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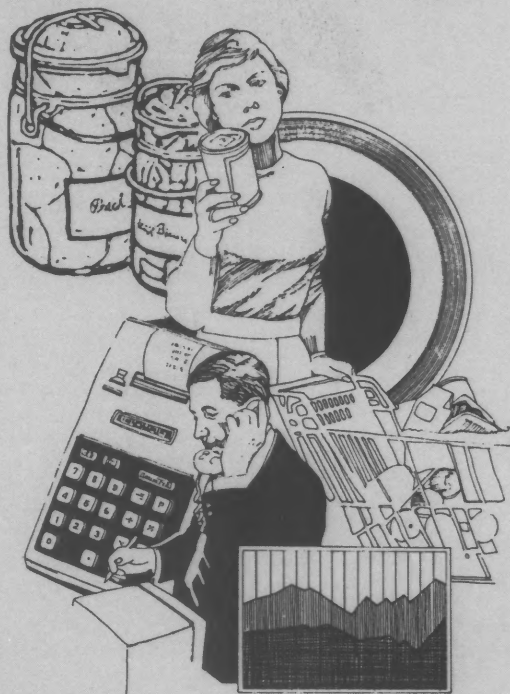


A Publication of the International Association of Milk, Food and Environmental Sanitarians, Inc.

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Antibiotics In My Milk?!

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INTRODUCTION

The title of this article is usually the surprised response received when a producer is informed that an antibiotic residue has been detected in their milk. For the consumer who unknowingly drinks antibiotic adulterated milk and is allergic to penicillin or other beta lactam compounds, the reaction may be quite different. To these people it could become a matter of life or death. The problem, anaphylaxis or anaphylactic shock which can be as slight as watery eyes or develop into severe swelling and lead to shock. Reaction time is as little as 5 minutes and can require rapid medical assistance. National figures indicate that 4-15 people in every 100,000 have this type of allergy. Most of these people are aware of their problem and wear or carry some type of warning identification with them at all times. Few such individuals would, or for that matter should ever have any reason to associate drinking a glass of milk with anaphylaxis. There is no legitimate reason for antibiotic adulterated milk to get into today's marketplace but recently in Minnesota it did. This time around, thanks to a successful recall, no one became ill. Could this incident occur again somewhere else, in your state or in your plant? There

are some important points to review and consider to be sure the answer to this question can be a definite "no".

THE "CHAIN OF CUSTODY"

This is a legal term which can be interpreted to mean being able to document who did what with or to a sample of milk where, when and with what result. There are well established routines set up to accomplish this for bulk haulers, plant personnel and laboratory technicians. Woven into these routines however, are areas where a "glitch" could occur and this was all it took in Minnesota to break the chain and enable adulterated milk to slip through. A review of past data from Minnesota indicates that, on an average, antibiotics are detected in less than 0.2% of all producer samples. This translates to 99.8% of the time being spent reading negative results. How easy it can become to overlook that one missing sample and assume it was negative like the rest! The chain of custody needs to be established and maintained at three main levels; the producer, the bulk hauler and the receiving/testing facility and personnel.

THE PRODUCER

The use of antibiotics for the treatment of diseases in dairy cattle is essential to herd health, milk production and milk quality. With the somatic cell count limits dropping to one million in 1986 and with the in-

roduction of premium payments tied to low cell counts, the use of antibiotics is not likely to diminish. Milk producers have to realize that the responsibility for an antibiotic free milk supply belongs to them. It is a problem that only prevention can cure.

Whether making an official farm inspection or just a routine farm call, a few extra minutes should be taken to check on the producers cow treatment procedures. Are treated cows properly marked and records maintained? Are dry cows treated and if so are they separated and/or adequately marked? Is hired help or part-time labor being used to milk the cows, especially over the weekends? Do these individuals know how to identify treated animals? Of the cases of antibiotic adulterated milk prosecuted in Minnesota the most common explanation to the judge has been "this happened because someone else was doing the milking".

Veterinarians are usually careful about documenting the treatment of animals but communication from the vet to the dairyman may not be as clear as it should be. If this seems to be a problem contact the vet and make them aware because they too are very interested in preventing the sale of adulterated milk. It is important that their recommendations are carefully followed by the producer.

Most plants and marketing organizations do have a program to test a producers tank of milk if antibiotic adulteration is suspected. These programs will usually offer to pay some portion of the total value of any adulterated milk provided it is re-

ported before being picked up. Unreported adulterated milk will usually mean a reduction in the milk check reflecting the value of the milk lost to adulteration. This type of penalty program is helpful in preventing the sale of adulterated milk but alone is not the answer. Many organizations are now making the new rapid on-farm screening tests available to their patrons and are educating them in the importance of their use. One organization is even supplying a test kit to any producer who is detected as having milk adulterated with antibiotics and the cost of this kit becomes part of their penalty program. They feel it has helped reduce second violations.

The State of Minnesota also has a new law which places a producer who sells adulterated milk on probation for one year and subjects them to a civil penalty. It also requires that all testing facilities report to the state any producers detected as selling adulterated milk. The State Department of Agriculture will then notify the producer of pending legal action.

THE BULK HAULER

Once the milk is pumped into the tank truck it now transfers what was previously just a producer problem on to the plant or receiving station. At this point the sample representing each producer's tank of milk becomes very important. This is the first and possibly the most important link in establishing the chain of custody. Any testing done or action taken from this point on is going to eventually come back to this individual producer sample. While recommended sampling procedures are rather specific there is always room for some error when people are involved. These errors could lead to an adulterated sample being missed and/or going undetected. Haulers must be able to verify that the sample taken accurately represents the milk contained in that producer's bulk tank on the day of pickup. For this to be possible the sample must be properly taken, labeled, stored, and delivered

in good condition to the receiving plant or laboratory. Marking only the cap of a sample container can lead to another break in the chain of custody. Removing the cap from such a sample renders the contents of the unmarked container unidentifiable. Another hauler practice which can lead to the loss of sample identity is premarking the sample containers before beginning the route. All information should be recorded on each container at the farm where the sample is taken. The use of individual producer coded labels or containers which can be stored at each farm is an effective way to deal with this problem. Samples have to be transported under proper conditions and delivered to the receiving station in good condition. The chain of custody can again be broken if the samples are received in a condition declared unfit for testing by the plant or laboratory.

Bulk haulers are frequently asked to take samples from their tank truck prior to unloading to be used for screening the load for antibiotics. These drivers should be aware that antibiotics, when present in milk, will be associated with the skim portion not the fat. If this tank is not properly mixed these samples will not accurately represent the producers milk contained in that load. Haulers are often instructed to take more than one sample from a load. These are not split samples and may not even be duplicate samples depending on how they are taken. They are really individual samples of the same tank of milk and should be treated that way. This becomes very important when loads are being screened for antibiotic adulteration. Screening on one sample and confirming on another could again constitute a break in the chain of custody and lead to inaccurate confirmatory test results.

THE RECEIVING AND TESTING FACILITIES

When receiving personnel are taking load samples to be used for offi-

cial antibiotic screening tests, they too should be licensed samplers and understand the importance of obtaining samples which accurately represent the milk on that tanker. Adequate sample storage space at the plant or lab is important to prevent having to dispose of samples too quickly in order to make room for new ones. It helps to have a separate cooler or freezer to hold samples which may need to be rechecked based on original screening test results. No producer samples should be destroyed until all storage tanks containing that milk have also been determined free of antibiotics. Again, any confirmatory tests should be performed on the original sample, not on one of the so called duplicates. When any positive test result is found it should signal to proceed with caution. If for some reason the original result cannot be confirmed all possible sources have to be checked. The original screening test cannot just be assumed wrong. These new rapid tests are proving to be quite accurate at detecting even low levels of antibiotic adulteration. The laboratory has to be certain, that when a clearly positive test will not confirm, that the volume of milk represented by that sample is truly free of antibiotic adulteration.

Laboratory technicians should be sure that good test sampling techniques are followed and there is no chance for samples to get mixed up on the lab bench. Sample records can also be a problem when 99.8% of all samples will probably be negative. This can trigger the use of ditto marks and other similar markings to record test results. One positive result can easily get lost in a long list of dashes, slashes and ditto marks. The technician should double check and be sure that positive test results are assigned to the correct sample in the laboratory records as well as in the confirmatory test procedures.

The purpose of a rapid screening program is to have results as quickly as possible on all milk received. Holding weekend samples over for the lab to run on Monday can easily result in a missed lot of adulterated

milk which could be on its way to the marketplace before test results are obtained. Weekend personnel should be trained to run the screening tests and contact the laboratory personnel if a problem is detected so results can be confirmed as quickly as possible.

Just because all loads going into a storage tank indicate no detectable antibiotics is no guarantee that the tank is safe to use. Storage tanks should all be checked before being reloaded or used for the manufacturing of any products. All finished products should also be sampled and tested prior to their release into the distribution channels. A plant processing and selling fluid products should not totally rely on an outside source for antibiotic test results. They need to know as soon as possible the products they are offering for sale are free of adulteration.

CONCLUSION

Antibiotic adulteration of milk is one public health threat that should no longer exist. The technology, testing methods and sampling procedures exist to detect a wide variety of antibiotic compounds which could be finding their way into the raw milk supply. For people who suffer from anaphylaxis the amount of antibiotic present in a glass of milk is not as significant as its presence. Once an allergic reaction is triggered, higher levels of antibiotics will not make it any worse. The fact of its presence is what is critical and therefore proper detection becomes essential. Dilution may not be the solution for a person who suffers from anaphylaxis.

The dairy industry has stated for years that all they needed to solve this adulteration problem was a rapid test for the detection of antibiotics. Some procedure which would enable a receiving station to check the tan-

kers of milk before they were unloaded. Not only have these tests been developed but some offer additional capabilities. It is now possible with some tests to specifically determine the antibiotic involved in the adulteration. This can be very helpful in tracing the source back to the farm and determining exactly what happened and how to prevent a reoccurrence. These tests are a rapid, selective and accurate means of detecting antibiotics in milk but when misuse and poor sampling are involved the risk of adulteration still remains. Producers, bulk haulers, and plants all have to do their part. That important "chain of custody" has to be maintained. All milk must be accurately sampled and tested so there is no chance of any antibiotic adulterated milk finding its way into the human food chain. The ball has been passed to our court. Now is not the time to fumble away the chance to eliminate another risk to public health.

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“Grasshopper” Food Protection Activities

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“Grasshopper” food protection activities have not been demonstrated by FDA or any other regulatory agency as being *effective* change agents; yet they continue to be promoted and be in evidence at the national, state, and local level. Health authorities seemingly hop from one new concept to another without ever fully demonstrating their value or the extent to which they are cost-effective. Like a grasshopper, such programs end up where they started—ground 0! There is no differentiation between activity and accomplishment.

After the 1971 National Conference on Food Protection, the “in thing” among many health authorities was to hop from whatever they were doing to manager certification, industry self-inspection, or other noteworthy recommendations of the conference. Without, however, having fully achieved these intended objectives on a significant national basis, the public health merchants are seeking new acclaim via the FDA multi-unit chain evaluations, national food protection certification examination, and HACCP. In fairness to all health departments, it must be acknowledged that some are no longer program hopping but rather are content with their present state of affairs.

One of the major reasons why “grasshopper” food protection activities have not and will not effectively change sanitation levels is the lack of any foundation to support them. The needed foundation is detailed in the “FDA Procedure for Evaluating Retail Food Protection Programs.”

One of the recommended basic building blocks is a sound inspection-enforcement program. Without it, none of the food protection “toys” previously mentioned will be cost-effective or produce *consistent*, positive results. FDA has, however, failed in its national public health leadership role to have the states carry out this important activity in a satisfactory manner. This fact was indirectly underscored in “HACCP A Critical Approach” by John J. Guzewich when he stated the following:

“...eighteen years of national foodborne disease data have shown that traditional inspection approaches have

not had a significant impact on the reported contributing factors in foodborne disease outbreaks.

Although these courses (manager certification) typically emphasize foodborne illness concerns, subsequent inspections probably do not reinforce what he has learned.”

The traditional aspects of the inspections have not been the main problem, but rather the fact the inspections have historically not been carried out in a satisfactory manner - lack of uniformity, not technically or legally correct, not complete and thorough, etc. This incidentally is another part of the answer to Mr. Guzewich's question, “Why have our traditional regulatory programs not resulted in a change of the predominance of these factors?” (Those that have been shown to be the major contributing causes of foodborne disease outbreaks.)

Thus, although some of the newer food protection “toys,” such as HACCP, being espoused by FDA and others have a place in decreasing foodborne outbreaks, they will be of little or no value unless part of an overall sound inspection-enforcement program. The importance of the latter was stressed at the 1971 National Food Protection Conference. The following was stated:

“Over the years, many regulatory agencies have espoused the philosophy that “education” is a more effective tool in securing compliance with foodservice sanitation laws than is strict enforcement. One need only observe the flagrant violations of many food protection requirements, such as holding potentially hazardous food at unsafe temperatures, to be convinced that this approach has not always worked effectively. *However, it can be effective if combined with a firm, equitable enforcement program.* (Italics by writer.)”

A football team that can't run the razzle-dazzle play because there is no command of the fundamentals will not improve the situation by devising more complex or sophisticated plays. This, however, is what has been happening in the field of public health. New programs are developed with no command of the fundamentals to carry them out or sustain them once established. Quite a few health departments are quick to wave their red flags concerning such activities, but after awhile both their arms and flags become tired from no accomplishment. Many regulatory agencies also seemingly want to throw the “bomb” and achieve their food protection goals in one big play.

Year after year, however, FDA continues to carry out their traditional state food program evaluations that tell all concerned parties what they already know - nothing really has been accomplished in significantly raising the sanitation levels and protecting the public's health. Essentially the same underlying reasons for this situation still exist. This was underscored by a review of all the latest FDA state food program evaluations that could be obtained under the Freedom of Information Act. Seventy-three percent of the reports had recommendations for improving field inspections. Many of the suggestions, incidentally, were essentially the same as those made by the writer as a survey officer in the early 60's.

A different approach is obviously needed by FDA and the states to effect a positive change in the quality of local and state inspections and related activities. Such action was also indicated by Dr. Frank L. Bryan in his paper, "Procedures for Local Health Agencies to Institute a Hazard Analysis Critical Control Point Program for Food Safety Assurance in Foodservice Operations." The following was stated:

"The HACCP approach is assuredly a means to get off the inspection "treadmill" that many food protection activities seem to be on."

Lastly, the time lag between identifying food program deficiencies and initiation of the recommended corrective action via such evaluations and food protection conferences must be *drastically* reduced. It is interesting to note, for example, that in the 1971 Proceedings of the National Food Protection Conference the following was stated:

"While 27 states and 150 communities have adopted this code (1962 Foodservice Sanitation Manual), state and local programs continue to give inadequate attention to the most important aspect of foodservice sanitation programs: operating practices. A review of inspection reports reveal that few, if any, of the unsafe handling practices cited above are reported as deficiencies. Re-evaluation of current inspection techniques and procedures, with re-direction to assure that adequate attention is being given to operating practices, is urgently needed if mishandling of foods is to be eliminated."

The question must be asked, therefore, why has it taken 14 years for federal and state officials to begin to implement this important recommendation in the form of HACCP? Is it because the creation of a new food protection "toy" is needed to justify regulatory agency existence, divert attention away from the fact other food protection activities have accomplished little or nothing, or to give some semblance of credibility to those charged with protecting the public's health?

Another equally valid question that should be pondered by food program administrators is how can a more

sophisticated inspection (HACCP) be accomplished whenever the more simpler aspects of such an activity have not been achieved? Even the floors, walls, ceiling, and equipment aspects of inspections have not been properly done in a uniform manner either onsite or via plan reviews. At the 1977 National Conference on Food Protection in Foodservice, the following was stated:

"Regulatory agencies must give greater attention to ensuring that the environment of the foodservice establishment is conducive to effective pest control. Specific areas that particularly need improvement are design, construction, and installation of equipment; structural soundness of foodservice establishments; plan review and follow up; and sanitation and housekeeping."

Perhaps by the year 2000 this recycling of public health problems and solutions will come to a space age end. There is no need for additional national food protection conferences or federal or state food program evaluations. Ample, justifiable work remains for all parties to do from the previous ones. Grasshopper food protection activities in any form, however, are not productive and never will be! Although there will always be some new public health concerns, the major existing problems that have been defined must be addressed to have significant progress. The practice of hopping from one new problem to another at the expense of doing nothing about older existing ones must cease. The writer fully recognizes that a person can justify any public health program or position regardless of its value. A true professional, however, will not do this.

In conclusion, the present state of affairs perhaps can be best summed up by the following statement:

"The best minds from all over gather together on a local, state, and national level and after much deliberation and debate reach their conclusions, yet the work remains in defeat and uncertainty."

NOTE: For those who may be tempted to load up their "retort cannon" with an extra charge of powder, before you fire remember: There is a *big* difference between activity and accomplishment.

REFERENCES

1. John J. Guzewish, "HACCP A Critical Approach," *Environment News Digest*, Vol. LI, No. 5, pp. 4-7, November-December 1984.
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3. Frank L. Bryan, "Procedures for Local Health Agencies to Institute A Hazard Analysis Critical Control Point Program For Food Safety Assurance in Foodservice Operation," *Journal of Environmental Health*, Vol. 47 (5), pp. 241-245 March/April 1985.
4. *Food Protection in Foodservice*, National Institute for Foodservice Industry, Chicago, 1978.

**You can weigh,
dissolve, wait...
sterilize, wait...
temper, wait...
inoculate,
pour,
incubate.**

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inoculate
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Meeting Registration Form

1986 IAMFES Annual Meeting

August 3-7, 1986

NAME _____ COMPANION _____

EMPLOYER _____

ADDRESS _____ PHONE # _____

CITY _____ STATE/PROVINCE _____ COUNTRY _____ ZIP _____

Please check where applicable

Affiliate Delegate _____ Speaker _____
 Affiliate Member _____ 30 year member _____
 IAMFES Member _____ 50 year member _____
 Past President _____ Non Member _____
 Executive Board _____ Student _____
 Exhibitor _____ Honorary Member _____

Certificates of Attendance will be available this year. Contact Registration Desk, Wednesday August 6, 1986.

ADVANCE REGISTRATION (note, all prices at the door are at least 20% higher)
 Advance register before July 1 and SAVE. Refundable if canceled prior to June 30, 1986.

	Member	Companion(s) Each	Student	Non Member
Registration	___\$30	___\$10	___Free	___\$40
Early Bird Reception*	___Free	___Free	___Free	___Free
Zoo and Pig Roast	___\$19	___\$19**	___\$19	___\$19
Banquet and Reception	___\$20	___\$20	___\$20	___\$20
*National Mastitis Council	___Free	___Free	___Free	___Free

*Indicate attendance

**Children 16 and under \$5 each. No. _____

SPECIAL EVENTS
 choose the special events you wish to attend and include with your registration

An information booth will be available to assist you in your recreational plannings of Minneapolis sites.

Tuesday, August 5 — 9:30 a.m. to 3:30 p.m.

Comprehensive tour of the Twin Cities including such attractions as Guthrie Theater, St. Paul's Cathedral, St. Anthony Falls, Landmark Center, Minneapolis lakes and much more. Also included is lunch at Forepaughs, a haunted Victorian Mansion. Cost (including lunch) \$26/person. (Min. of 30 people)

Wednesday, August 6 — 9:30 a.m. to 2:30 p.m.

Minibus service to Southdale Shopping Center. Transportation provided free.

Monday, August 4

9:30 a.m. to 2:30 p.m.

Guided tour of Ard Godfrey House, Lady of Lourdes Church, shopping and browsing at redeveloped riverfront area. Lunch - own expense. Cost \$11/person. (Min. of 30 people)

Tuesday, August 5 — 9:00 a.m. to 4:00 p.m.

Spend a fun-filled day at Valley Fair, an outdoor entertainment center featuring carnival rides, games, exhibits, etc. Included in price is admission, transportation, lunch, Day Tours Hostess/Guide and an adult escort. (No one under 10 unless accompanied by an adult) Cost \$20/person (Min. of 30 people)

MAIL TODAY TO:

Dr. David Smith
 Registration Chairman
 %MSA
 PO Box 13694
 Roseville, MN 55113

U.S. Funds only
 Make check or money order payable to:
 IAMFES 1986 Meeting Fund

Ard Godfrey House _____ at \$11 = _____
 Tour of Twin Cities _____ at \$26 = _____
 Valley Fair _____ at \$20 = _____
 Shopping _____
 Registration Total from above _____
 Grand Total \$ _____

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1986 IAMFES Annual Meeting
August 3-7, 1986**

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Study Reveals Calcium Lowers High Blood Pressure

Calcium lowers blood pressure in people with mild to moderate high blood pressure, according to a double-blind study published in the December 1985 issue of *Annals of Internal Medicine*.

As principal researcher, David A. McCarron, M.D., Oregon Health Sciences University, reported that extra calcium lowered blood pressure to a level determined clinically significant in 44 percent of patients with high blood pressure or hypertension. Some of these subjects required drug therapy to lower their blood pressures prior to trying calcium. Nineteen percent who began the study with normal blood pressure also showed marked decreases.

Calcium effectively lowered blood pressure with no adverse effects to the patients, the study revealed. Each person received 1,000 milligrams of calcium per day for 8 weeks in addition to their usual intake.

National Center for Health Statistics data showed adults who consumed 1,500 milligrams of the mineral per day had high blood pressure 45 to 50 percent less often than adults with an intake of 500 milligrams per day. Several studies have shown an association between low calcium consumption in the diet and high blood pressure. Factors such as age, sex, weight, ethnic origin, geographic location, and use of alcohol did not effect these results.

Dairy foods such as milk, cheese, yogurt, and ice cream provide 74 percent of the calcium in our nation's food supply. Protein, riboflavin, and magnesium are among the other nutrients found in significant amounts in foods from the milk group.

McCarron, whose research was funded in part by National Dairy Council, mentioned in the study that future research projects should examine the long-term effects of calcium in managing hypertension and the therapeutic effects of dietary calcium.

National Dairy Council is the nutrition research and nutrition education arm of the dairy industry. United Dairy Industry Association, through the combined efforts of American Dairy Association, Dairy Research Inc., and National Dairy Council, conducts a total dairy product promotion program representing 95 percent of the nation's dairy farmers and 86 percent of the milk marketed.

Raw Milk No Longer Available In Texas Food Stores

On August 17, 1985 the Texas Board of Health made a historic decision concerning the availability of raw milk for direct consumption by citizens of the

State of Texas.

The Board of Health ruled that raw milk could no longer be purchased in retail food stores within Texas. This issue was addressed by the Board in the adoption process for the Department's "Rules on Retail Food Store Sanitation." These rules became effective December 1, 1985.

In summary, after the effective date of December 1, 1985 the only legal source of raw milk for direct consumption within the State of Texas will be on the premises of producer dairies which comply with more stringent Grade A Raw Milk for Retail Standards. This raw milk must meet the following criteria:

- Standard Plate Count - 20,000/ml
- Direct Microscopic Somatic Cell Count - 1,000,000/ml
- Coliform - 10/ml
- Antibiotics - Negative
- Tuberculosis-free - Annual blood test
- Brucellosis-free - Annual blood test

Also, "Rules on Retail Food Store Sanitation" restricts the sale of raw cheese to those cheese products that are produced in accordance with the Code of Federal Regulations, 21 CFR Part 133. This addresses minimum aging and temperature requirements for "cured" raw cheese.

In the process of adopting any type of rule, the overriding consideration which the Board of Health must address is, will this rule provide the necessary protection for the general public. The Board felt the only positive way to address this issue was to adopt the rule as stated.

For more information contact: Texas Department of Health, Kirmon C. Smith, 1100 West 49th Street, Austin, Texas 78756. 512-458-7111.

New Dairy Health Program Increases Profits

DairyCHAMP, a new herd health program offered by the University of Minnesota, can hardly avoid making money for dairy farmers.

The cost is low. And, most farmers who enroll in the program end up making improvements in milk production and profits, says Diane Fraser, who operates the data laboratory for the program through the College of Veterinary Medicine. The Agricultural Extension Service also supports DairyCHAMP.

Dairy farmers feeling the economic squeeze "have every reason to enroll in the program," Fraser says. "Research shows that some farmers will get \$10 back for every \$1 invested in programs like this. One herd was under 35 pounds of milk a day in average milk production when it went on the program. After a year it was up to 55 pounds."

Throughout the program, local veterinarians work

with dairy farmers' herds. Information submitted by the farmer and veterinarian is sent to the university, where it's recorded on a mainframe computer. The computer program processes cow histories, and tabulates and summarizes them. Then, performance can be monitored and reproduction and other disease problems can be identified for management attention by the farmer and veterinarian.

Improvement comes from the management changes recommended by the veterinarian and carried out by the farmer. "If the computer says mastitis is a problem in late lactation, the veterinarian tries to figure out a solution. But the veterinarian gets a lot of help from the computer program. Veterinarians couldn't give farmers this high quality help without the computer program," Fraser says.

More efficient production can come from balancing feed rations, controlling mastitis better and getting cows bred back faster after calving, according to Fraser. The program sets up target goals, then lets you know how the herd is progressing.

For example, a month-by-month target of the number of cows not pregnant and milking can be monitored by the computer. Each month you can see at a glance how close you are to the target.

A program is also available for heifers. For more information, contact Diane Fraser, Large Animal Clinical Sciences, University of Minnesota, St. Paul, MN 55108. 612-376-9102 or call Dr. Norm Williamson, 612-373-1854.

New Test Tells If Ground Beef Is Fresh

Ground beef in bulk can now be tested by buyers for restaurants, supermarket chains and the military - before they buy - to quickly estimate the shelf-life.

The new chemical test was developed by Dr. A. Douglas King, Jr., of the Agricultural Research Service, U.S. Department of Agriculture, and by former co-worker Patricia Nassos-Stalder. King is a chemist with the agency's Western Regional Research Center, Albany, California.

King said the test, originally designed to help buyers for the federal school lunch program, is better than other methods for detecting possible early spoilage of hamburger. He said the test is "cheaper, simpler, and faster." Testing is done in one hour, compared to as many as nine days for other techniques. An analysis is run using high-performance liquid chromatography, available at commercial laboratories.

Freshness of the ground beef is determined by measuring lactic acid in the meat. Lactic acid is a compound that occurs naturally in animals and is also produced by bacteria. High levels of the acid indicate

the beef will spoil quickly and have a bad odor.

King said the test is used in the first of two stages of processing ground beef: Meat is first coarsely ground, then kept refrigerated in large, oxygen-free plastic bags until needed, which may be as long as several weeks. Later, when a supermarket or other outlet buys these chubs or keeper packs, the coarse grind is converted to the familiar fine grind that has a much shorter shelf-life.

Bacteria that produce lactic acid thrive in the oxygen-free pack, and are probably beneficial at low levels. But lactic acid can build up, if the beef is kept in oxygen-free storage too long, and can cause sour odor spoilage, according to the chemist.

A small sample of the coarsely ground beef can be analyzed to detect a buildup of the lactic acid. King said the test has been patented.

Fast Food Can Be Nutritious

Individuals who want to eat healthfully can incorporate fast food into a balanced diet by varying their fast food selections, choosing menu items that contribute to nutrient needs, and choosing meals of appropriate calorie content, according to the report *Fast Food and the American Diet*, published by the American Council on Science and Health (ACSH), an independent scientific organization.

"Many people think that the foods served in fast food restaurants are substantially different in content and nutritional value from similar foods served at home. But, in fact, it is the speed and style of service, rather than the food itself, which distinguishes fast food restaurants from others. It might be more accurate to refer to fast food as "fast-service food," said ACSH Executive Director Dr. Elizabeth M. Whelan.

"Some of the nutritional limitations of fast food are inherent in the fast-service concept," Dr. Whelan added. "To keep service speedy, menus are kept short. This limits the variety of foods available. Since variety is important for good nutrition, meals eaten at fast-service restaurants should be incorporated into a varied diet that includes many other types of food.

"Fast service also means heavy reliance on deep fat frying, a speedy form of preparation that increases a food's calorie count. If you're watching your weight, you should find out about the calorie contents of your favorite fast food items, so that you can avoid sabotaging your diet with a poorly chosen fast food meal."

The addition of salad bars to many fast food restaurant menus has increased the available sources of vitamins A and C and dietary fiber and has made

it easier for individuals on low-calorie, low-sodium, or low-fat diets to select fast food meals that meet their special needs, the ACSH report notes. However, consumers who are observing special dietary restrictions should not assume that everything at the salad bar is suitable for them, ACSH warns. They need to choose salad ingredients and dressings wisely.

"Some of the supposed nutritional limitations of fast food are the fault of the consumer rather than the menu," said ACSH Research Associate Kathleen A. Meister. "For instance, fast food meals have been criticized because they are often low in calcium. However, high-calcium menu items - milk, shakes, or main dishes that contain cheese - are available in virtually all fast food restaurants. The problem is that people don't order them.

"The diets of many Americans, particularly women and teenage girls, do not meet the recommended allowance for calcium. Some women avoid milk because they're worried about its calorie count. Fast food restaurants could make it easier for customers to get the calcium they need by offering lowfat or skim milk, which has all the calcium of whole milk but fewer calories," she said.

The American Council on Science and Health is an independent, nonprofit consumer education organization promoting scientifically balanced evaluations of food, chemicals, the environment, and health.

To obtain a copy of *Fast Food and the American Diet*, send a self-addressed, stamped (39¢ postage), business-size (#10) envelope to Fast Food Report, ACSH, 47 Maple St., Summit, NJ 07901.

UW-Madison Researchers Receive Dairy Research Grants

Four University of Wisconsin-Madison researchers received dairy research grants totaling \$278,214.

The grants, awarded by the National Dairy Promotion and Research Board, went to Janet Greger, Department of Nutritional Science; and Daryl Lund, Elmer Marth and Norman Olson of the Department of Food Science in the College of Agricultural and Life Sciences at UW-Madison.

Greger will compare the health benefits and drawbacks of dietary calcium from dairy products to calcium supplements, such as pills. She will examine how much calcium, phosphorus, zinc and iron is available to the body from milk-supplemented diets compared to diets supplemented by commercial calcium sources.

Lund will study the products and procedures used to remove milk deposits in milk-processing and dairy operations. The study should produce recommendations

for operating heat exchangers to reduce or eliminate milk fouling which occurs during pasteurization and sterilization.

Marth will investigate the now-notorious, but little-understood *Listeria monocytogenes* bacterium and its behavior in milk and milk products. The bacterium, which can grow in refrigerated, pasteurized milk, can cause meningitis, abortions and perinatal septicemia, which kills newborn babies. The bacterium was recently implicated in 58 deaths in California.

Olson will examine flavor development in cheese varieties made from ultrafiltered milk - milk in which the fats and proteins have been concentrated. Cheese from ultrafiltered milk often develops less flavor intensity; and Olson will study ways to enhance flavor.

The National Dairy Promotion and Research Board supports dairy research and promotional efforts across the country. The Board has awarded more than \$3.4 million in grants to researchers in food science, nutrition and medicine. The money comes from a 15-cent-per-hundredweight checkoff collected from dairy farmers.

Yogurt Not Necessarily Low Calorie

Yogurt can be a dieter's delight - or downfall.

According to a Texas A&M University Agricultural Extension Service nutritionist, it all depends on the type of yogurt you eat.

"Yogurt's calorie count depends on the butterfat content of the milk from which it is made," says Dr. Alice Hunt. "The more butterfat, the higher the calories."

One cup of nonfat plain yogurt contains about 90 calories, while the low-fat type has about 150 calories and the whole milk product can have 180 to 210 calories.

Many of the new custard-style or creamy style yogurts use whole milk, Hunt observes. The fat from the whole milk adds flavor and creaminess, but also makes some of these products almost equal to ice cream in calories.

"Dieters should also consider the serving size on yogurt products," says the nutritionist, "since more manufacturers are using six-ounce containers instead of eight-ounce containers for the higher calorie yogurt."

She cautions consumers to note the serving size when comparing calories among yogurt products. "A six ounce container of a higher-fat yogurt may have the same number of calories as an eight-ounce cup of low-fat yogurt because the serving size is reduced."

Flavoring in yogurts is another source of calories a

dieter may want to avoid, says the nutritionist.

Flavored yogurts contain two to three times more calories than plain yogurt, with the extra calories coming from fruit and sugars such as sucrose, fructose, corn sweetener or honey.

Whether you eat high-calorie or low-calorie yogurt, both have one big plus, says Hunt. Most yogurts contain about 350 milligrams of calcium per serving which is about 35 percent of the U.S. Recommended Daily Allowance.

Free Copies Of Latin American Import Export Directory Available

With the object of increasing business relations between Latin American countries and the rest of the

world the Latin American Trade Council is distributing free copies of the *Latin American Import Export Directory*.

This directory is compiled to provide comprehensive and up-to-date information on general business facilities in Latin America required by overseas companies and organizations for the promotion of international trade and general business contacts. The 400-page plus Latin American Import Export Directory contains more than 30,000 companies with their addresses, telephone and telex numbers, and have been classified by specific activity which allows the importer or exporter to locate needed data precisely.

Free copies of the captioned publication are now available for collection upon written request to: Latin American Trade Council, Circulation Department, P.O. Box 12, San Jose 1007, Costa Rica (Central America).

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IAMFES Secretary Candidates



Ron Case is presently Corporate Quality Assurance Manager for Kraft Inc. in Glenview, Illinois. During his 12 years with Kraft Inc., he has had a variety of Quality Control positions, including Food Technologist and Corporate Laboratory Control Manager. Prior to coming to work in the food industry, he was a secondary school Science teacher in Kentucky.

Ron received his Bachelor's Degree from the University of Kentucky in Science Education and his Master's Degree from the University of Notre Dame in Chemistry. He has done additional graduate work at the University of Wisconsin in Food Safety.

An active member of IAMFES and the Illinois affiliate for 8 years, Ron has served on the laboratory committee and has been a speaker at both the state and international meetings.

As part of the APHA Technical Committee on "Standard Methods for the Examination of Dairy Products", he helped prepare the 15th edition and authored one chapter. He has been active in the Association of Official Analytical Chemists (AOAC) and has published papers on detection of antibiotics in milk.

He is currently serving on the joint committee of experts for the International Dairy Federation/International Standards Organization/AOAC on topics dealing with dairy analyses. He has been actively involved with the National Conference on Interstate Milk Shipments and has served on its Laboratory Committee since 1979.



Upon completion of active duty with the U. S. Navy (1966-1970), Phil enrolled in college at the University of Wisconsin-Platteville graduating at the end of the 1972 year. For the last 13 years he has been with Associated Milk Producers, Inc., Mid-States Region. Current responsibilities and job title is Director of Quality Control & Standards.

Obviously many matters pertaining to quality and its job-related activities are involved in the day-to-day functions of the Quality Department. Phil has been a member of the International approximately ten years and has been Membership Chairman for three years. AMPI, as well, has been a sustaining member of the International.

On the local level, Phil has been involved with the Illinois Milk, Food and Environmental Sanitarians for the same length of time and has been Illinois Membership Chairman for the last three years. One of the first experiences he had with the Illinois chapter was being involved with the IAMFES meeting in Chicago (Arlington Heights - 1975) and being responsible for registration, as well as other meeting duties.

Currently, Phil is serving as Second Vice-President of the Illinois Sanitarians and is looking forward to meeting the challenge in Illinois as well as, nationally.

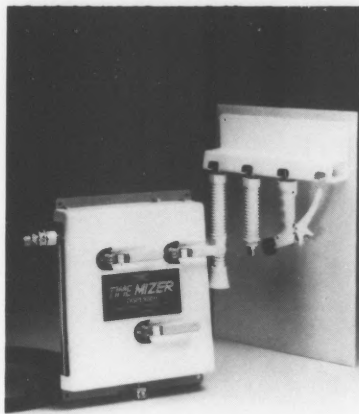
Phil is a member of the Chicago Dairy Technological Society, National Mastitis Council (Board of Directors), National Council of Interstate Milk Shipments and attends 3A Sanitary Standards meetings.

The AMPI in-house magazine publishes a quality column monthly put together by the Quality Department. He also contributes articles to a national dairy magazine.

Most of Phil's spare time is spent with his wife and two children (ages six and three).

New Product News

The products included herein are not necessarily endorsed by Dairy and Food Sanitation.



New Cleaning/Sanitizing System Cuts Cost and Saves Time

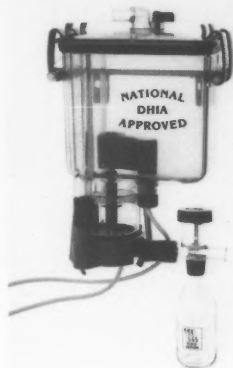
• Supermarket meatroom, deli and bakery managers can cut labor and chemical costs as well as reduce the incidence of tainted food with the TIME:MIZER Supermarket Sanitation System, a cleaning and sanitizing system complete with chemicals, equipment and training procedures from Johnson Wax.

The TIME:MIZER system includes Choice Cut meatroom degreaser, J-80 Sanitizer, a wall-unit dispenser, and spray gun attachments and wall rack. This matched system protects profits while it expertly cleans and sanitizes meatrooms, deli's, bakeries and other difficult-to-clean areas. The TIME:MIZER dispenser accurately proportions the cleaner and sanitizer, thereby eliminating misuse due to incorrect dilution. Meat and other food contamination losses are lowered as a result of the system's thorough cleansing.

Choice Cut Meatroom Degreaser is a heavy-duty foaming cleaner designed to cut through grease, fats, protein and grit quickly. J-80 sanitizer kills both gram positive and gram negative bacteria and is the final step in a complete sanitation program. Johnson Wax provides system installation, training for supermarket personnel and offers audio/visual aides as well.

For more information contact: Pete Maglocchi, Associate Market Development Manager, Commercial Products group - U.S.A. Johnson Wax, Racine, WI 53403-5011. 414-631-2000.

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Zero Electronic Milk Meter Given National D.H.I.A. Approval

• Zero Manufacturing announces the National D.H.I.A. approval of the ZERO ELECTRONIC MILK METER. The Zero Electronic Milk Meter offers these unique features:

- Can be used on any existing manual or automatic milking system.
- Incorporates a superior butterfat sampling system.
- Assists in identifying marginal producers.
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- In-place cleaning with the rest of the system.
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- Can link to a home computer through an in-parlor milk yield computer for the complete cow/feed management system.

Zero Manufacturing offers a complete line of cow feed management systems, milking pipelines, bulk milk tanks and heat recovery systems.

For more information contact: Zero Manufacturing Co., 811 Duncan Avenue, Washington, MO 63090. 314-239-6721.

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Acetic Acid Test Kit



Water Conditioner Aids in Cutting Chemical Costs

• Dairymen and processors around the country are finding the AQUA-FLO non-chemical water conditioner an amazing aid in cutting chemical costs, providing clearer sanitary systems and reducing algae growth in all water systems. Whether your problem is calcium scaling, stuck valves or high chemical costs, AQUA-FLO can help.

A unique approach allows this device to enhance flavor, make water seem "wetter" and retain solids in solution longer than normal - all without chemicals. For line sizes 3/4" to 3". If you're looking for more efficiency in your liquid lines and want to reduce scaling, corrosion and chemical costs, call toll free, 1-800-368-2513 or write AQUA-FLO, INC., 6244 Frankford Avenue, Baltimore, MD 21206.

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Test Kit Now Available Determining Acetic Acid

• A test kit for the enzymatic determination of Acetic Acid in a variety of materials is now available from Boehringer Mannheim Biochemicals. Utilizing the enzymes acetyl-CoA synthetase, citrate synthase, and malate dehydrogenase in a NAD-NADH coupled procedure, this kit comes complete with enough reagents for 30 to 60 determinations.

With this kit, Acetic Acid may be measured quickly and accurately with minimal sample preparation and set-up time. Intensely colored liquids having acetic acid levels less than 0.02 g/l will require decolorization prior to assay. Working procedures are available for a variety of materials, including wine, beer, paper products, fruit juices, emulsifiers, and cheese.

For additional information contact: Boehringer Mannheim Biochemicals' Research Kit Department at 800-428-5433 (in Indiana call collect, 317-849-9350).

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Minolta's Chroma Meter II Tests Freshness of Milk

• According to reports from representatives of Minolta Corporation in Australia, a recent Symposium on Sediment Testing has revealed a test for freshness in milk using the Minolta CR-100 meter. A small sample of milk is mixed with a reagent and the color of the mixture is measured using the CR-100, providing a dependable indication of freshness. The symposium which took place in Sydney, was sponsored by the New South Wales Dairy Corporation.

The Minolta Chroma Meter CR-100, a meter for measuring reflected subject color is used in many industries. The measuring area at the tip of the head is only 8mm in diameter, allowing readings of very small samples without cutoff. This highly accurate meter is one of the most compact and lightweight tristimulus color analyzer on the market.

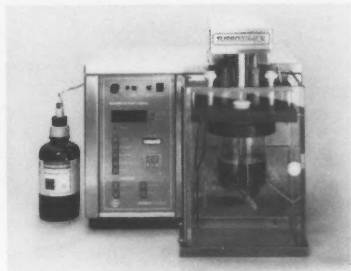
Using high-sensitivity silicon photo cells filtered to match CIE (Commission Internationale de L'Eclairage) Standard Observer response, this meter makes precise readings, which are processed by a built-in microcomputer and displayed on a custom-designed liquid-crystal display.

For more information contact: Rob Kneller, Bozell & Jacobs Public Relations, 6 E. 43rd Street, New York, NY 10017. 212-916-8500. Or contact: John T. McCasland, Minolta Corporation, 101 Williams Drive, Ramsey, NJ 07446. 201-825-4000.

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Gelco Space Trailer



Baird & Tatlock Introduces Turbo Titrator For Karl Fischer Titrations

• Baird & Tatlock has announced the introduction of the TURBO titrator for Karl Fischer titrations in industrial, research and university applications.

The TURBO model offers a built-in homogenizer which pulverizes and blends solids or poorly miscible liquids. Difficult samples are introduced directly into the reaction vessel. A powerful 6,000 rpm homogenizer quickly reduces solids to fine particles, and blends with appropriate solvents. Titration begins automatically at the end of the preset homogenate time. After titration, a digital display immediately presents results in mg of moisture.

The TURBO model is a volumetric titrator, ideally suited for rapid moisture measurement where moisture content ranges from .01% to 100%. All standard and pyridine free Karl Fischer reagents can be used successfully with the TURBO Model.

Safety features include a fully enclosed reaction vessel, interlocks which prevent the unit from operating when open for user access, and an enclosed reagent pumping system which minimizes discharge of fumes.

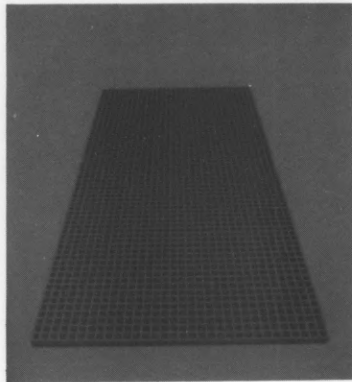
For further information contact: Baird & Tatlock's exclusive US distributor, Freeman, Gerdes & Co., Inc., 41 Washington Avenue, Pleasantville, NY 10570. 914-747-2228.

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Gelco Space Trailer Gets Lab Into Action Quickly

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neau back into business in less than two weeks.

According to Galarneau, his laboratory is responsible for conducting tests of dairy herds required by the New York State Department of Agriculture and Markets. Once a month he tests milk samples for bacteria and three times a month for butterfat content.

For more information contact: Gelco Space, Two Bala Plaza, P.O. Box 7100, Bala Cynwyd, PA 19004. 215-581-0400

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Food Science Facts

For The Sanitarian



Robert B. Gravani
Cornell University
Ithaca, NY

THE pH OF FOODS

The tartness or sour taste of grapefruit, sauerkraut, yogurt and pickles is the result of the intensity of acidity in these products. The acidity of foods has been used for centuries to enhance microbiological stability and preserve products. Acidity plays a primary role in the preservation of fermented foods and combined with other factors such as heat, water activity and chemical preservatives acts to prevent food deterioration and spoilage.

The acidity of a food may occur naturally as in citrus fruits, apples, tomatoes and strawberries or it may be produced in foods through microbial fermentation. Selected acid producing bacterial cultures added directly to foods can produce desirable products like yogurt, buttermilk and fermented meat products. Acid may also be added directly to a food; an example is the addition of acetic acid to fish and vegetables, lactic acid to spanish-type olives and citric acid to beverages.

The intensity of acidity of a food is expressed by its pH value. The pH of a food is one of several important factors that determine the survival and growth of microorganisms during processing, storage and distribution. Consequently, food processors are interested in determining the pH of foods and in maintaining pH at certain levels to control microbial growth and prevent product deterioration and spoilage.

The pH scale was developed from mathematical calculations based on the dissociation (temporary breakdown) of water. These complex calculations allow us to measure pH on a scale that runs from 0 to 14. The values that are less than 7 are acidic, while those greater than 7 are alkaline. pH 7 is neither acid or alkaline and is considered neutral. Pure water has a pH of 7 and is neutral.

The pH scale is based on the hydrogen ions concentration [H+] in the food. The more hydrogen ions present, the more acid the food and the lower the pH. The diagram below shows the pH scale and the taste of foods at acid and alkaline pH values.

Foods can be classified according to their pH as follows:

- Acid foods - products that have a natural pH of 4.6 or below.
- Low-acid foods - foods (other than alcoholic beverages) that have a pH greater than 4.6 and less than 7.0. (Low-acid does not mean low pH, but relates to the pH values above 4.6.)
- Acidified foods - low-acid foods that have their pH lowered to 4.6 or less by the addition of acids or acid foods.

An example of the pH of several kinds of acid and low acid foods are shown below.

Acid Foods		Low Acid Foods	
pH		pH	
3.7 and Lower	3.7 to 4.5	4.6 to 5.3	5.4 and Higher
Sauerkraut	Tomatoes	Meat & Vegetable	Meats
Pickles	Pears	Mixtures	Seafoods
Berries	Figs	Spaghetti	Milk
Citrus Fruits	Pineapple	Soups	Corn
Rhubarb		Asparagus	Lima Beans
		Beets	
		Pumpkin	
		Spinach	
		Green Beans	

pH is used to control microorganisms in foods by: (1) directly inhibiting microbial growth, and (2) reducing the heat resistance of the microbes.

The pH Scale

Sour or Tart Taste							Bitter Taste							
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Acid							Neutral		Alkaline					

Most fruits are naturally acid and may be given a mild heat process in which the temperature does not exceed 212°F and does not require pressure. Vegetables are predominately low-acid foods and require a severe heat process to destroy all spores of *Clostridium botulinum*. For foods that may be acidified like cucumbers, artichokes, cauliflower, peppers and fish, it is essential that the pH be allowed to equilibrate (stabilize) thoroughly before the heat treatment. This involves the addition of sufficient acid, proper mixing, and enough time for the pH to fall to 4.6 or below, at the center of solid foods.

Every microorganism has a minimum, an optimum and a maximum pH for growth. Most microorganisms grow best at pH values around 7.0 while only a few grow below pH 4.0. Yeasts and molds are generally more acid tolerant than bacteria and can grow at lower pH values. Foods with pH values below 4.5 are usually not easily spoiled by bacteria but are more susceptible to spoilage by yeasts and molds. Microorganisms can grow in wide pH ranges and these ranges are probably the difference between different bacterial strains, types of food or growth medium and the type of acid or base used to adjust pH.

The table below shows the approximate pH ranges of microbial growth for selected bacteria, yeasts and molds.

Although the pH of a food influences what microorganisms will grow, these organisms can change the pH of food by the production of metabolic by-products during their growth. These metabolites can be acid or alkaline, depending on: the food; the microorganisms; and the time allowed for growth. Most microorganisms produce acid due to the breakdown of sugars (carbohydrates) in the food. The lactic acid bacteria, for example, can lower the pH of foods by producing lactic acid. The adjustment of pH by controlled acid production is sometimes desirable and is widely used in many food fermentations. Other bacteria like *Pseudomonas* species are proteolytic and breakdown the proteins in foods. Protein breakdown and the production of ammonia and/or other alkaline metabolic by-products raises the pH of the food.

The pH of foods is an important and often critical factor in food processing. In the next issue of Food Science Facts, the measurement of pH and the pH values of common foods will be discussed.

ORGANISM	pH		
	MINIMUM	OPTIMUM	MAXIMUM
Most bacteria	4.5	6.5-7.5	9.0
<i>E. coli</i>	4.3-4.4	6.0-8.0	9.0-10.0
Most <i>Pseudomonas</i> species	5.6	6.6-7.0	8.0
Most <i>Lactobacillus</i> species	3.0-4.4	5.5-6.0	7.2-8.0
Most <i>Salmonella</i>	4.0-5.0	6.0-7.5	9.0
Most <i>Staphylococcus</i> species	4.2	6.8-7.5	9.3
Yeasts	1.5-3.5	4.0-6.5	8.0-8.5
Molds	1.5-3.5	4.5-6.8	8.0-11.0

ENVIRONMENTAL *LEGIONELLA*

The National Reference Service on Legionellosis at the Laboratory Centre for Disease Control (LCDC) has recently received increased numbers of requests for information concerning examination of environmental sources for *Legionella*. The following summary has been prepared to deal with most of the questions raised.

Nosocomial legionellosis usually results from inhalation of *Legionella*-contaminated aerosols from such sources as evaporative condensers, cooling towers, and potable water (showers, taps, and water storage tanks). Whirlpools and respiratory/therapy equipment have also been implicated as sources.

Recovery of *Legionella* from environmental sources does not in itself constitute proof of the source of the infecting agent during episodes of legionellosis because the organism is frequently isolated from water sources unrelated to human disease. An association between exposure to a potential source, including identification of the mechanism of aerosol production, and occurrence of disease must be established.

Furthermore, isolation of the same species and serogroup from patient and suspected environmental sites does not constitute proof of source. Subtyping is essential especially for *L. pneumophila* serogroups 1 and 6 which form LCDC records and account for approximately 70% of the isolates from patients and the environment.

Routine environmental sampling unrelated to cases of disease is of questionable value and has not been recommended because the organism is ubiquitous.

In the event that culturing for *Legionella* from environmental sites is indicated, the following may be useful. Sampling for environmental isolates should include swabbing with moist sterile Dacron® swabs on the inside of taps (under washers), shower head interiors (dismantle), and swabs placed in small quantities of sterile tap water. Water samples should be taken from such taps and shower outlets (25-50 ml) and from bottom drains of storage tanks (1 L) to obtain some sediment. If samples cannot be processed immediately, they should be kept cold until such time as this is possible. Swabs and water samples should be plated directly onto selective media such as Edelstein's (available commercially). Thereafter, cells in water samples should be concentrated either by centrifuging or on bacteria-retaining membrane filters and then plated on Edelstein's media. Swabs retained from direct plating and the sediments from water samples are acid treated or heat treated and plated on the selective media. Plates are incubated at 35°C for up to 10 days and examined daily for suspicious colonies.

The National Reference Service for Legionellosis will distribute reagents and methodologies for the identification of *Legionella* on request. The Service will also provide advice on recovery and identification of *Legionella* from clinical and environmental sources and will examine cultures submitted for a second opinion regarding identification. Arrangements will also be made with Dr. J. Joly, Laval University, for subtyping of strains. Dr. Joly is a member of a World Health Organization team evaluating monoclonal antibody subtyping and is working in close collaboration with LCDC. *Canada Diseases Weekly Report* 9-14-1985.

VIBRIO PARAHAEMOLYTICUS IN BRITISH COLUMBIA

Vibrio parahaemolyticus is a marine vibrio which causes gastroenteritis and, less commonly, wound infection and septicemia. Over the course of one week in July 1985, 3 cases of extra-intestinal *V. parahaemolyticus* infection occurred in the Vancouver area.

Case No. 1: A 21-year old woman lacerated the sole of her foot on a clam at Point Roberts beach, just south of Vancouver. The next day the wound was purulent with surrounding inflammation and she was started on oral ampicillin by her family physician. Culture of the wound grew *V. parahaemolyticus* resistant to ampicillin. By the time the culture result was available the wound had improved and therapy was not changed.

Case No. 2: A 54-year old woman, with a history of mastoid surgery as a child, presented to her family physician with purulent otitis externa which had developed over the course of several days after swimming in the Strait of Georgia. She was initially treated with cephalexin and topical Cortisporin®. Culture of the ear grew *V. parahaemolyticus* resistant to cephalexin and polymyxin B. Treatment was changed to oral tetracycline and gentamicin ear drops and she improved over the next few days.

Case No. 3: A 30-year old woman cut her knee on a shell while swimming in Burrard Inlet, Vancouver. Several days later, she presented to her family physician with a purulent wound which grew both *V. parahaemolyticus* and *Pseudomonas putrifaciens*. She improved without antibiotic therapy.

Comments: *V. parahaemolyticus* is a frequent cause of gastroenteritis in Japan where it is associated with the consumption of raw seafood. In North America, the organism has been found to be an infrequent cause of gastroenteritis even when appropriate media for vibrio isolation from stools have been routinely used. Extra-intestinal infection has also been uncommon and has usually taken the form of infection of wounds incurred in a marine environment or during contact with seafood. In a 10-year review of vibrio infections in a Gulf Coast community, Bonner et al report only 3 extra-intestinal infections due to *V. parahaemolyticus*. All infections were severe, requiring surgical debridement of necrotic tissue, and one of the patients who had underlying disease (acute myelogenous leukemia) developed septicemia and died.

In British Columbia, 2 cases of *V. parahaemolyticus* wound infections were reported in 1976. To the authors' knowledge, none have been reported since, although the organism is known to be present in nearby Puget Sound and has been found in B.C. coastal waters this summer (M.T. Kelly, University of British Columbia: personal communication, 1985). July, 1985 was exceptionally hot in British Columbia with coastal water temperatures reaching 20°C in some areas. These conditions would favor high vibrio counts and increased recreational water use, 2 factors which are considered important in the seasonal distribution (summer-fall peak) of vibrio infections.

In contrast to the *V. parahaemolyticus* wound infections reported by Bonner, these 3 cases and the 2 previous B.C. cases reported by Bowmer were all minor, local infections without tissue necrosis or systemic toxicity. It is likely that the spectrum of *V. parahaemolyticus* wound infections includes self-limited

infections which are not cultured.

Editorial Note: A recent article in the LCDC Newsletter indicated that between September, 1978 and September, 1984, 11 vibrios involving at least 3 different species were isolated from extra-intestinal sites of 10 patients at the Chaleur Regional Hospital in Bathurst, New Brunswick. Two isolates were *V. parahaemolyticus*; 5 *V. alginolyticus*; 3 non-O1 *V. cholerae*; and 1, which could not be identified by CDC, Atlanta, was called a halophilic vibrio species. Sites include a leg wound, ear, and a wound on the sole of the foot. A direct link between a salt water environment and isolation of the vibrio could be made in 4 of the cases. An association between ingestion of seafood or contact with a salt or brackish water environment and infection in humans is well documented in the literature. All the Bathurst cases were males ranging in age from 9 to 30 years. No explanation for the male predominance can be given; however, a high male to female ratio has been documented by others. It was suggested in the article that perhaps in such areas close to the sea and involving a large seafood industry it would be appropriate to incorporate plates of selective media in the routine analysis of stool cultures to determine the incidence of vibrio-related diarrhea, particularly during the period (May to October) when maximum consumption of seafood occurs and when the water temperature favors multiplication of marine vibrios.

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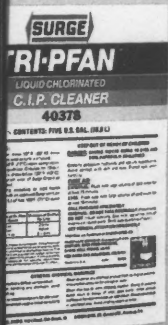
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Dairy Quality

by Darrell Bigalke, Food & Dairy Quality Mgmt., Inc., St. Paul, MN

Control And Evaluation Of A Quality Management System

Part IV

The November, December and January *Dairy Quality* articles defined and described the planning, organizing, and implementation of a Quality Management System (QMS). They pointed out that the QMS is an innovative approach that is consistent with current attitudes toward quality. Key aspects are defining quality as conformance to specifications and developing specifications that reflect consumer acceptance, safety, and improved profits.

This article discusses the importance of control and evaluation of a QMS to assure the production of quality products and improved profits. Additional programs that should in time be added to a QMS also are suggested to assure that long range quality and profit objectives be met.

A. Control of a Quality Management System

The primary objective of a QMS is production of quality products and profit improvement. To achieve this objective, it is necessary that the QMS function according to plan by controlling the implementation and function of the QMS. Koontz and O'Donnell (1) suggest that controlling implies measurement of accomplishments and events and relating them to plans and correction of deviations that assure the attainment of objectives. Two methods can be used to measure the accomplishments related to implementation and function of the QMS. These are:

1. The measurement of the degree of conformance to specifications for products and profits.
2. Review existing specifications.
3. Develop new process control procedures.
4. Change supplier of manufacturing supplies, raw materials, or other ingredients necessary for production.
5. Change organizational structure of the QMS or organization.
6. Improve staffing to assure qualified, trained, and motivated personnel.
7. Change techniques of directing and leading.

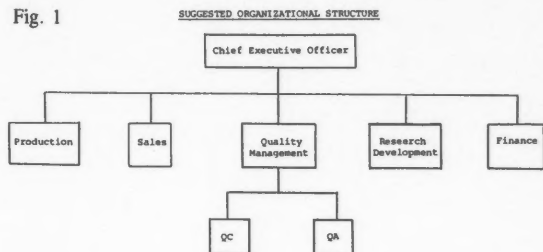
8. Exercise contingency plans.
9. Other activities necessary to assure conformance to specifications.

Control requires planning and a clear organizational structure. Planning for continued successful operation of a QMS requires utilization of clear, measurable objectives and continued development of "progress control charts." Progress control charts (discussed in the August article) should include tasks to be accomplished, responsibility, timing for accomplishment of tasks, objectives, budgets, and milestones. Specific tasks to be included on the progress control chart would include: policy development, process control procedure development, implementation of control mechanisms, specification development or revision, audit procedure development and implementation, sanitation considerations, and engineering developments. Effective planning also requires continuous development of contingency plans. Contingency plans will facilitate control, offset uncertainty and change, focus attention on objectives, and help to gain an economical operation.

Clearly defined organizational structure (internal structure of roles) and the outline of organizational authority and responsibility are required for a properly functioning QMS. An organizational structure is effective if it facilitates the contributions of individuals in attainment of objectives (improved product quality and profits). An organizational structure with the quality management department having direct line authority to the chief executive officer is suggested. While several organizational structures are effective, Figure 1 is one example of organizational structures that would facilitate the accomplishments of objectives outlined by the QMS.

Organizational authority is the degree of discretion in organizational positions conferred on persons occupying these positions the right to use their judgment in decision making. Responsibility and accomplishment of expected results is facilitated by clearly defining tasks to be accomplished by each member of the organization. Communication of responsibilities is accomplished through job descriptions, objectives, and reporting systems. Responsibilities of each department of the organization were outlined in the August article.

Fig. 1



B. Further Developments

Continuous in-house or external training programs must be adopted. The training programs should address general manufacturing activities, laboratory activities, quality management functions, safety, or other training that is appropriate for the QMS.

Other programs that may be revised or adopted to assure continued success of a QMS are: 1) supplier certification, 2) product recall and inventory procedures, 3) product recall classification system, 4) consumer complaint follow-up program, 5) continuous product specification review and revisions based on manufacturing capabilities, consumer survey, and cost benefit determinations, and 6) continuous documentation and communication of increased profits attributed to the QMS. Increased profits resulting from the QMS actions should be documented and communicated to all those involved in the operation.

In summary, a QMS is a systems approach to achieving quality based on defining quality as conformance to specifications. Specifications must reflect consumer acceptance, safety, and improved profits. Specifications for improved profits should be based on control of the "cost of quality." The "cost of quality" includes prevention costs, appraisal costs, and product and process failure costs. Controlling product and process failure costs facilitates conformance to specifications resulting in improved profits and improved product quality.

- (1) Koontz, H. and O'Donnell, C. (1976). *Management, a System and Contingency Analysis of Managerial Functions*, Fifth Edition, McGraw-Hill Book Company, N.Y.



N.M.C.

NATIONAL MASTITIS COUNCIL

What You Can Do To Prevent Bacteria From Getting Into The Udder

Mastitis is caused when bacteria at the teat end pass through the teat canal. Two basic approaches to prevention of mastitis are:

1. reducing the numbers of bacteria on the teat end.
2. reducing the chances that the bacteria remaining on the teat end will pass through the teat canal.

Bacterial numbers on the teat end can be reduced by good milking time hygiene and begins with good premilking procedures. The goal is to have the teats *clean* and *dry* before the milking machine is applied. A sound practice is to use two paper towels for each cow - one to wash, the other to dry. Automated backflushing units can reduce the spread of bacteria from one cow to another.

After milking, all teats should be dipped or sprayed with a teat dip that has been proven effective. Post milking teat disinfection is the single most effective measure dairymen have for the prevention of new infections caused by bacteria that are spread from one cow to another.

Other types of bacteria - the environmental - reach the teat end between milkings from the cow's surroundings. To prevent these types of infections, it is necessary to provide an environment in which the teats will remain as clean and dry as possible.

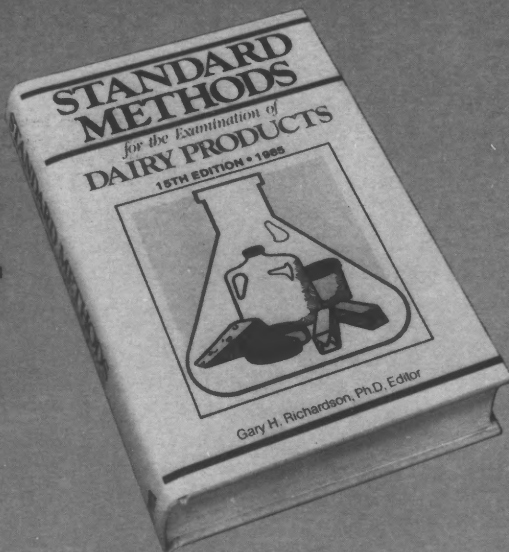
There are two basic ways to prevent passage of bacteria through the teat canal. Since some organisms pass through the canal during milking due to action of the milking machines, it is necessary to have milking systems that are well-designed, in good operating condition and used with recommended procedures. The other is to protect the health of the teat canal. Anything that injures the teat end may favor passage of bacteria through the canal. Such factors include physical injury, teat dilators, teat cannulas, irritating teat dips, chapping, frostbite, severe sunburn and several diseases of the teat.

Passage of bacteria through the canal, with subsequent infection, is common during the dry period, especially just after drying off and in the precalving period. Prevention of infection in dry cows requires teat dipping after the last milking of the lactation and dry cow treatment using approved dry cow products. As with milking cows, it is necessary to provide an environment in which the teats will stay clean and dry, and is especially true for cows close to calving.

This article is one of a continuing series made available by the National Mastitis Council. For additional information, contact the NMC, 1840 Wilson Blvd., Arlington, VA 22201.

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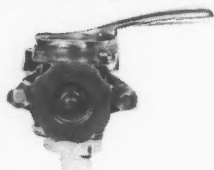
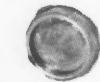
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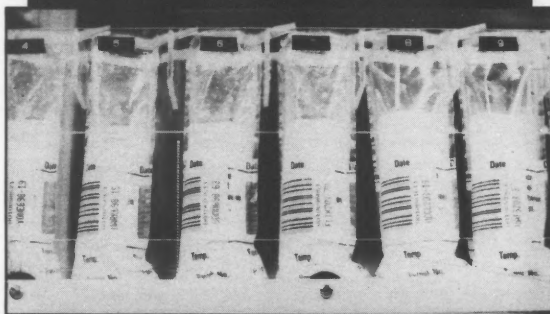
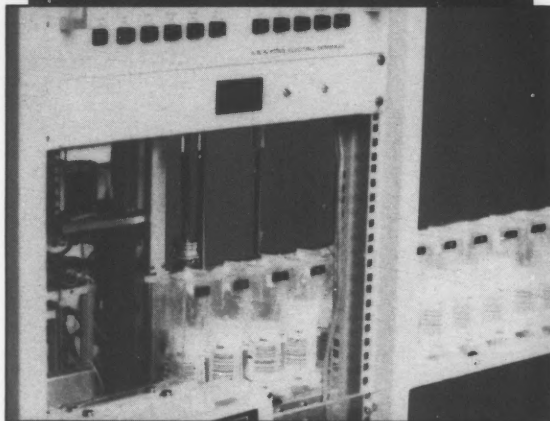
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Abstracts of papers in the February Journal of Food Protection

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Rapid Detection of Salmonellae in Foods Using Immunoassay Systems, George F. Ibrahim, Mary J. Lyons, Reta A. Walker and Graham H. Fleet, Hawkesbury Agricultural Research Unit, New South Wales Department of Agriculture, Richmond, N.S.W. 2753, Australia and School of Food Technology, University of New South Wales, Kensington, N.S.W. 2033 Australia

J. Food Prot. 49:92-98

A standard cultural method, radioimmunometric (RIMA) and enzyme immunometric (EIMA) assays were compared for detection of salmonellae in 235 food samples. The immunoassays used titanous hydroxide as the solid-phase, commercial Spicer-Edwards salmonella polyvalent H antisera (SEA) or pooled antisera produced against 10 salmonella flagellins (PFA). Nineteen food samples were positive for *Salmonella* by the standard cultural method. These as well as one additional sample were also positive for *Salmonella* by RIMA and EIMA. No false-negative results were obtained from the immunoassays using PFA, whereas two false-negative results were observed when SEA was used. The incidence of false-positive results when SEA and PFA were used were, respectively, 3.0 and 0.9% with RIMA and 2.6 and 0.9% with EIMA. The immunoassays were also able to detect 77 *Salmonella* serotypes when grown alone or in association with other species of *Enterobacteriaceae*, in mannitol selenite cystine broth. Both immunoassays performed reliably on enrichment cultures stored under refrigeration for up to 9 d. Also, of 6 non-motile salmonellae, 5 were detectable by the immunoassays. The immunoassays were simple, rapid and cost-efficient.

Applicability of the *Bacillus stearothersophilus* Disc Assay for Penicillin Residues in Casein/Caseinates, Kathleen T. Rajkowski and James W. Messer, Department of Health and Human Sciences, Food and Drug Administration, Division of Microbiology, 1090 Tusculum Avenue, Cincinnati, Ohio 45226

J. Food Prot. 49:99-103

Six buffer systems were examined as hydrating solutions for assaying antibiotic residues in bovine casein or caseinates by

the qualitative *Bacillus stearothersophilus* disc assay method. Formic acid and 1% potassium phosphate buffer systems were suitable in that they did not react adversely with the *B. stearothersophilus* spores or cause degradation of penicillin. With the formic acid buffer, a 20% casein slurry and a 10% caseinate slurry were sufficiently fluid to allow capillary saturation of a 12.7-mm paper disc. Casein and caseinate rehydrated with 1% potassium phosphate buffer were too viscous to permit saturation of a disc. The detectable level in a 20% casein slurry and a 10% caseinate slurry was ≥ 0.004 IU penicillin G/ml. Casein and caseinate prepared from potassium or procaine penicillin G-contaminated skim milk contained no detectable level of antibiotics as determined by the *B. stearothersophilus* disc assay method.

Homologous Bacteriophage Control of *Pseudomonas* Growth and Beef Spoilage, G. Gordon Greer, Agriculture Canada, Lacombe Meat Research Centre, Lacombe, Alberta, Canada T0C 1S0

J. Food Prot. 49:104-109

The effects of homologous bacteriophages upon growth of a beef spoilage pseudomonad and the retail case life of beef were examined under conditions of simulated retail display. Initial studies with an aqueous extract of beef muscle showed *Pseudomonas* growth was significantly limited by phages for up to 3 d at 7°C. Subsequently, it was shown that the treatment of *Pseudomonas*-inoculated steaks with high titer phage lysates (10^8 PFU/ml) resulted in a 1- to 2-log reduction in the level of bacterial contamination and a 2-log increase in phage numbers after 4 d of retail display. These changes were accompanied by a marked decrease in steak surface discoloration and a concurrent improvement in retail acceptance. Steak case life was positively correlated with phage concentration within the range of 10 to 10^8 PFU/ml. At the highest concentration of phages tested (10^8 PFU/ml) steak case life was significantly increased from 1.6 to 2.9 d. It was concluded that phages could multiply on the steak surface and have the potential for the biological control of beef spoilage.

Relationship of Somatic Cell Count and Total Sulfhydryls in Milk, Daniel R. Samles, Susan L. Dill, Ronald L. Richter and Charles W. Dill, Department of Animal Science, Texas A&M University, College Station, Texas 77843

J. Food Prot. 49:110-111

Individual milk samples from 32 cows were analyzed to determine the relationship between somatic cell concentration and total sulfhydryl concentration (cysteine plus reduced cystine). A significant relationship was detected between somatic cell count, which ranged from 1.7×10^4 to 1.0×10^7 cells/ml, and total sulfhydryls per gram of milk protein. The regression equation, total sulfhydryls/g of milk protein = $31.96 + 7.99$ (\log_{10} somatic cell count) with $r^2 = 0.19$, was calculated. The mean total sulfhydryl concentration was $73.1 \mu\text{mol/g}$ of protein. The minimal effect of somatic cell concentration on total sulfhydryl concentration indicates that somatic cell concentration should have little influence on chemical parameters of milk protein determined by sulfhydryl analysis when proper experimental controls are used.

Effect of Sugar and Low-Dose Irradiation on Toxin Production by *Clostridium botulinum* in Comminuted Bacon, C. N. Huhtanen, J. Shieh, E. Wierbicki, L. Zaika, R. K. Jenkins, R. L. Buchanan and D. W. Thayer, Eastern Regional Research Center, Agricultural Research Service, U.S. Department of Agriculture, 600 East Mermaid Lane, Philadelphia, Pennsylvania 19118

J. Food Prot. 49:112-116

Comminuted bacon, processed to contain target levels of $40 \mu\text{g NaNO}_2/\text{g}$ and 0, 0.25 or 0.75% sucrose or 0.75% glucose, was inoculated with a mixture of spores of 20 strains of *Clostridium botulinum* (400 spores per g) and was canned under vacuum. Portions were irradiated using ^{137}Cs at doses of 0, 0.19, 0.38, 0.75, 1.12 and 1.5 Mrad. Cans were incubated for 1, 2, 4 or 8 wk at 30°C . Some cans of nonirradiated bacon without or with 0.25% sucrose became toxic in 2 wk; with 0.75% sucrose, toxin production was delayed to 8 wk. Bacon irradiated at 0.75 Mrad, made with or without sucrose, became toxic in 2 to 4 wk, whereas most cans of bacon irradiated at 1.5 Mrad remained toxin-free for the 8-wk incubation period. A comparison of bacon made with 0.75% sucrose or glucose showed no difference between the sugars in the rates of toxin production by *C. botulinum* in irradiated cans of bacon. Irradiation at 0.19 Mrad increased the rate of toxin formation over nonirradiated bacon in sugar-containing (0.75%) bacon, but had no effect in sugar-free bacon. The pH of nonirradiated bacon containing 0.75% glucose or sucrose decreased from pH 6.12 and 6.11, respectively, to pH 5.63 and 5.67 after 8 wk of incubation at 30°C . The titratable acidity showed a concurrent increase. The pH and titratable acidity of bacon irradiated at 0.19 Mrad or higher showed no changes.

Use of Sodium Substitutes in Cottage Cheese and Buttermilk, B. J. Demott, J. P. Hitchcock and P. M. Davidson, De-

partment of Food Technology and Science and Animal Science, University of Tennessee, Knoxville, Tennessee 37901-1071

J. Food Prot. 49:117-120

Twenty-four market samples of cottage cheese had an average sodium concentration of $4.91 \pm 1.20 \text{ mg/g}$. Two samples of cottage cheese formulated to contain 1.1% "Lite" and Zyest, and having sodium concentrations of 3.23 and 2.54 mg/g had significantly lower flavor scores than a sample containing 1.4% NaCl and having 6.25 mg of Na/g. The Standard Plate Counts and the yeast and mold counts on the cottage cheese after storing 10 d at 4°C were not different between samples containing salt, salt substitute or salt substitute plus a dry yeast preparation. Psychrotrophic bacteria were more numerous in the samples containing the yeast preparation. Four samples of buttermilk containing .015% "Zyest 45-F" and .25% NaCl, .25% "Lite" and .015% "Zyest 45-F", .25% NaCl, or .25% "Lite" had comparable flavor scores. The sodium concentrations of the four samples were 1.096, .793, 1.125 and .771 mg/g, respectively. The growth of yeasts and molds in samples containing "Zyest 45-F" and "Lite" was slightly but not significantly greater than the other three samples. Psychrotrophic counts on buttermilk after 7 d of storage at 4°C were much lower than the original counts, but were not influenced by the additives used.

Influence of Sample Reconstitution on Recovery of *Salmonella* Species from Low-Moisture Dairy Foods, Paul L. Poelma, Clyde R. Wilson and Wallace H. Andrews, Division of Microbiology, Food and Drug Administration, Washington, D.C. 20204

J. Food Prot. 49:121-125

Recovery of *Salmonella* species from dry whole milk, lactic casein, non-instantized nonfat dry milk, rennet casein and sodium caseinate was compared under rapid and slow conditions of rehydration. For rapid rehydration, a 25-g portion of each product was blended or swirled with 225 ml of appropriate preenrichment medium. After 60 min, the flask contents were adjusted to pH 6.8 and incubated at 35°C . For slow rehydration, a 25-g portion of each product was gently added to 225 ml of appropriate preenrichment medium, allowed to soak undisturbed for 60 min at room temperature, and then incubated at 35°C without pH adjustment. Recovery of *Salmonella* by the slow rehydration (soak) method was equal or enhanced for all products tested except sodium caseinate. Use of a meter instead of test paper to adjust the pH of rapid rehydration (blend/swirl) preenrichments did not improve recovery of *Salmonella*. Examination of dry whole milk and non-instantized nonfat dry milk by the soak method should be limited to 25-g amounts since 100-g and 375-g composites were not completely wetted. Composites of lactic and rennet casein weighing $\leq 375 \text{ g}$, however, may be examined by the soak method without loss of analytical sensitivity.

Sulfite Residues in Restaurant Salads, Laura B. Martin, Julie A. Nordlee and Steve L. Taylor, Food Research Institute, Department of Food Microbiology and Toxicology, and Department of Food Science, University of Wisconsin, 1925 Willow Drive, Madison, Wisconsin 53706

J. Food Prot. 49:126-129

Sulfiting agents, which have been used as salad fresheners to prevent the enzymatic browning of restaurant salads, may pose a hazard to sulfite-sensitive asthmatics. Chopped lettuce treated with a commercial salad freshener at the recommended level of 1 tablespoon per gallon (ca. 5.3 g/L) of dip solution can contain as much as 963 mg/kg (ppm) total SO₂ equivalents. Most of the sulfite in chopped lettuce is free SO₂. If commercial salad fresheners are abused by using levels in excess of 1 tablespoon per gallon, progressively higher levels of residual sulfite are retained on the lettuce. Cole slaw prepared according to a typical commercial formulation contained 350 mg/kg total SO₂. A survey of lettuce salads, cole slaw and potato salads from 25 local and national chain restaurants and delicatessens in Madison, Wisconsin, showed sulfite residue levels to be well below those of a treated salad, indicating a lack of sulfite use.

Shelf-Life Extension of Vacuum Packaged Frankfurters Made from Beef Inoculated with *Streptococcus lactis*, S. Y. Wang, T. R. Dockerty, R. A. Ledford and J. R. Stouffer, Department of Animal Science, Cornell University, Ithaca, New York 14853-4801

J. Food Prot. 49:130-134

Fresh beef, containing .5% dextrose, was inoculated with *Streptococcus lactis*, incubated for 3, 5 and 7 d at 7±1°C, and then used to manufacture frankfurters. The frankfurters were vacuum-packaged and stored for 1, 2, 4 and 6 weeks at 3±1°C. Microbial quality was evaluated by examining frankfurters for aerobic and psychrotrophic counts at the end of each storage period. The level of nisin, an antibiotic substance produced by this strain of *S. lactis*, was also monitored in fresh meat and processed products. During the incubation period, no appreciable reduction in pH occurred in fresh meat. Growth of psychrotrophs was slower in treated than untreated fresh meat, but whether this was due to presence of nisin or competition resulting from the heavy inoculation with *S. lactis* is unclear. Before and after processing, nisin levels in the 5- and 7-d incubation-treated groups were higher than in the 3-d group, and all treated groups had higher nisin levels than untreated groups. Little difference in aerobic and psychrotrophic

growth was noted with storage time between treated and untreated groups for the 3-d incubation period, but well defined differences were noted in the 5- and 7-d incubation groups, with aerobic growth in treated groups being significantly slowed through the 6-week storage period, and psychrotrophs being 1 to 1.5 log cycles lower at the 6-week evaluation. The growth patterns suggest that nisin played a role in the reduced growth rate of bacteria in treated groups.

Survival and Growth of *Campylobacter jejuni* in Egg Yolk and Albumen, A. Gavin Clark and Donna H. Bueschgens, Department of Microbiology, University of Toronto, 150 College Street, Toronto, Ontario, Canada M5S 1A8

J. Food Prot. 49:135-141

Campylobacter jejuni will grow in egg yolk and in yolk-albumen melanges reaching populations in excess of 10⁸ CFU/ml. Albumen alone is highly toxic, with D₁₀ values of 2.4 h in vitro at 42°C. Exposure to albumen in vitro is not reversed by later exposure to yolk; rather a substrate accelerated death effect is seen in the presence of added yolk. *C. jejuni* was generally more sensitive to gelatinous albumen than to less viscous albumen, although both forms of albumen inhibited motility after 6 h of incubation at 42°C. Sensitivity to albumen was only partially due to the individual effects of pH or lysozyme. The major factor in the sensitivity of *C. jejuni* to egg white was the conalbumin as demonstrated by in vitro culture.

Effects of Radurization and Refrigerated Storage on Quality and Shelf-Life of Freshwater Prawns, *Macrobrachium rosenbergii*, S. Angel, B. J. Juven, Z. G. Weinberg, P. Lindner and E. Eisenberg, Department of Food Science, Agricultural Research Organization, The Volcani Center, P.O. Box 6, Bet Dagan 50250, Israel, and Soreq Nuclear Research Center, Yavne, Israel

J. Food Prot. 49:142-145

The effects of radurization on bacteriological, chemical, physical and sensory changes were studied in iced-stored freshwater prawns of the species *Macrobrachium rosenbergii*. At both 145 and 230 krad, counts of potential spoilage bacteria

were reduced. Irradiation at 230 krad resulted in increased TVBN values. No significant differences in texture (mushiness) were observed between irradiated and nonirradiated samples throughout the storage period. Atypical streptobacteria ($D=59$ krad) were the predominant organisms isolated from irradiated prawns after 4 weeks of refrigerated storage. No connection was found between development of mushiness and total or proteolytic bacterial counts.

Toxicological Safety Evaluation of a *Bacillus acidopullulyticus* Pullulanase, M. Stavnsjerg, R. K. Hjortkjaer, V. Bille-Hansen, B. F. Jensen, R. J. Greenough, M. McConville, M. Holmstroem and K. P. Jazelden, Novo Industri A/S, Research and Development Division, 2880 Bagsvaerd, Denmark and Inveresk International Ltd., Musselburg EH21 7UB, Scotland

J. Food Prot. 49:146-153

Promozyme®, an amylopectin debranching enzyme produced by *Bacillus acidopullulyticus*, was studied to evaluate its safety in the food industry. A dietary subchronic toxicity study incorporating fertility and teratogenicity studies was performed in 1-month-old rats at concentrations of 0.5, 1.5 and 5% Promozyme. No adverse effects were seen at the 0.5 and 1.5% dose levels, and at the 5% dose level only minor or equivocal signs of toxicity were recorded. With the exception of a moderate reduction in body weight gain the F_{1A} litters at the 5% dose level, no effects were found in the fertility study, and Promozyme was not teratogenic. In a 13-wk oral toxicity study in dogs, no adverse effects resulted from 0.5 g/kg/d, whereas mild gastrointestinal disturbances were seen clinically at 1.5 and 5.0 g/kg/d. In dogs given 5.0 g/kg/d, terminal investigations showed increased kidney weights and mineralized casts in renal cortical tubules. This was probably due to the high content of ash (phosphorus) in the test material. Lack of mutagenic potential was confirmed in bacterial mutagenic assays with *Salmonella typhimurium* (TA 1535, TA 1537, TA 1538, TA 98 and TA 100) and in an in vivo cytogenetic study in rat bone marrow cells after a single dose and daily dosing for 5 d of up to 8 g/kg/d. In an acute inhalation study with 4 h of exposure of rats, no death occurred at the highest dose level used, i.e., 2 mg/L. The test material was non-irritating to skin and did not produce eye injury in rabbits. A skin sensitization study in guinea pigs revealed no indication that the enzyme is a sensitizer. The pathogenic potential of the enzyme-producing *B. acidopullulyticus* was investigated by single intraperitoneal and subcutaneous administrations to rats and mice; the microorganism was found to be nonpathogenic ($LD_{50} > 10^{10}$ cells/kg). Tests of culture broths revealed that the microorganism does not produce antibiotics. Results indicated that production and the intended use of Promozyme can be regarded as safe for plant workers and consumers.

Pictorial Guide for Rapid Identification of Common Adult Storage Insects, Richard M. Klein, Food and Drug Administration, Department of Health and Human Services, New York Regional Laboratory, 850 Third Avenue, Brooklyn, New York 11232

J. Food Prot. 49:154-160

To assist analysts with identification of the adult insects most commonly found in foods, detailed drawings of 21 such insects are provided. For each example, accompanying text summarizes the identifying characteristics and gives additional information about its name and habits. Larger scale drawings of adult antennae and mandibles are included with most examples.

***Campylobacter jejuni* in Foods: Its Occurrence, Isolation from Foods, and Injury**, Samuel A. Palumbo, Eastern Regional Research Center, Agricultural Research Service, U.S. Department of Agriculture, Philadelphia, Pennsylvania 19118

J. Food Prot. 49:161-166

The following aspects of *Campylobacter jejuni* has been reviewed: characteristics of *C. jejuni*, its occurrence in foods, methods to quantitatively recover the organism from food, and heat injury and freeze-thaw stress of *C. jejuni*. *C. jejuni* can be heat injured in 0.1 M potassium phosphate buffer at 46°C. Heat injury can be demonstrated as the differential count between brucella agar plus ferrous sulfate, sodium metabisulfite and sodium pyruvate (FBP) and brilliant green 2% bile broth agar plus FBP. Heat-injured *C. jejuni* will grow on brucella agar containing either of the three antibiotic mixtures typically used to isolate *C. jejuni*. Heat-injured *C. jejuni* will repair (regain dye and bile tolerance) in brucella broth plus FBP. *C. jejuni* can be freeze-thaw stressed. This stress is demonstrated as a sensitivity to the antibiotic polymyxin B or incubation at 42°C. Addition of succinate and cysteine increased recovery of freeze-thaw stressed *C. jejuni*. Although the presence of injured/stressed *C. jejuni* in foods has not yet been detected, methods are now available to begin this search. The injury/stress process may explain the often encountered difficulty in isolating *C. jejuni*, especially low numbers, from foods.

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411	Capital Equipment Corp. 2421 Darwin Road Madison, WI 53704	(11/15/83)	242 Puriti, S.A. de C.V. (not available in USA) Alfredo Nobel 39 Industrial Puente de Vigas Tlalnepantla, Mexico	(9/12/72)
82R	Cherry-Burrell Corp. (A Unit of AMCA Int'l. Corp.) 2400-6th St. SW, P.O. Box 3000 Cedar Rapids, Iowa 52406	(12/11/57)	149R Q Controls Subsid. of Cesco Magnetics 93 Utility Court Rohnert Park, California 94928	(5/18/64)
407	Continental Disc Corp. 4103 Riverside NW Kansas City, MO 64150	(10/14/83)	424 Robert-James Sales, Inc. P.O. Box 1672, 269 Hinman Ave. Buffalo, NY 14216-0672	(8/31/84)
376	Defontaine Inc. 563 A. J. Allen Circle Wales, WI 53183	(1/25/83)	287 Sanitary Processing Equipment Corp. P.O. Box 178, Salino Station Syracuse, New York 13201	(1/14/77)
455	Flowtech Inc. 120 Interstate N. Pkwy. E. #208 Atlanta, Georgia 30339-2103	(9/17/85)	334 Stainless Products, Inc. 1649-72nd Ave., Box 169 Somers, Wisconsin 53171	(12/18/80)
271	The Foxboro Co. 38 Neponset Ave. Foxboro, Massachusetts 02035	(3/8/76)	391 Stork Food Machinery, Inc. 672 Hwy. 202-206N-Box #5 Bridgewater, NJ 08807	(6/9/83)
67R	G & H Products Corp. 7600-57th Avenue P.O. Box 1199 Kenosha, WI 53141	(6/10/57)	300 Superior Stainless, Inc. 611 Sugar Creek Rd. Delavan, Wisconsin 53115	(11/22/77)
350	H&K, Inc. -Rosista Div. 2365 S. 170th Street P.O. Box 54 New Berlin, WI 53151	(1/7/82)	357 Tanaco Products 3860 Loomis Trail Rd. Blaine, Washington 98230	(4/16/82)
369	IMEX, Inc. 4040 Del Rey Ave. Unit 9 Marina del Rey, CA 90292	(11/3/82)	73R L. C. Thomsen & Sons, Inc. 1303-43rd St. Kenosha, Wisconsin 53140	(8/31/57)
203R	ITT Grinnell Valve Co., Inc. Dia-Flo Division	(11/27/68)	191R TCI-Superior Division, Mueller Canada Inc. 6500 Northwest Dr. Mississauga, Ontario, Canada L4V 1K4	(11/23/66)
			250 Universal Dairy Equipment 408 First Avenue, So. Albert Lea, Minnesota 56007	(6/11/73)

3-A SYMBOL HOLDERS

- | | | | |
|--|------------|--|------------|
| 449 Up-Well Enterprises Co., USA
P.O. Box 5334
Grants Pass, Oregon 97527 | (8/1/85) | 11-03 Plate-type Heat Exchangers for Milk and Milk Products | |
| 304 VNE Corporation
1415 Johnson St., P.O. Box 187
Janesville, Wisconsin 53547 | (3/16/78) | 38 APV Crepaco, INC.
100 South CP Ave.
Lake Mills, Wisconsin 53551 | (10/19/56) |
| 278 Valex Products Corp.
6080 Leland Street
Ventura, California 93003 | (8/30/76) | 20 APV Crepaco, INC.
395 Fillmore Ave.
Tonawanda, New York 14150 | (9/4/56) |
| 86R Waukesha Specialty Co., Inc.
Hwy 14
Darien, Wisconsin 53144 | (12/20/57) | 458 APV International Limited
(Not available in USA)
P.O. Box 4, Manor Royal
Crawley
West Sussex RH10 2QB
England | (10/15/85) |
| 09-07 Instrument Fittings and Connections Used on Milk and Milk Products Equipment | | 17 Alfa-Laval, Inc.
2115 Linwood Ave.
Ft. Lee, New Jersey 07024 | (8/30/56) |
| 428 ARi Industries, Inc.
381 ARi Court
Addison, IL 60101 | (9/12/84) | 120 Alfa-Laval, Ltd.
(DeLaval Agric. Div.)
11100 No. Congress Ave.
Kansas City, Missouri 64153 | (12/3/59) |
| 321 Anderson Instrument Co., Inc.
RD #1
Fultonville, New York 12072 | (6/14/79) | 326 American Vicarb Corp.
77 Oriskany Dr.
Tonawanda, New York 14150 | (2/4/80) |
| 315 Burns Engineering, Inc.
10201 Bren Rd., East
Minnetonka, Minnesota 55343 | (2/5/79) | 30 Cherry-Burrell Corp.
(A Unit of AMCA Int'l. Inc.)
2400-6th St. SW, P.O. Box 3000
Cedar Rapids, Iowa 52406 | (10/2/56) |
| 206 The Foxboro Co.
38 Neponset Ave.
Foxboro, Massachusetts 02035 | (8/11/69) | 14 Chester-Jensen Co., Inc.
5th & Tilghman Sts., P.O. Box 908
Chester, Pennsylvania 19016 | (8/15/56) |
| 418 Pasilac, Inc.
660 Taft St., NE
Minneapolis, MN 55413 | (4/2/84) | 362 Kroeze Dairy Equipment, Inc.
14393 Euclid Ave.
Chino, California 91710 | (7/20/82) |
| 367 RdF Corporation
23 Elm Ave.
Hudson, New Hampshire 03051 | (10/2/82) | 15 Kusel Equipment Co.
820 West St., P.O. Box 87
Watertown, Wisconsin 53094 | (8/15/56) |
| 420 Stork Food Machinery, Inc.
672 Hwy. 202-206N-Box #5
Bridgewater, N.J. 08807 | (4/17/84) | 360 Laffranchi Wholesale Co.
P.O. Box 698
Ferndale, California 95536 | (7/12/82) |
| 32 Taylor Instrument Co.
Div. of Combusion Eng.
95 Ames St.
Rochester, New York 14601 | (10/4/56) | 414 Paul Mueller Co.
P.O. Box 828
Springfield, MO 65801 | (12/13/83) |
| 444 Tuchenhagen North America, Inc.
4119 Green Tree Road
Milwaukee, WI 53209 | (6/17/85) | 365 Pasilac Therm, Inc.
660 Taft St., N.E.
Minneapolis, Minnesota 55413 | (9/8/82) |
| 10-03 Milk and Milk Products Filters Using Disposable Filter Media, as Amended | | 279 The Schlueter Co.
112 E. Centerway
Janesville, Wisconsin 53545 | (8/30/76) |
| 371 Alloy Products Corp.
1045 Perkins Ave., P.O. Box 529
Waukesha, Wisconsin 53187 | (12/10/82) | 426 TCI-Superior Division,
Mueller Canada Inc.
6500 Northwest Dr.
Mississauga, Ontario, Canada L4V 1K4 | (8/31/84) |
| 35 Ladish Co., Tri-Clover Div.
9201 Wilmot Rd.
Kenosha, Wisconsin 53141 | (10/15/56) | 12-04 Tubular Heat Exchangers for Milk and Milk Products | |
| 435 Sermia Equipment Limited
(Not available in USA)
2511 Barbe Avenue
Chomedey, Laval, Quebec, Canada H7T 2A2 | (11/27/84) | 438 APV Crepaco, INC.
395 Fillmore Avenue
Tonawanda, New York 14150 | (12/10/84) |
| 296 L. C. Thomsen & Sons, Inc.
1303 43rd St.
Kenosha, Wisconsin 53140 | (8/25/77) | 248 Allegheny Bradford Corp.
P.O. Box 200 Route 219 South | (4/16/73) |

3-A SYMBOL HOLDERS

	Bradford, PA 16701			Newburyport, Massachusetts 01950	
243	Babson Bros. Company 2100 So. York Rd. Oak Brook, Illinois 60521	(10/31/72)	356	Damrow Co. (Div. of DEC Int'l. Inc.) 196 Western Ave., P.O. Box 750 Fond du Lac, Wisconsin 54935-0750	(3/10/82)
103	Chester-Jensen Co., Inc. 5th & Tilghman Sts., P.O. Box 908 Chester, Pennsylvania 19016	(6/6/58)	311	GEA Wiegand Corporation 8940 Route 108 Columbia, Maryland 21045	(8/28/78)
307	G & H Products Corp. 7600-57th Avenue P.O. Box 1199 Kenosha, WI 53141	(5/2/78)	273	Niro Atomizer Food & Dairy, Inc. 1600 County Rd F Hudson, Wisconsin 54016	(5/20/76)
217	Girton Manufacturing Co. Millville, Pennsylvania 17846	(1/31/71)	107R	C. E. Rogers Co. So. Hwy #65, P.O. Box 118 Mora, Minnesota 55051	(7/31/58)
238	Paul Mueller Co. P.O. Box 828 Springfield, Missouri 65801	(6/28/72)	446	Stern Industries, Inc. P.O. Box 70 Winsted, Minnesota 55395	(7/8/85)
96	C. E. Rogers Co. So. Hwy #65, P.O. Box 118 Mora, Minnesota 55051	(3/31/64)	299	Stork Food Machinery, Inc. 672 Hwy. 202-206N-Box #5 Bridgewater, N.J. 08807	(11/17/77)
298	Sanitary Processing Equipment Corp. P.O. Box 178, Salino Station Syracuse, NY 13201	(1/28/85)	427	TCI-Superior Division, Mueller Canada Inc. 6500 Northwest Dr. Mississauga, Ontario, Canada L4V 1K4	(8/31/84)
392	Stork Food Machinery, Inc. 672 Hwy. 202-206N-Box #5 Bridgewater, N.J. 08807	(6/9/83)	387	Unitech Div. of the Graver Co. 2720 Hwy. 22 Union, New Jersey 07083	(5/13/83)

13-08 Farm Milk Cooling and Holding Tanks

49R	A-L Stainless Inc. 113 Park St., South Peterborough, Ontario Canada K9J 3R8	(12/5/56)
240	Babson Bros. Company 2100 So. York Rd. Oak Brook, Illinois 60521	(9/6/72)
4R	Dairy Equipment Co. 1919 So. Stoughton Rd. Madison, Wisconsin 53716	(6/15/56)
179R	Heavy Duty Products (Preston) Ltd. (not available in USA) 1261 Industrial Rd. Cambridge (Preston) Ontario Canada N3H 4W3	(3/8/66)
12R	Paul Mueller Co. 1600 W. Phelps, P.O. Box 828 Springfield, Missouri 65801	(7/31/56)
16R	Zero Manufacturing Co. 811 Duncan Ave. Washington, Missouri 63090	(8/27/56)

16-05 Evaporators and Vacuum Pans for Milk and Milk Products

254	APV Anhydro, Inc. 165 John L. Dietsch Square Attleboro Falls, Massachusetts 02763	(1/7/74)
132	APV Crepaco, INC. 395 Fillmore Ave. Tonawanda, New York 14150	(10/26/60)
277	Alfa-Laval, Inc. Contherm Division P.O. Box 352, 111 Parker St.	(8/19/76)

17-06 Fillers and Sealers of Single Service Containers for Milk and Milk Products

366	Autoprod, Inc. 12 So. Denton Ave. New Hyde Park, New York 11040	(9/15/82)
346	B-Bar-B, Inc. E. 10th & McBeth, P.O. Box 909 New Albany, New York 47150	(10/21/81)
192	Cherry-Burrell Corp. (A Unit of AMCA Int'l., Inc.) 2400-6th St. SW, P.O. Box 3000 Cedar Rapids, Iowa 52406	(1/3/67)
382	Combibloc, Inc. 4800 Roberts Rd. Columbus, OH 43228	(4/15/83)
324	Conoffast 711 Jorie Blvd. Oak Brook, Illinois 60521	(11/29/79)
137	Ex-Cell-O Corp. 850 Ladd Rd., Bldg. "A" Walled Lake, Michigan 48088	(10/17/62)
352	GMS Engineering 1936 Sherwood St. Clearwater, Florida 33515	(1/12/82)
452	Jagenberg Inc. Freshwater Blvd. P.O. Box 188 Enfield, Connecticut	(9/3/85)
220	Liquipak International, Inc. 2285 University Ave. St. Paul, Minnesota 55114	(4/24/71)

3-A SYMBOL HOLDERS

- | | | | |
|---|------------|---|------------|
| 330 Milliken Packaging
White Stone, South Carolina 29353 | (8/26/80) | 160 DCI, Inc.
P.O. Box 1227, 600 No. 54th Ave.
St. Cloud, Minnesota 56301 | (4/5/65) |
| 442 Milliken Packaging
White Stone, SC 29386 | (2/21/85) | 181 Damrow Co.
(Div. of DEC Int'l., Inc.)
196 Western Ave., P.O. Box 750
Fond du Lac, Wisconsin 54935-0750 | (5/18/66) |
| 281 Purity Packaging Corp.
800 Kaderly Dr.
Columbus, Ohio 43228 | (11/8/76) | 439 JV Northwest Engineering, Inc.
18088 S.W. Lower Boones Ferry Rd.
Portland, OR 97223 | (1/22/85) |
| 351 Tetra Pak
4885 Alpha Rd.
Suite 100
Dallas, Texas 75234 | (1/7/82) | 155 Paul Mueller Co.
1600 W. Phelps, P.O. Box 828
Springfield, Missouri 65801 | (2/10/65) |
| 211 Twinpak, Inc. (Canada)
2225 Hymus
Dorval, Quebec, Canada H9P 1J8 | (2/4/70) | 460 Niro Atomizer Food & Dairy Inc.
1600 County Road F
Hudson, Wisconsin 54016 | (11/4/85) |
| 18-00 Multiple-Use Rubber & Rubber-Like Materials Used
as Product Contact Surfaces in Dairy Equipment | | | |
| 429 Bepex Corporation
P.O. Box 880
Santa Rose, CA 95402 | (9/25/84) | 312 Sanitary Processing Equipment Corp.
P.O. Box 178, Salino Station
Syracuse, New York 13201 | (9/15/78) |
| 19-03 Batch and Continuous Freezers for Ice Cream, Ices,
and Similarly Frozen Dairy Foods, as Amended | | | |
| 141 APV Crepaco, INC.
100 South CP Ave.
Lake Mills, Wisconsin 53551 | (4/15/63) | 434 TCI-Superior Division,
Mueller Canada Inc.
6500 Northwest Dr.
Mississauga, Ontario, Canada L4V 1K4 | (11/9/84) |
| 146 Cherry-Burrell Corp.
(A Unit of AMCA Int'l., Inc.)
2400-6th St. SW, P.O. Box 3000
Cedar Rapids, Iowa 52406 | (12/10/63) | 165 Walker Stainless Equipment Co., Inc.
Elroy, Wisconsin 53929 | (4/26/65) |
| 401 Coldelite Corp. of America
Robinson Rd. & Rt. 17 So.
Lodi, NJ 07644-3897 | (8/22/82) | 23-01 Equipment for Packaging Frozen Desserts, Cottage
Cheese, and Similar Milk Products, as Amended | |
| 286 O. G. Hoyer, Inc.
201 Broad St.
Lake Geneva, Wisconsin 53147 | (12/8/76) | 174 APV Anderson Bros. Mfg. Co.
1303 Samuelson Rd.
Rockford, IL 61109 | (9/28/65) |
| 465 Leon's Frozen Custard
3131 S. 27th Street
Milwaukee, Wisconsin 53151 | (12/17/85) | 209 Dobby Packaging Machinery Incorp.
869 S Knowles Ave.
New Richmond, Wisconsin 54017 | (7/23/69) |
| 412 Sani Mark, Inc.
5767 Dividend Road
Indianapolis, IN 46241 | (11/28/83) | 302 Eskimo Pie Corp.
530 E. Main St.
Richmond, Virginia 23219 | (1/26/78) |
| 355 Emery Thompson Machine & Supply Co.
1349 Inwood Ave.
Bronx, New York 10452 | (3/9/82) | 343 O. G. Hoyer, Inc.
201 Broad St.
Lake Geneva, Wisconsin 53147 | (7/6/81) |
| 22-04 Silo-type Storage Tanks for Milk and Milk Products | | | |
| 262 A-L Stainless Inc.
113 Park St., South
Peterborough, Ontario Canada K9J 3R8 | (11/11/74) | 222 Maryland Cup Corp.
Owings Mills, Maryland 21117 | (11/15/71) |
| 154 APV Crepaco, INC.
100 South CP Ave.
Lake Mills, Wisconsin 53551 | (2/10/65) | 447 Mateer-Burt Co., Inc.
436 Devon Park Drive
Wayne, Pennsylvania 19087 | (7/22/85) |
| 168 Cherry-Burrell Corp.
(A Unit of AMCA Int'l., Inc.)
575 E. Mill St.
Little Falls, New York 13365 | (6/16/65) | 24-01 Non-coil Type Batch Pasteurizers | |
| 22-04 Silo-type Storage Tanks for Milk and Milk Products | | | |
| 262 A-L Stainless Inc.
113 Park St., South
Peterborough, Ontario Canada K9J 3R8 | (11/11/74) | 158 APV Crepaco, INC.
100 South CP Ave.
Lake Mills, Wisconsin 53551 | (3/24/65) |
| 154 APV Crepaco, INC.
100 South CP Ave.
Lake Mills, Wisconsin 53551 | (2/10/65) | 161 Cherry-Burrell Corp.
(A Unit of AMCA Int'l., Inc.)
575 E. Mill St.
Little Falls, New York 13365 | (4/5/65) |
| 168 Cherry-Burrell Corp.
(A Unit of AMCA Int'l., Inc.)
575 E. Mill St.
Little Falls, New York 13365 | (6/16/65) | 402 Coldelite Corp. of America
Robinson Rd. & Rt. 17 So.
Lodi, NJ 07644-3897 | (8/22/83) |
| 22-04 Silo-type Storage Tanks for Milk and Milk Products | | | |
| 262 A-L Stainless Inc.
113 Park St., South
Peterborough, Ontario Canada K9J 3R8 | (11/11/74) | 187 DCI, Inc.
P.O. Box 1227, 600 No. 54th Ave.
St. Cloud, Minnesota 56301 | (9/26/66) |

3-A SYMBOL HOLDERS

- 166 Paul Mueller Co. (4/26/65) **28-00 Flow Meters for Milk and Liquid Milk Products**
 P.O. Box 828
 Springfield, Missouri 65801
- 25-01 Non-coil Type Batch Processors for Milk and Milk Products**
- 159 APV Crepaco, INC. (3/24/65)
 100 South CP Ave.
 Lake Mills, Wisconsin 53551
- 162 Cherry-Burrell Corp. (4/5/65)
 (A Unit of AMCA Int'l., Inc.)
 575 E. Mill St.
 Little Falls, New York 13365
- 188 DCI, Inc. (9/26/66)
 P.O. Box 1227, 600 No. 54th Ave.
 St. Cloud, Minnesota 56301
- 167 Paul Mueller Co. (4/26/65)
 P.O. Box 828
 Springfield, Missouri 65801
- 448 Scherping Systems (8/1/85)
 801 Kingsley Street
 Winsted, Minnesota 55395
- 202 Walker Stainless Equipment Co. (9/24/68)
 New Lisbon, Wisconsin 53950
- 26-02 Sifters for Dry Milk and Dry Milk Products**
- 173 Blaw-Knox Food & Chemical Equip. Co. (9/20/65)
 P.O. Box 1041
 Buffalo, New York 14240
- 229 Russell Finex, Inc. (3/15/72)
 156 W. Sandford Blvd.
 Mt. Vernon, New York 10550
- 363 Kason Corp. (7/28/82)
 1301 East Linden Ave.
 Linden, New Jersey 07036
- 430 Midwestern Industries, Inc. (10/11/84)
 915 Oberlin Rd., P.O. Box 810
 Massillon, OH 44648-0810
- 185 Rotex, Inc. (8/10/66)
 1230 Knowlton St.
 Cincinnati, Ohio 45223
- 172 SWECO, Inc. (9/1/65)
 6033 E. Bandini Blv.
 P.O. Box 4151
 Los Angeles, California 90051
- 176 Sprout-Waldron, Koppers Co., Inc. (1/4/66)
 Muncy, Pennsylvania 17756
- 27-01 Equipment for Packaging Dry Milk and Dry Milk Products**
- 353 All-Fill, Inc. (3/2/82)
 40 Great Valley Pkwy.
 Malvern, Pennsylvania 19355
- 409 Mateer-Burt Co. (10/31/83)
 436 Devon Park Dr.
 Wayne, PA 19087
- 272 Accurate Metering Systems (4/2/76)
 1731-33 Carmen Dr.
 Elk Grove Village, Illinois 60007
- 253 Badger Meter, Inc. (1/2/74)
 4545 W. Brown Deer Rd.
 P.O. Box 23099
 Milwaukee, Wisconsin 53223
- 265 Electronic Flo-Meters, Inc. (3/10/75)
 P.O. Box 38269
 Dallas, Texas 75238
- 359 Emerson Elec. Co. (6/11/82)
 Brooks Instrument Div.
 P.O. Box 450, North 301
 Statesboro, Georgia 30458
- 226 Fischer & Porter Co. (12/9/71)
 County Line Rd.
 Warminster, Pennsylvania 18974
- 224 The Foxboro Co. (11/16/71)
 38 Neponset Ave.
 Foxboro, Massachusetts 02035
- 223 Invalco Measurement & Control (11/15/71)
 P.O. Box 556
 Tulsa, OK 74101
- 399 E. Johnson Engineering & Sales (8/3/83)
 11 N. Grant St.
 Hinsdale, IL 60521
- 320 Max Machinery, Inc. (3/28/79)
 1420 Healdsburg Ave.
 Healdsburg, California 95448
- 378 Micro Motion, Inc. (2/16/83)
 7070 Winchester Circle
 Boulder, Colorado 80301
- 431 Pasilac, Inc. (10/11/84)
 660 Taft St., N.E.
 Minneapolis, MN 55413
- 270 Taylor Instrument Co. (2/9/76)
 Div. of Combustion Eng.
 95 Ames St.
 Rochester, New York 14601
- 386 Turbo Instrument, Inc. (5/11/83)
 21A Altarinda Rd.
 Orinda, California 94563
- 29-00 Air Eliminators for Milk and Fluid Milk Products**
- 340 Accurate Metering Systems, Inc. (6/2/81)
 1731-33 Carmen Dr.
 Elk Grove Village, Illinois 60007
- 436 Scherping Systems (11/27/84)
 801 Kingsley Street
 Winsted, MN 55395
- 30-01 Farm Milk Storage Tanks**
- 421 Paul Mueller Co. (4/17/84)
 P.O. Box 828
 Springfield, MO 65801
- 31-01 Scraped Surface Heat Exchangers, as Amended**
- 290 APV Crepaco, INC. (6/15/77)
 100 South CP Ave.
 Lake Mills, Wisconsin 53551
- 274 Alfa-Laval, Inc. (6/25/76)
 Contherm Div.

3-A SYMBOL HOLDERS

- P.O. Box 352, 111 Parker St.
Newburyport, Massachusetts 01950
- 361 BFM Machinery Corp. (7/12/82)
P.O. Box 117
Fall River, Wisconsin 53932
- 323 Anco-Votator Div. (7/26/79)
Cherry-Burrell Corp.
P.O. Box 35600
Louisville, KY 40232
- 323 Cherry-Burrell Corp. (7/26/79)
(A Unit of AMCA Int'l., Inc.)
2400-6th St., SW, P.O. Box 3000
Cedar Rapids, Iowa 52406
- 32-00 Uninsulated Tanks for Milk and Milk Products**
- 397 APV Crepaco, INC. (6/21/83)
100 South CP Ave.
Lake Mills, Wisconsin 53551
- 264 Cherry-Burrell Corp. (1/27/75)
(A Unit of AMCA Int'l., Inc.)
575 E. Mill St.
Little Falls, New York 13365
- 268 DCI, Inc. (11/21/75)
600 No. 54th Ave., P.O. Box 1227
St. Cloud, Minnesota 56301
- 354 C. E. Rogers Co. (3/3/82)
So. Hwy #65, P.O. Box 118
Mora, Minnesota 55051
- 441 Scherping Systems (3/1/85)
801 Kingsley St.
Winsted, MN 55395
- 433 TCI-Superior Division, (11/9/84)
Mueller Canada Inc.
6500 Northwest Dr.
Mississauga, Ontario, Canada L4V 1K4
- 339 Walker Stainless Equipment Co., Inc. (6/2/81)
601 State St.
New Lisbon, Wisconsin 53950
- 33-00 Polished Metal Tubing for Dairy Products**
- 310 Allegheny Bradford Corp. (7/19/78)
P.O. Box 200 Route 219 South
Bradford, PA 16701
- 413 Azco, Inc. (12/8/83)
P.O. Box 567
Appleton, WI 54912
- 289 Ladish Co., Tri-Clover Div. (1/21/77)
9201 Wilmot Rd.
Kenosha, Wisconsin 53141
- 308 Rath Manufacturing Co., Inc. (6/20/78)
2505 Foster Ave.
Janesville, Wisconsin 53545
- 368 Gordon J. Rodger & Sons Ltd. (10/7/82)
P.O. Box 186
Blenheim, Ontario Canada N0P 1A0
- 335 Stainless Products, Inc. (12/18/80)
1649-72nd Ave., Box 169
- Somers, Wisconsin 53171
- 331 United Industries, Inc. (10/23/80)
1546 Henry Ave.
Beloit, Wisconsin 53511
- 35-00 Continuous Blenders**
- 417 Cherry-Burrell (2/7/84)
Anco/Votator Division
P.O. Box 35600
Louisville, KY 40232
- 464 Dairy Service Mfg., Inc. (12/12/85)
4630 W. Florissant Ave.
St. Louis, Missouri 63115
- 415 Luwa Corporation (1/5/84)
4404 Chesapeake Dr.
Charlotte, NC 28216
- 292 Waukesha Div., Abex Corp. (8/25/77)
1300 Lincoln Ave.
Waukesha, Wisconsin 53186
- 36-00 Colloid Mills**
- 293 Waukesha Div., Abex Corp. (8/25/77)
1300 Lincoln Ave.
Waukesha, Wisconsin 53186
- 37-00 Pressure and Level Sensing Devices**
- 318 Anderson Instrument Co., Inc. (4/9/79)
R.D. #1
Fultonville, New York 12072
- 405 Drexelbrook Engineering Co. (9/27/83)
205 Keith Valley Rd.
Horsham, PA 19044
- 423 Dynisco (6/15/84)
Ten Oceana Way
Norwood, MA 02062
- 459 Endress + Hauser, Inc. (10/17/85)
2350 Endress Place
Greenwood, Indiana 46142
- 463 The Foxboro Company (12/6/85)
38 Neponset Avenue
Foxboro, Massachusetts 02035
- 317 Invalco Measurement & Control (2/26/79)
P.O. Box 556
Tulsa, OK 74101
- 396 King Engineering Corp. (6/13/83)
P.O. Box 1228
Ann Arbor, Michigan 48106
- 456 Moore Technologies Inc. (10/17/85)
P.O. Box 258
Klamath Falls, Oregon 97601
- 419 Pasilac, Inc. (4/2/84)
660 Taft St., NE
Minneapolis, MN 55413
- 328 Rosemount, Inc. (5/22/80)
12001 W. 78th St.
Eden Prairie, Minnesota 55344
- 285 Tank Mate Div/Monitor Mfg. Co. (12/7/76)
P.O. Box AL
Elburn, IL 60119

3-A SYMBOL HOLDERS

410 Viatran Corporation
300 Industrial Drive
Grand Island, NY 14072

(11/1/83)

38-00 Cottage Cheese Vats (In Press)

385 Stoelting, Inc.
P.O. Box 127
Kiel, Wisconsin 53042-0127

(5/5/83)

40-00 Bag Collectors for Dry Milk and Dry Milk Products

406 Chicago Conveyor Corporation
330 LaLonde Avenue
Addison, IL 60101

(10/5/83)

381 Marriott Walker Corp.
925 E. Maple Rd.
Birmingham, Michigan 48011

(4/12/83)

453 MikroPul Corporation
10 Chatham Road
Summit, New Jersey 07901

(9/4/85)

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February 12-13, **DAIRY AND FOOD INDUSTRY CONFERENCE**, to be held at Ohio State University. For more information contact: John Lindamood, Department of Food Science and Nutrition, 2121 Fyffe Road, The Ohio State University, Columbus, OH 43210.

February 17-19, **FOOD PESTICIDE APPLICATORS' RECERTIFICATION WORKSHOP** for Arkansas, Alabama, Louisiana, Mississippi, Little Rock, Arkansas. For more information contact: Harold Rowe at 813-586-5710 or write: Jean Day, Registrar, Food Sanitation Institute, 1019 Highland Ave., Largo, FL 33540.

February 24-26, **12TH ANNUAL TECHNICAL SEMINAR**, to be held at the Holiday-Inn University Center, Gainesville, FL. For more information contact: ABC Research Corporation, 3437 SW 24th Avenue, Gainesville, FL 32602. 904-372-0436.

February 25-26, **KENTUCKY FIELDMAN AND SANITARIAN EDUCATIONAL CONFERENCE**, to be held at the Executive Inn, Louisville, Kentucky. For more information contact: Betty Kelly, KAMFES Secretary-Treasurer, P.O. Box 817, Shelbyville, KY 40065.

February 27, **MEAT PROCESSING CONFERENCE**, to be held at the Hyatt Regency, Oakland, California. For more information contact: A. W. Brant or Shirley Rexroat, Department of Food Science & Technology, University of California, Davis, CA. 95616. 916-752-2191.

March 4-5, **VIRGINIA ASSOCIATION OF SANITARIANS AND DAIRY FIELDMEN'S ANNUAL MEETING**, to be held at Virginia Polytechnic Institute & State University. For more information contact: W. J. Farley, Rt. 1, Box 247, Staunton, VA 24401.

March 9-11, **FOOD SANITATION EDUCATIONAL EXPERIENCE WORKSHOP**, Orlando, FL. For more information contact: Harold Rowe at 813-586-5710 or write: Jean Day, Registrar, Food Sanitation Institute, 1019 Highland Ave., Largo, FL 33540.

March 12-13, **THIRD ANNUAL CHEESE RESEARCH AND TECHNOLOGY CONFERENCE**, to be held at the Dane County Forum and Sheraton Inn and Conference Center, Madison, WI. For more information contact: Norman F. Olson, Professor, Department of Food Science, UW-Madison, 107 Babcock Hall, 1605 Linden Drive, Madison, WI 53706. 608-263-2001.

March 16-19, **AMERICAN CULTURED DAIRY PRODUCTS INSTITUTE ANNUAL MEETING AND CONFERENCE**, to be held at Hilton Palacio Del Rio, San Antonio, TX. For more information contact: Dr. C. Bronson Lane, ACDPI, P. O. Box 7813, Orlando, Florida 32854. 202-223-1931.

March 19, **ONTARIO FOOD PROTECTION ASSN. TECHNICAL SEMINAR**, Sanitation Through Design, to be held at the Airport Holiday Inn, Rexdale, Ontario, Canada.

For more information contact the OFPA, PO Box 79, Streetsville, Ontario L5M 2B7.

March 19, **INDIANA DAIRY INDUSTRY CONFERENCE**, Theme: Securing The "Safety Net" for the Dairy Industry, to be held at Stewart Center, Purdue University, West Lafayette, IN. For more information contact: James V. Chambers, Food Science Department, Smith Hall, Purdue University, West Lafayette, IN. 47907. 317-494-8279.

March 24-28, **MID-WEST WORKSHOP IN MILK AND FOOD SANITATION**, to be held at Ohio State University. For more information contact: John Lindamood, Department of Food Science and Nutrition, 2121 Fyffe Road, The Ohio State University, Columbus, OH. 43210.

March 25 & 26, **WESTERN FOOD INDUSTRY CONFERENCE**, to be held at University of California, Davis, CA. 95616. For more information contact: J. C. Bruhn or Shirley Rexroat, Department of Food Science & Technology, University of California, Davis, CA. 95616. 916-752-2191.

March 26-28, **MISSOURI MILK, FOOD AND ENVIRONMENTAL HEALTH ASSOCIATION ANNUAL MEETING**, to be held at the Ramada Inn, Columbia, MO. For more information contact: John Norris, Division Health, Box 570, Jefferson City, MO 65101. 314-751-3696.

April 14-18, **STATISTICAL QUALITY CONTROL SHORT COURSES**, Statistical Methods Applied to Productivity Improvement and Quality Control - For the Food Processing Industry, to be held at the University of California, Davis, CA. For more information contact: Robert C. Pearl, Food Science & Technology Dept., University of California, Davis, CA 95616. 916-752-0980.

April 15-17, **FLAVOR WORKSHOP II**. For more information contact: Gary Reineccius, University of Minnesota, Dept of Food Science, 1334 Eckles Ave., St. Paul, MN 55108. 612-373-1438.

April 21-23, **FOOD ANTIOXIDANTS SYMPOSIUM: INTERNATIONAL PERSPECTIVES** to be held at the Loew L'Enfant Plaza Hotel, Washington, D.C. Preregistration deadline: March 14, 1986. For more information contact: Ms. Elaine Auld, International Life Sciences Institute - Nutrition Foundation, 1126 Sixteenth Street, N.W. Suite 111, Washington, DC. 20036. 202-659-0074/872-0778.

April 22-23, **FLORIDA ASSOCIATION OF MILK, FOOD & ENVIRONMENTAL SANITARIANS MEETING**, to be held at the International Inn, Orlando, FL. For more information contact: Dr. Franklin Barber, 1584 Cumberland Ct., Fort Myers, FL 33907.

April 23, **SANITATION WORKSHOP FOR THE FOOD PROCESSING AND FOOD SERVICE INDUSTRIES**, to be held at Inn at the Park, Anaheim, CA. For more information

contact: Kathryn Boor, Food Science and Technology, University of California, Davis, CA 95616. 916-752-1478.

April 27-30, **AOAC SPRING TRAINING WORKSHOP**, to be held at the Stouffer Madison Hotel, Seattle, WA. For more information contact: Mike Wehr, Oregon Dept. of Agriculture. 503-378-3793.

April 28-30, **FOOD INDUSTRY CERTIFICATION/RECERTIFICATION PESTICIDE UPDATE WORKSHOP & EXPOSITION** for all midwestern states, Matteson, Illinois. For more information contact: Harold Rowe at 813-586-5710 or write: Jean Day, Registrar, Food Sanitation Institute, 1019 Highland Ave., Largo, FL 33540.

April 29-May 1, **WORKSHOP ON TRACE ANALYSIS OF FOODS**. For more information contact: G. Reineccius, Department of Food Science and Nutrition, University of Minnesota, 1334 Eckles Avenue, St. Paul, MN 55108. 612-373-1438.

April 30-May 2, **SOUTH DAKOTA ENVIRONMENTAL HEALTH ASSOCIATION ANNUAL MEETING**. For more information contact: Stanley A. Swagoshi, South Dakota Department of Health, 1320 So. Minnesota, Suite A, Sioux Falls, SD 57105. 605-339-7113.

May 4-9, **FOOD SANITATION EXECUTIVE LEADERSHIP INSTITUTE**, University of Illinois, Champaign, Illinois. For more information contact: Harold Rowe at 813-586-5710 or write: Jean Day, Registrar, Food Sanitation Institute, 1019 Highland Ave., Largo, FL 33540.

May 5-7, **6TH INTERNATIONAL FOOD & WINE SHOW**, to be held at the Civic Auditorium and Brooks Hall, San Francisco, CA. For more information contact: Sandra Call, National Fairs Inc., 1902 Van Ness Avenue, San Francisco, CA 94109. 415-474-2300.

May 12-15, **ASEPTIC PROCESSING AND PACKAGING WORKSHOP**, to be held at Purdue University, West Lafayette, IN. For more information contact: James V. Chambers, Food Science Department, Smith Hall, Purdue University, West Lafayette, IN 47907. 317-494-8279.

May 12-15, **3-A SANITARY STANDARDS COMMITTEE ANNUAL MEETING**, to be held in Kansas City, MO. For more information contact: Lisa M. Devery, Dairy and Food Industries Supply Association, Inc., 6245 Executive Boulevard, Rockville MA 20852. 301-984-1444.

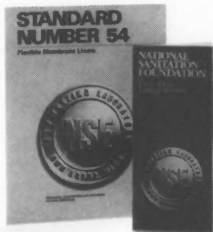
AUGUST 3-7, IAMFES ANNUAL MEETING to be held at the Radisson South, Minneapolis, MN. For more information contact: Kathy R. Hathaway, IAMFES, Inc., P.O. Box 701, Ames, IA 50010. 515-232-6699.



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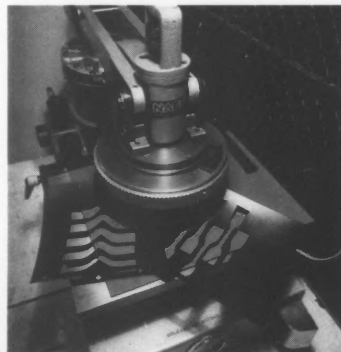
NSF *Standard 54* includes requirements for evaluation of flexible membrane liners and fabrication techniques. Under its provisions, an evaluation and listing program has been initiated, which includes:

- qualification testing of the liners and factory seams,
- unannounced plant inspections by NSF,
- annual published *Listing of authorized manufacturers and products*, and

- annual retesting of listed products.

It offers guidelines for appropriate site evaluation, design, materials selection, construction, operation, and maintenance.

All in all, NSF *Standard 54* provides a significant advancement in sanitation and protection of public health. For your free copy of *Standard 54* and a *Facts about Listing Services* brochure, write to: National Sanitation Foundation, Office and Laboratories, P.O. Box 1468, Ann Arbor, MI 48106 USA. Or call (313) 769-8010; Telex: 753215.



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