, shows 160,835 farm milk tanks installed and in use in the United States as of January 1, 1961. This figure represents an increase of 20,040, or 14.2 per cent over the revised total of 140,795 tanks installed as of January 1, 1960.

Earlier annual figures were 117,103 on January 1, 1959; 91,096 on January 1, 1958; 57,386 on January 1, 1957; and 29,885 on January 1, 1956. The widespread adoption of the farm bulk system of milk handling has been one of the most rapid and revolutionary changes within the dairy industries in recent years.

Here is the preliminary state-by-state sooreboard on installations in the 12-months of 1960:

State	Installations as of 1/1/61	Installations as of 1/1/60	Change
Alabama	1,385	1,122	263
Alaska	21	15	6
Arizona	420	540	-120
Arkansas	1,226	685	541
California	4,324	4,689	-365
Colorado	936	924	12
Connecticut	2,683	2,426	257
Delaware	314	250	64
Florida	997	997	0
Georgia	2,451	1,927	524
Hawaii	36	21	15
Idaho	880	840	40
Illinois	10,484	9,967	517
Indiana	6,278	4,650	1,628
Iowa	5,084	4,467	617
Kansas	2,118	1,785	333
Kentucky	3,193	2,728	465
Louisiana	2,602	2,414	188
Maine	1,789	1,509	280
Maryland	3,235	2,864	371

Massachusetts	1,416	1,311	105
Michigan	12,000	10,200	1,800
Minnesota	8,900	8,250	650
Mississippi	1,680	1,079	601
Missouri	3,160	2,447	713
Montana	442	490	-48
Nebraska	2,100	1,861	239
Nevada	159	157	2
New Hampshire	894	679	215
New Jersey	1,078	1,028	50
New Mexico	430	430	0
New York	8,370	7,380	990
North Carolina	4,000	3,850	150
North Dakota	524	449	75
Ohio	12,000	9,200	2,800
Oklahoma	2,040	1,842	198
Oregon	1,077	1,195	-118
Pennsylvania	6,332	5,225	1,107
Rhode Island	287	280	7
South Carolina	772	732	40
South Dakota	1,908	1,360	548
Tennessee	2,552	2,307	245
Texas	5,871	5,612	259
Utah	1,180	1,100	80
Vermont	3,502	2,829	673
Virginia	2,700	2,525	175
Washington	4,250	4,000	250
West Virginia	278	196	82
Wisconsin	20,324	17,816	2,508
Wyoming	153	145	8
U. S. Total	160,835	140,795	20,040

LETTER TO THE EDITOR

Quincy Health Center
Department of Health

May 2, 1961

Dear Sir:

In my opinion there is no substitute for Local Milk Inspection or the City Milk Inspector.

In Massachusetts the Office of Milk Inspector is created for Cities under Law and his duties defined by the same Law.

In enforcing this Law the local Milk Inspector makes personal contacts with producers and dealers large and small and the different problems of the industry from producer to consumer at least once a month and in some cases more often. The State or Federal Official contact the same people at the most once or twice per year. Who does the work in the interim? The local Inspector is on the job daily or weekly to correct problems that arise from day to day.

We all know as Inspectors how fast problems can occur and multiply if not corrected immediately; here again the local Inspector is close by to correct these conditions before they explode and create a health menace.

The collection and analysis of milk samples weekly in our case is still necessary procedure in order to keep control of the finished product, the Laws and Regulations are good ones in spite of automation and modern equipment because the element of human error is still involved in the processing and packaging of milk products.

The time has not yet arrived for the centralization of Milk Inspection under State or National control. We still need the inspection and control at the local level.

After twenty years as an Inspector of Milk and Dairy Farms, I find the same problems and violations, namely high bacteria counts, low fat content, coliform contamination and careless pasteurization, poor housekeeping not only by the small dealer but the larger companies also.

From time to time we are requested by someone or some group to relinquish our duties and authority to State or National groups seeking greater personal power.

The present Laws and Regulations are good and apply to-day to conditions in the Milk Industry as they always have.

I am sure other Milk Inspectors will agree with me.

The preceding letter is my own personal opinion and is not expressing the opinion of the Massachusetts Milk Inspectors' Association.

Trusting this will meet with your approval.

Very truly yours,

John J. Curtin, Reg. San.
Inspector of Milk and Dairy Farms
City of Quincy, Mass.

HELPFUL INFORMATION

Editorial Note: Listed below are sources of information on a variety of subjects. Requests for any of the material listed should be sent by letter or postcard to the source indicated.

Milk Sanitation Administration. A compilation of lectures. Sup't. of Documents, Gov't. Printing Office, Washington, D. C. $1.25. 1960.

Principles and Procedures of Statistics with Special Reference to the Biological Sciences. R. G. Steel & J. H. Torrie. McGraw-Hill Book Co., New York, N. Y.

A Training Guide for Restaurant Sales Personnel. H. Robert Kinker, Walter T. Day and Robert L. Huxol. Published William C. Brown Co., Dubuque, Iowa. $2.50.

Dairy Waste Treatment by Aeration: Theory, Design, Construction, Operation. Supt. of Documents, Gov't. Printing Office, Washington, D. C. 20c.

Milk Dating Regulations: *Their Effect on Milk Distribution and Merchandising Practices.* Supt. of Documents, Gov't. Printing Office, Washington, D. C.

How Manufacturing Co-ops Market Grade A Milk. 1960. Supt. of Documents, Gov't. Printing Office, Washington, D. C. 25c.

Clean Water, A National Resource. Supt. of Documents, Gov't. Printing Office, Washington, D. C. 10c.

Trade Barriers in Milk Distribution. Dept. of Agric. Economics, Univ. of Illinois, Urbana, Ill.

Anaplasmosis in Cattle. Supt. of Documents, Gov't. Printing Office, Washington, D. C. 5c.

Procedure for Testing Pasteurization Equipment. Supt. of Documents, Gov't. Printing Office, Washington, D. C. 25c.

Insects That Carry Disease. Supt. of Documents, Gov't. Printing Office, Washington, D. C. 10c.

Trichinosis. Supt. of Documents, Gov't. Printing Office, Washington, D. C. 5c.

Bacterial Food Poisoning and Its Control. Bulletin Dept., Univ. of Mass., Amherst, Mass. Single copy, free; Add'l. copies 10c each.

The Public Health Sanitarian; the Man Behind the Scene. Albuquerque Health Dept., P. O. Box 1293, Albuquerque, Arizona. Leaflet.

Potential Adjustments in Dairy Marketing in the Northern Plains States. State Bulletin 450. College of Agric., Lincoln, Nebraska.

Economics of Mechanical Dairy Barn Cleaners. Bul. 505. Virginia Agric. Expt. Station, Blacksberg, Va.

Dairy Industry Plant Training Manual. $4.00. American Dairy Science Assoc., 32 Ridgeway Circle, White Plains, N. Y.

Handling Milk on Grade A Farms in Utah. Utah Agric. Expt'l. Station Bul. 412. Logan, Utah.

INDEX TO ADVERTISERS

Classified Ads

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Single service milk sample tubes. For further information and a catalogue please write, Dairy Technology, Inc., P. O. Box 101, Eugene, Oregon.

Keep milk rejects down . . . recommend Lo-Bax, the chlorine bactericide that effectively sanitizes cows' teats and udders, milking utensils and machinery. Lo-Bax is easy and economical to use, dissolves quickly and rinses freely . . . provides positive chlorine protection throughout all phases of milk handling. Write for the details on Lo-Bax Special and Lobax-W (with a wetting agent).

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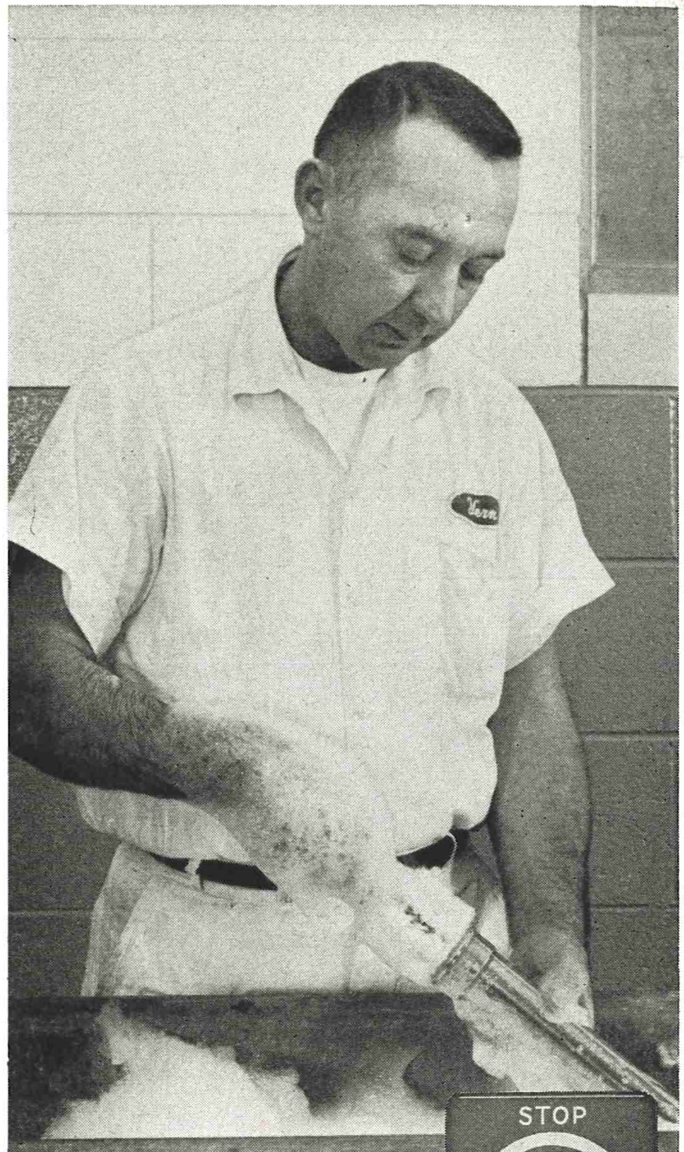

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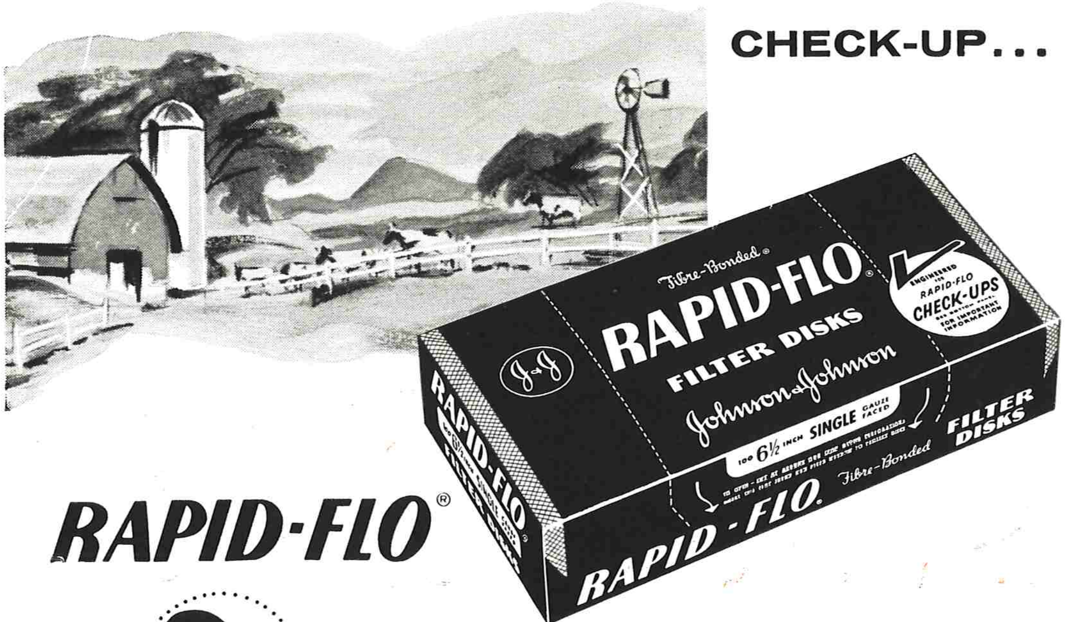

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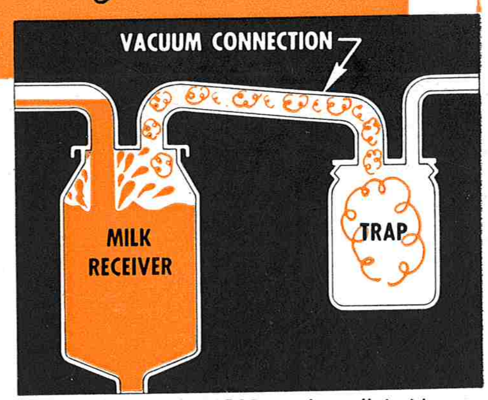

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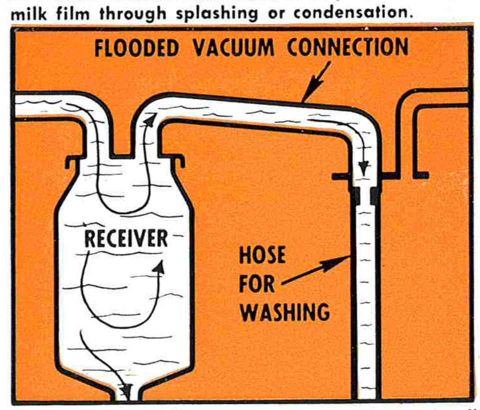

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