

February, 1982
Vol. 2, No. 2
Pages 45-88
ISSN: 0273-2866
Box 701
Ames, Iowa 50010

\$5.00

XEROX UNIVERSITY MICROFILM
INTERNATIONAL
300 N ZEEB ROAD
ANN ARBOR MI 48106

Dairy and Food Sanitation

A Publication for Sanitarians and Fieldmen

- Maintaining Your USPH Rating
- 1 Alert Cook + 1 Bad Can of Mushrooms
= A Total Recall
- Microbial Injury Reviewed For the Sanitarian
- Purifying Food Via Irradiation



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

Few things are as consistent as
the reproducible performance of Bacto
dehydrated culture media from Difco.

For more than 60 years, Difco Laboratories has served the world with products universally recognized as being unsurpassed for quality.

The Difco concept of quality is exemplified by Bacto dehydrated culture media. These media exhibit consistent, performance-standardized reproducibility and a rigidly controlled level of biological activity, assuring accurate interpretation of test results.

The quality of every batch of Bacto dehydrated culture media is protected by the stringent quality control techniques you expect from a leader. This, plus on-going collaboration between Difco and leading international microbiologists in developing and improving culture media, are definitive factors in helping you maintain your laboratory's reputation for integrity of test results.

DIFCO
LABORATORIES
DETROIT, MICHIGAN 48232 USA

TRANSFLOW® TUBING AND TRANSFLOW® PANELING SYSTEMS HAVE A WAY OF MAKING YOUR JOB EASIER.

Guidelines, forms, thermometers, levels—they're all part of inspecting a dairy. Yet, there's more to it. An experienced eye and commitment are what make you the professional. And Norton parallels that experience, commitment and professionalism with two products that help dairies meet sanitation codes.

Transflow brand tubing. It's the milk tubing with the blue stripe; the stripe that symbolizes consistent quality. **Transflow tubing** is considered the standard for milking machines, portable transfer systems, dumping stations and clean-in-place units.

Transflow paneling systems are fast becoming another standard for milking parlors and livestock confinement areas.

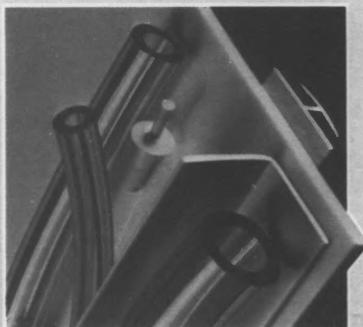
Transflow panels are made from a chemically inert, specially formulated material. Dirt and bacteria-forming waste cannot penetrate the easy-to-

clean smooth, nonporous surfaces. Result: sanitary walls and ceilings.

By developing these two products, both meeting FDA and 3-A standards, Norton has given something of value to the dairy industry; something that will help you cap-off each inspection with your stamp of approval.

Norton would like to mail you a **hat** that will remind you of how to make your job a little bit easier. Write Norton Specialty Plastics Division, P.O. Box 350, Akron, Ohio 44309, or call toll free: 1-800-321-9634.

In Ohio call collect: **NORTON**
216-630-9230.



IAMFES Sustaining Members

Alpha Chemical Services, Inc.
P.O. Box 431
Stoughton, MA 02072

Associated Milk Producers, Inc.
8550 West Bryn Mawr
Chicago, IL 60631

Babson Bros. Co.
2100 S. York Road
Oak Brook, Illinois 60101

Bio-Lab
P.O. Box 1489
Decatur, GA 30031

Borden, Inc.
Dairy & Services Div.
16855 Northchase
Houston, TX 77060

Dairymen, Inc.
10140 Linn Station Road
Louisville, KY 40223

Darigold
635 Elliott Ave. W.
Seattle, WA 98109

Dean Foods
1126 Kilburn Ave.
Rockford, IL 61101

De Laval Agricultural Division
Alfa-Laval Inc.
11100 North Congress Avenue
Kansas City, MO 64153

Difco Laboratories
P.O. Box 1058-A
Detroit, MI 48232

Diversey-Wyandotte
1532 Biddle Ave.
Wyandotte, MI 48192

Eastern Crown, Inc.
P.O. Box 216
Vernon, N.Y. 13476

GAF
140 West 51st St.
New York, NY 10020

G. B. Fermentation, Inc.
One North Broadway
Des Plaines, IL 60016

H. B. Fuller Co.
Monarch Chemicals Div.
390 Jackson St. NE
Minneapolis, MN 55421

Kendall Co.
One Federal St.
Boston, Massachusetts 02101

Klenzade Division
Economics Laboratory, Inc.
Osborn Building
St. Paul, MN 55102

The Kroger Co.
1212 State Avenue
Cincinnati, OH 45204

Maddelena's Inc.
139 Lakeville St.
Petaluma, California 94952

**Maryland & Virginia Milk Producers
Assn., Inc.**
P.O. Box 9154 Rosslyn Station
Arlington, Virginia 22209

Michigan Milk Producers Assoc.
24270 W. Seven Mile Road
Detroit, MI 48219

Mid America Dairymen, Inc.
P.O. Box 1837 SSS
800 W. Tampa
Springfield, MO 65805

Nasco International
901 Janesville Ave.
Fort Atkinson, Wisconsin 53538

National Mastitis Council
30 F Street NW
Washington, DC 20001

Norton Co.
P.O. Box 350
Akron, Ohio 44309

Oxoid USA, Inc.
9017 Red Branch Rd.
Columbia, MD 21045

Reitman Manufacturing Co.
10319 Pearmain St.
Oakland, CA 94603

Seiberling Associates, Inc.
11415 Main St.
Roscoe, Illinois 61073

United Industries, Inc.
1546 Henry Avenue
Beloit, WI 53511

Universal Milking Machine Div.
Universal Cooperatives Inc.
408 S. First Ave.
Albert Lea, MN 56007

W. A. Golomski & Associates
1006 Martin Dr. West
Bellevue, NE 68005

Walker Stainless Equipment Co.
601 State St.
New Lisbon, WI 53950

Webco Chemical Corporation
Rt. 197
Dudley, Massachusetts 01570

West Agro-Chemical, Inc.
P.O. Box 864
Amherst, NH 03031

Zero Manufacturing Co.
811 Duncan Ave.
Washington, MO 63090

Dairy and Food Sanitation is published monthly by the International Association of Milk, Food and Environmental Sanitarians, Inc, executive offices at PO Box 701, 413 Kellogg, Ames, IA 50010. Printed by Heuss Printing and Signs, Inc, 911 Second St, Ames, IA 50010-0701. Application to mail at second-class postage rates is pending at Ames, IA. Postmaster: Send address changes to IAMFES, 413 Kellogg, Ames, IA 50010-0701.

Manuscripts: Correspondence regarding manuscripts and other reading material should be addressed to Jan Richards, PO Box 701, Ames, IA 50010-0701. 515-232-6699.

"Instructions to Contributors" can be obtained from the editor.

Orders for Reprints: All orders should be sent to

IAMFES, Inc., PO Box 701, Ames, IA 50010-0701. Note: Single copies of reprints are not available from this address; address reprint requests to principal author.

Business Matters: Correspondence regarding business matters should be addressed to Earl O. Wright, IAMFES, PO Box 701, Ames, IA 50010-0701.

Subscription Rates: \$60.00 per volume, one volume per year, January through December. Single copies \$5.00 each.

Sustaining Membership: A sustaining membership in IAMFES is available to companies at a rate of \$300 per year, which includes \$100 credit toward an ad in the "annual meeting issue" of the Journal, usually the July issue. For more information, contact IAMFES, PO Box 701, Ames, IA 50010-

0701, 515-232-6699.

Membership Dues: Membership in the Association is available to individuals only. Direct dues are \$28.00 per year and include a subscription to *Dairy and Food Sanitation*. Direct dues and both journals are \$50.00. Affiliate membership is \$28.00 per year, plus state dues, and include a subscription, also. Affiliate dues and both journals are \$50.00, plus state dues. Student membership is \$10.00 per year, with verification of student status, and includes one journal.

Claims: Notice of failure to receive copies must be reported within 30 days domestic, 90 days foreign. All correspondence regarding changes of address and dues must be sent to IAMFES, Inc., P.O. Box 701, Ames, IA 50010-0701, 515-232-6699.

IAMFES
OFFICERS AND EXECUTIVE BOARD

President, HARRY HAVERLAND, FDA Training Facility, Room 8002 Federal Office Building, 550 Main St., Cincinnati, OH 45202.

President-Elect, ROBERT MARSHALL, 203 Eckles Hall, Univ. of Missouri, Columbia, MO 65201.

First Vice-President, A. RICHARD BRAZIS, W. A. Golomski & Assoc., Manager, Sanitation-Microbiology Group, 1006 Martin Drive West, Bellevue, NE 68005.

Second Vice-President, ARCHIE C. HOLLIDAY, 216 Ravenscroft Dr., Richmond 35, VA 23235.

Secretary-Treasurer, SIDNEY BARNARD, 9 Borland Lab, Pennsylvania State University, University Park, PA 16802.

Jr. Past President, WILLIAM ARLEDGE, Dairymen, Inc., 10140 Linn Station Road, Louisville, KY 40223.

Sr. Past President, WILLIAM KEMPA, Ryerson Polytechnic Institute, 50 Gould St., Toronto, Ont., Canada.

Affiliate Council Chrmn., LEON TOWNSEND, Milk Control Branch, Bureau for Health Services, 275 East Main St., Frankfort, KY 40601.

EDITORS

KATHY MOORE HATHAWAY, *Editor*, Box 701, Ames, Iowa 50010

EARL O. WRIGHT, *Executive Secretary and Managing Editor*, Box 701, Ames, Iowa 50010

EDITORIAL BOARD

H. V. ATHERTON	Burlington, VT
K. J. BAKER	Rockville, MD
D. K. BANDLER	Ithaca, NY
S. BARNARD	University Park, PA
H. BENGSCHE	Springfield, MO
F. BODYFELT	Corvallis, OR
J. BRUHN	Davis, CA
J. BURKETT	Sioux City, IA
J. CARROLL	Arlington, TX
J. CHAMBERS	West Lafayette, IN
C. D. CLINGMAN	Orlando, FL
R. DICKIE	Madison, WI
F. FELDSTEIN	Culpeper, VA
R. FUQUA	Mt. Juliet, TN
E. GADD	Jefferson City, MO
J. GERBERICH	Eau Claire, WI
P. HARTMAN	Ames, IA
C. HINZ	Alexander, NY
C. JELLINGS	Clinton, IA
J. JEZESKI	Gainesville, FL
W. LAGRANGE	Ames, IA
C. LIVAK	Lancaster, PA
P. MARTIN	Chicago, IL
D. MILLER	Orlando, FL
L. PARHAM	Oklahoma City, OK
C. PRICE	Lombard, IL
D. RACE	Camillus, NY
J. REEDER	Arlington, VA
D. ROLLINS	Springfield, MO
R. SANDERS	Washington, DC
G. SMITH	Schenectady, NY
C. WEBSTER	LeClaire, IA
E. ZOTTOLA	St. Paul, MN

Dairy and Food Sanitation

Vol. 2

February, 1982

No. 2

• 1 Alert Cook + Bad Can of Mushrooms = A Total Recall <i>Roger W. Miller</i>	48
• Purifying Food Via Irradiation <i>Richard Thompson</i>	50
• The NSF Seal- Its Formulation and Uses <i>Charles A. Farish</i>	53
• Microbial Injury Reviewed for the Sanitarian <i>J. L. Smith and S. A. Palumbo</i>	57
• Maintaining Your USPH Rating <i>Howard Cobb</i>	64
Calendar	65
News and Events	66
Committee Reports	69
Certificate of Merit Award	70
Food Service Sanitation Notes	71
Book Reviews	72
3-A Symbol Holder List	75
JFP Abstracts	81

1 Alert Cook + 1 Bad Can Of Mushrooms = A Total Recall

ROGER W. MILLER

There aren't many occasions in which the FDA undertakes a Class I, or total, recall of a product. Such a case occurred earlier this year after an Illinois fireman opened a can of mushrooms and became suspicious. When he opened that can he opened up the way for mobilization of a system to prevent a possible outbreak of food poisoning.

"When I opened the first can, the water came out. . . sorta pushed itself out. . . The odor was hard to describe. . . It was highly fermented. . . It wasn't 5 seconds before the smell permeated the kitchen. . . and it stayed there for 6 or 8 hours. . . When I opened the second can, the same thing happened."

A fireman's life can be full of drama. But that usually doesn't occur in the kitchen of the firehouse when preparing food for fellow smoke-eaters. Nevertheless, that's what happened to fireman Ron Hill of Rockford, Ill.

But let him describe it:

"When I opened the first can, the water came out. . . sorta pushed itself out. . . . The odor was hard to describe. . . . It was highly fermented. . . . It wasn't 5 seconds before the smell permeated the kitchen. . . and it stayed there for 6 or 8 hours. . . . When I opened the second can, the same thing happened."

Hill suspected that he had a couple of badly tainted cans of mushroom stems and pieces and he realized right then that he ought to be telling someone about it. So he called the store where he had purchased the mushrooms.

Neither the manager nor assistant manager was in, and the clerk he talked to didn't seem to sense the possible gravity of the situation. She told Hill to return the cans to the store and she'd give him his money back.

In retrospect, Hill says he probably never would have called the Winnebago County Health Department if the clerk hadn't shown such disinterest. And, if Hill hadn't called the health department, a major food poisoning epidemic might have been the tragic outcome. There were hundreds and possibly thousands of contaminated cans similar to those that Hill had reported. Each of these cans might have contained harmful microorganisms with the potential to produce a dangerous poison.

Hill's call to the county health department set the stage for the rest of the drama. Thousands of FDA, state and local officials visited tens of thousands of wholesale and retail food outlets nationwide searching for the suspect 4-ounce cans of mushroom stems and pieces.

Hill's presence of mind and his tenacity subsequently led to what is called a Class I recall. The object of this full-fledged recall was to recover similar cans produced by the firm that processed the mushrooms that stunk up the firehouse kitchen. With assistance from state and local authorities, the recall was carried out and the resulting statistics were significant:

- More than 132,000 "audit checks" were made at retail stores that received or might have received the suspect mushrooms.

- A total of \$1,868,752 spent by FDA and the states, including such expenses as \$5,059 for telephone calls, \$15,070 for lab costs, and \$110,108 for travel expenses.

- 139,560 employee hours expended through July 15 by FDA and state personnel. That figure includes 14,858 hours of overtime for FDA employees and is equivalent to 67 employees working full time for a year.

But let the drama unfold itself.

Hill's information about the bad-smelling, strange acting cans of mushrooms was relayed to Arlyn Baumgarten, supervisory investigator at FDA's resident inspection post in Waukegan, Ill., late on a Friday night, Baumgarten directed Charlie Peterson and Bill Nelson of

the Rockford FDA office to obtain the samples of the potentially dangerous product. The Winnebago County Health Department had already embargoed all similar cans of mushrooms in the store chain where Hill had made his purchase.

By midnight, Baumgarten had also alerted FDA's emergency and epidemiologic branch, as well as the agency's Cincinnati laboratory, that a potentially dangerous product was on the way.

Baumgarten also got the name of the buyer for the store chain and determined that the chain's warehouse was located at Milan, Ill., near Peoria. Leroy Kipp, investigator from FDA's Peoria office, visited the warehouse on Saturday morning and found a number of cans described as "hard swells," "soft swells" and "leakers." * Any of these are indicators of a problem.

Samples of the products were flown from Chicago's O'Hare Field Saturday, headed for the FDA laboratory at Cincinnati, which has the facilities needed for detecting the suspected poison.

By Monday morning, the Cincinnati lab had evidence of what everyone suspected—the cans contained botulinum toxin, which is fatal in about one-fourth of all its poisoning cases. Even a tiny taste of this poison can be fatal, and scientists are unsure about the consequences of inhaling the stuff.

That same morning, investigators from FDA's Philadelphia district office arrived at the manufacturer, Oxford Royal Products, Inc., of Kelton, Pa., to investigate possible causes for the swollen, putrid cans of mushrooms found by fireman Hill. After tests confirmed the identification of the toxin, the manufacturer voluntarily initiated a Class I recall of that lot. Further investigation by FDA found more swollen cans of mushrooms in a Denver warehouse. After FDA's Dallas lab confirmed the same toxin in the Denver lot, the firm extended the recall to all 4-ounce cans of mushroom stems and pieces. The five FDA district offices checking on the recall of the first lot were joined by FDA employees from all 151 locations around the country as well as employees from all 50 states and a number of local jurisdictions looking for Oxford's products.

* "Swells" are cans that are swollen on both ends; "soft swells" yield to hand pressure; "hard swells" do not. "Leakers," as the name implies, are cans that leak.

The firm's computer records told where the suspect cans were sent, but not all wholesalers had records of their distribution. Consequently, it was necessary to visit every retail outlet in a given area to search for the suspect mushrooms.

It soon became clear that FDA did not have enough investigators to quickly visit all possible locations. Chemists, microbiologists, consumer affairs officers and others from virtually all walks of FDA life were sent out to look for the mushrooms.

Nationwide publicity was generated to alert the public about the recall and to warn them to look for the suspect mushrooms in their own cupboards and pantries. FDA headquarters issued press releases on May 14, 22 and 29, and district FDA offices turned out their own releases and answered questions from scores of reporters and the public. Several trade associations pitched in to help by notifying their member firms.

In all, the number of cans involved ran into the millions. Thousands were returned to the manufacturer for reprocessing and thousands more were destroyed by state and local authorities.

What went wrong? The answer to that, according to Paula Oliver, director of investigations for FDA's Philadelphia District, was a combination of factors, including plant equipment failure and inexperienced personnel.

Was the recall successful? Well, there were no cases of poisoning reported anywhere in the country, even though the spores were found in hundreds of cans among the limited number of lots that were analyzed. And, says Philadelphia's Oliver, "Look how fast we got it done—most of it in two weeks."

The recall workings impressed *WASHINGTON POST* reporter T. R. Reid. Writing about the incident in the newspaper, Reid concluded that the system worked "swiftly and smoothly."

And the syndicated "Wagman File" by Robert J. Wagman for the Newspaper Enterprise Association commented that the "quick action may have saved your life or the life of someone you know."

Roger W. Miller is editor of FDA CONSUMER magazine.

Purifying Food Via Irradiation

“If food irradiation as a preservation process is to move forward, it must be supported by the food industry, which has to overcome consumer wariness about the safety of irradiated foods.”

RICHARD THOMPSON

Exposing foods to radiation can give longer shelf and storage life. To much of the food industry, it is an acceptable preservation technique. But not all consumers are convinced that such foods are safe. Now the lines are being drawn on this long-dormant issue, as FDA takes another look at regulating irradiated foods.

“The time has come to legitimize food preservation by irradiation. Food safety concerns for this process appear to be nil.” *S. W., Lincoln, Neb.*

“A large body of knowledge gathered over 20 years demonstrates that foods treated by irradiation are safe, wholesome, and palatable.” *J. L. B., U.S. Embassy, Tokyo, Japan.*

“I don’t care how low level the radiation is, it contributes to cancer.” *R. B., Van Nuys, Calif.*

“Here in the Islands, pesticide residues are everywhere, even in our drinking water. We consider it vital that irradiation (of bulk foods to control insects) be approved, to eliminate further buildup of pesticides in products we consume.” *S. C. C., Kaneohe, Hawaii.*

“I am against irradiation of food at any level for any purpose.” *L. E. R., Honolulu.*

What prompted these strong statements was an announcement last March in the *FEDERAL REGISTER* that the Food and Drug Administration (FDA) was ready to re-think its position on irradiating food to help preserve it, and wanted to hear comments on the subject.

And comments it got, nearly 100 letters from scientists, food manufacturers, government officials, health and medical professionals, and private citizens. Some sent lengthy documentation in their comments that food irradiation is long overdue. Others sent a simple message: the “I am against. . .” from Hawaii was handwritten on a postcard.

What many of the latter may not know—or won’t accept—is that a great deal has been learned about food irradiation (treating food to preserve it) over the past three decades. Much knowledge has come from a study begun by the U.S. Army in 1953 at its research facility at Natick, Mass., where food, clothing, and similar supplies are tested for military use. There a variety of foods of all types (but especially meats) were treated with various degrees of radiation, and the effects on those foods were carefully examined.

Questions the study asked—and the answers it provided—included:

- Did irradiation change the chemistry of the food? Natick found no harmful chemical effects produced by irradiation of beef, ham, pork and chicken, the high-protein foods of most concern to the Army.

- Did it affect food packaging or containers? Natick found that packaging materials are not absorbed by the irradiated meats, and that the wholesomeness (quality) of the foods irradiated through their packages is not adversely affected.

- Did irradiation provide preservation for these foods? Natick found that irradiation does destroy harmful spoilage bacteria in these meats, giving them a longer shelf and storage life.

- How did the irradiated foods taste? In acceptance studies. Natick reported that both military and civilian test panels judged irradiated foods (the meats listed above, plus fish, bread and potatoes) to be only slightly less tasty than fresh or frozen foods.

Irradiation is a straightforward process. The materials to be treated—in this case, food—are exposed momentarily to a controlled amount of radiation from cobalt 60, cesium 137, or some other radiation source, much as an individual is briefly exposed to diagnostic x-rays. The food can be treated in cartons as it moves along a packing line, or it can be treated in bulk.

The amount of radiation the food receives is measured in “rads,” a rad meaning units of radiant energy absorbed. A kilorad is one thousand rads, a megarad is 1 million.

Below 100 kilorads is considered a low dose. From 100 kilorads to 1 million rads is considered medium dose, and above 1 million is high dose.

Foods can be irradiated at low and medium doses for limited effects, such as inhibiting the growth of bacteria that cause foods to spoil, thus permitting longer storage without spoiling. FDA has approved low doses for killing insects in grain and for inhibiting the growth of sprouts (eyes) on potatoes, but the process has not been adopted commercially in the United States.

High-dose irradiation (more than one million rads) will render a food product completely sterile, because it destroys all living organisms (mold, bacteria, spores, etc.) in or on the food. It was high-dose irradiation that Natick used in most of its studies during the 1950's and 1960's, but the data supplied to FDA did not demonstrate to FDA's satisfaction that the process was completely safe.

One reason that irradiation hasn't been adopted by food manufacturers in this country is that the process would be regulated under the 1958 Food Additives Amendment to the Food, Drug, and Cosmetic (FDC) Act. That amendment prohibits use of a new additive (for taste, preservation or other effect) until the sponsor of the additive has shown by testing that it is safe. Only then may FDA approve it, by issuing a regulation that specifies the food and the conditions of use for the additive.

When Congress was writing that amendment, it was especially concerned with what was, in 1958, a promising new method of preserving food by irradiating it, then under study by the Army at Natick. Because of its concern, Congress classified the radiation source itself—the cobalt 60 or whatever—as a food additive, because that source can affect the characteristics of a food as conventional additives do. The law further said that a food is considered adulterated if it has been intentionally subjected to radiation, unless FDA has approved the use of such radiation.

What Congress wanted was assurance that the food would not become radioactive when treated and that there would be no harmful chemical changes (no toxic substances created) in the food itself. Those who were advocates of irradiation could not devise tests that would meet this requirement, and irradiation never took hold.

In this complicated situation—and hampered by testing technology of the late 1950's and 1960's—irradiation as a method of preserving food could not live up to promise. Food manufacturers who wanted to use irradiation did not seem able to conduct tests that could demonstrate to FDA (under the food additive amendment) that the process was as safe as the law required.

In 1963 FDA did approve an Army petition to irradiate canned bacon, based on a summary of data from the Natick studies. But closer examination of that data and of the study itself revealed discrepancies in the findings, and that approval was revoked without its ever having actually been used.

The Army had this early interest in food irradiation because it needed foods that could be stored for long periods of time in unfavorable conditions, and still provide nutritious meals for troops in the field. For those reasons, it set up the massive program at Natick. The Army was also encouraged by the Eisenhower Atoms for Peace doctrine of the 1950's that encouraged other-than-military uses for atomic energy.

Much that is known about food irradiation and its technology in this country came out of the Natick studies, which the Army operated experimentally for more than 25 years, at a total cost of \$50 million. The project has now shut down, and its records and some of its staff transferred to the Department of Agriculture, where work will be continued at an installation near Philadelphia.

If food irradiation as a preservation process is to move forward, it must be supported by the food industry, which has to overcome consumer wariness about the

safety of irradiated foods. In its March notice in the *FEDERAL REGISTER*, FDA asked for comment on a number of points regarding food irradiation. Among these are whether special good manufacturing practice regulations are needed for this technique, and what might be the economic impact (cost or savings to industry and consumers) if the process were approved. But one point that seems to demonstrate the gap between the food industry and the consuming public is the question of labeling irradiated foods.

FDA's present rules would require that "treated with radiation" appear on the labels of the foods. Those in the food industry who object to this requirement believe it would be the "kiss of death" for products with these labels.

"I believe it is discriminatory and not in the public interest to require that irradiated foods be labeled as such," said a food technologist. "The public equates 'irradiation' with 'radioactive,' and therefore the labeling would be misinformation." The same point was expressed by an industry consultant in Michigan. "Canned foods carry no information as to their processing. Why should irradiated foods?" But a woman writing from Van Nuys, Calif., echoes what most other commenting as ordinary consumers told FDA: "To irradiate foods without the public's knowledge is to betray the public trust."

The food industry, judging from its comments to FDA, is convinced that the technology is available to irradiate foods that are safe and wholesome for consumption. It sees public acceptance as the real obstacle, and thinks public fears are unfounded.

"The problem we face," said a seafood processor who has worked with irradiation, "is the word itself. Consumers do not know how to handle 'radiation.' Finding the word on retail shelves would cause great alarm in the marketplace."

These are some of the issues that FDA must resolve before making a decision about food irradiation. After all comments have been reviewed, the agency must sort out the pros and cons on what everyone agrees is a lively subject before it prepares its proposed final regulations.

Some proponents of food irradiation claim that changing the definition of irradiation in the law—making it a process rather than an additive—would simplify getting the technology adopted. But they miss the point, say FDA officials. It does not matter what irradiation is called, it would still be regulated in terms of food safety.

Even though activity in food irradiation declined in the 1970's, FDA's interest did not. FDA scientists believe enough is now known about radiation chemistry to warrant re-opening the question of food irradiation. They believe that criteria can be set for measuring the safety of irradiated foods.

The food industry is not unanimous in its endorsement of irradiation. Some seem willing to stay with the present commercial methods of preserving foods. Both the Florida and California citrus growers associations have asked in their petitions that citrus products be excluded from the list of foods approved for irradiation. Their experience shows that the process damages the peel and allows the fruit to bruise easily in packing and transport. Conventional refrigeration is still the best way.

And a nutritionist writing from, of all places, Citrus Springs, Fla., told FDA that food safety, not quality, has been the only question raised in the proceedings. "Radiation destroys vitamins and enzymes," he said. "Don't let this process be used."

Persons close to this issue in industry, consumer organization, and FDA sense that lines are being drawn for controversy that could take years to resolve.

Richard Thompson is a member of FDA's public affairs staff.

The NSF Seal — Its Formulation and Uses

CHARLES A. FARISH

*Former Executive Director, National Sanitation Foundation
 and NSF Testing Laboratory, Inc., Ann Arbor, Michigan*

The criteria for the sanitary design, construction, installation and evaluation of foodservice equipment must be acceptable to three separate parties: food sanitarians, and regulatory agencies, equipment operators and equipment manufacturers. The Joint Committee on Food Equipment Standards of the National Sanitation Foundation was established in recognition of this fact. It has developed a set of standards complying with fundamental sanitation regulations--making possible uniform design and construction of sanitary equipment. The standards include basic definitions, materials to be used, design and construction, and installation of equipment.

“There is a possibility of conflict between the various parties interested in acceptable equipment. It is therefore important that the public health criteria for the design of foodservice equipment be acceptable to all parties concerned.”

Designing foodservice equipment is more complicated than one might think. Such equipment must satisfy the needs of the food sanitarian or regulatory agency, but also those of equipment operators, and manufacturers.

The operator wants the equipment to be functional, long-lasting, easy to use, service and maintain, and to be as economical as possible.

The sanitarian wants it to be safe from public health hazards, easy to clean, free of built-in harborage for vermin, and built so that food protection can be attained.

The designer and manufacturer is concerned with giving the purchaser as much for his money as possible and still having an attractive and functional piece of equipment that is acceptable from a public health standpoint.

There is a possibility of conflict between the various parties interested in acceptable equipment. It is therefore important that the public health criteria for the design of foodservice equipment be acceptable to all parties concerned. The manufacturer may otherwise experience unnecessary obstacles during the construction and installation of the equipment.

Recognition of these facts led to the establishment of the Joint Committee on Food Equipment Standards of the National Sanitation Foundation (NSF). This committee is composed of membership from most professional public health organizations and interested associations and groups. Committee members are appointed by the specific organization being represented.

National Sanitation Foundation Standards

The Joint Committee on Food Equipment Standards considers all aspects of the equipment as it might affect the public health. The standards developed by the committee include the recognized needs for uniformity of specifications. The lack of standard or uniform equipment specifications has been confusing and expensive to industry.

For many years, health authorities have prepared regulations and ordinances governing the sanitation of food establishments. These regulations and ordinances have given responsibility of accepting various types of food equipment to health departments, without providing definitive specifications for such equipment.

In previous years, manufacturers of equipment were often plagued with different requirements in different states. They were also inclined to question the professional qualifications of some sanitation officials who freely expressed conflicting opinions on what they called “essential sanitation requirements” for foodservice equipment.

This need for uniform sanitation standards was recognized by many leaders in public health. Through their efforts, the American Public Health Association and the Conference of State and Territorial Health Officers requested NSF to “develop standards for various phases of sanitation.”

Design of Sanitary Foodservice Equipment

Standards and criteria for foodservice equipment must be based on fact, as well as on sound engineering and sanitation practices. In many instances additional facts are needed before a particular standard can be prepared, so additional research may be necessary.

Such research must be practical, must take into consideration the interests of the entire industry and the public health official, and must be designed to render a service to the general public.

Any effective standards program must be designed with the public in mind. It should be useful to the manufacturers of equipment, to the users of the equipment, and to public health agencies as the responsible enforcement authority. Uniformity of design and construction makes compliance with fundamental sanitation regulations possible, which benefits everyone.

Principals for the Sanitary Design of Foodservice Equipment

Many factors must be considered when establishing criteria for the design of foodservice equipment. This is especially true when the criteria must be uniformly acceptable to users and public health officials alike.

Some of the general principles for the design and construction of foodservice equipment are:

- The equipment should contain the fewest number of parts to efficiently perform the required job. This should also permit the equipment to be disassembled, maintained, and easily cleaned. In some instances it is necessary that in-place cleaning be used due to the design of the equipment.
- All equipment parts which come into contact with food products should be readily accessible for examination and cleaning, or readily removable for cleaning and inspection.
- A proper radius should be provided to permit ease of cleaning product contact surfaces.
- Metal should be joined with a seam and finish that provides a smooth, easily cleanable food contact surface.
- All surfaces within the product zone must be smooth, and free of pits, crevices, or other difficult-to-clean areas.
- Food contact surfaces should be non-absorbent, non-toxic, odorless, and unaffected by the food products and cleaning compounds.
- Toxic metals such as cadmium, lead, copper and its alloys and other metals which may deleteriously affect the foods, should not be used. The same consideration must be given to certain plastics which are not acceptable for food contact applications.
- Product zones must be free of recesses, open seams and gaps, ledges, inside threads and shoulders, and bolts or rivet heads.

- Gaskets or packing and sealing materials must be non-toxic, non-absorbent, and unaffected by food products or cleaning compounds, and installed so they are easily cleanable.
- Splash zone areas should be designed and constructed to permit frequent cleaning.

The joint committee has agreed that there are four basic sanitation fundamentals around which the details of NSF Food Equipment Standards are developed. These requirements specify the construction of the equipment be of (1) materials that are non-toxic, easily cleanable, and will not chip or crack. The design and construction must also provide for (2) ease of cleaning, (3) the elimination of harborage of insects, dirt, or bacteria, and (4) food protection.

Basic Criteria for Foodservice Equipment

Utilizing the four basic sanitation fundamentals listed above, the Joint Committee on Food Equipment Standards has developed a general format for NSF Food Equipment Standards. In *Basic Criteria C-2* the pattern of specifications for design of sanitary foodservice equipment is established. The Criteria, as are all NSF Standards, is divided into a number of sections which will be briefly discussed:

General Provision

This section sets forth the coverage of the Standard or criteria. Possible exceptions are listed, as are applicable special requirements. The first section also indicates that Standard or criteria specifications are established as minimum requirements and that "variations may be permitted when they tend to make units more resistant to wear, corrosion, or more easily cleanable."

Provision is also made for compliance, under existing NSF Standards, of units which have components or parts covered by such requirements. Alternate materials may be permitted when they can be "proven to be equally satisfactory from the standpoint of sanitation and protection of the product."

A provision is also established for the periodic review of all NSF Standards or criteria at intervals not exceeding three years. This policy sets a basis for revision of standards to keep them up-to-date with technological advances of industry and with progress being made in public health.

The Standards therefore are not stagnant and may be revised whenever either industry or public health leaders feel there is need for revision.

Definitions

The section of definitions is designed to include words or terms used frequently throughout the Standard, and those with specific meaning. For example, the word "accessible" is defined as: "readily exposed for proper and thorough cleaning and inspection with the use of only simple tools, such as a screw driver, pliers or

open-end wrench." This definition would be specific for use in the Standard and would not be found in a dictionary as stated.

Other terms such as "zones" and "contact surfaces" are defined specifically for use in the Standard. In one case the equipment zones are divided into food zone, splash zone, and non-food zone. Each area indicates the degree of protection required by the materials used and the design and construction of the equipment.

Materials

This section sets forth the general use of materials which will permit the design and construction of equipment withstanding normal wear, penetration of vermin, the corrosive action of foods and cleaning compounds.

Other elements found in the use environments not giving off an odor, color or taste to the food products are also included. Specific coverage of materials suitable for product contact surfaces, splash contact, and non-product contact surfaces is outlined under the materials section.

Also covered are special materials that may be used in fabrication--welding or soldering compounds, plastic resin systems, sound damping materials, and any other special material that might find application in the manufacture of foodservice equipment.

Design and construction

Having set forth the general coverage, detailed the word usage, and established material specifications, it is now possible to specify how the equipment shall be designed and constructed to meet acceptable public health criteria. This is perhaps the most important section of a Standard. It must be adequate to assure public health protection. It must also result in equipment that is functionable, usable, cleanable, and economical.

Each NSF Standard, in this section, specifies the acceptable requirements in each of the defined zones. The product contact surfaces must be designed and constructed so that they are readily accessible and easily cleanable, either in an assembled position or when removed. More critical radii and fabrication requirements are necessary for product zones in order to meet the function and cleanability requirements.

The splash and non-food contact surfaces are designed and constructed to less critical specifications, but they must be properly coordinated with the requirements for product zones.

The design and construction section must be of sufficient detail to permit manufacturers to utilize a variety of fabrication equipment, techniques and methods of production, and still comply with the standard.

In other words, one manufacturer might use body construction in which the sheet metal is formed without general interior framing, while another manufacturer might choose angle framing over which sheet metal is applied. There are specific provisions all manufacturers must comply with in order to produce acceptable

foodservice equipment.

This section must also detail requirements for construction of doors, access panels, openings into tops, gasket placement, shelving, levers and openings for compressors and evaporators. Too, it covers the methods of mounting the equipment--on legs and feet, casters, or sealed to the floor or counter.

Additional consideration must be given to temperature controls for use in heated or refrigerated equipment, and to the protection of food from broken glass or similar contaminants within the equipment.

Many items of equipment must also be designed and constructed so that water and waste connections may be properly made at the time of installation. This is significant when related to the operation, maintenance, and cleaning of the equipment.

Installation

No sanitation equipment standard is complete without including recommendations for installation of the equipment. Here again the knowledge and advice of all parties--designer, manufacturer, user, and sanitarian--are essential in order to obtain proper installation criteria. The NSF Joint Committee on Food Equipment Standards has developed a Manual on Installation of Food Service Equipment.

Evaluation of Foodservice Equipment

The NSF Testing Laboratory, a totally owned corporation of the National Sanitation Foundation, was organized at the request of Industry and Sanitation Officials to provide a research and evaluation facility for the National Sanitation Foundation.

The purpose of the Testing Laboratory is to perform research in environmental health, to test and evaluate equipment and products for compliance with NSF Standards, and to govern and control the NSF Seal.

The administrative and professional staff of the Testing Laboratory are all professional public health sanitation personnel. They have many years' experience with local, state and federal health agencies, and with universities which teach environmental health subjects.

The Testing Laboratory does not have responsibility for the development of NSF Standards. The primary function of the Testing Laboratory is to govern and control the NSF Seal. This is currently awarded to over 800 food equipment manufacturers for use on more than 20,000 items of equipment or products.

The Testing Laboratory staff visits manufacturing plants of all companies authorized to use the NSF Seal. Authorizations are for one year only. The continued use of the seal may be granted by the Board of Directors of the Testing Laboratory following a satisfactory re-examination at the point of manufacture.

As a result, it is necessary that the staff of the NSF Testing Laboratory have access to manufacturing plants at any time and without prior notification. The NSF Seal is issued to the equipment manufacturer upon an

agreement that he will abide by the policies which govern use of the NSF Seal.

Performance Testing

In several NSF Standards on food equipment there are specifications for performance. For example, the Standards covering spray-type dishwashing machines, hot water generating equipment, refrigeration equipment, dispensing freezers, vending machines, and others provide for the performance testing of the equipment. The Standards also set forth specifications for determining compliance with the materials, design and construction requirements.

For instance, consider the evaluation of spray-type dishwashing machines. The laboratory staff visits the dishwashing machine manufacturing plant and selects the machines to be tested. In many cases, particularly with smaller door-type machines, units may be shipped to the laboratory where more definitive testing techniques utilizing radioactive tracer soil may be used. Due to the size of large conveyor units, they are tested in each manufacturer's laboratories.

One of the requirements for the use of the NSF Seal is that manufacturers of equipment needing performance testing have their own quality control program. Temperature and pressure measuring equipment, provided by the lab staff, are taken to the dishwasher manufacturing laboratory to determine performance ability of the dish machines.

As the testing program has progressed, it has been necessary to have each dish machine manufacturer ship the various pumps and motors used on all their dishwashing machines to the laboratory. This enables the staff to develop pump curves on all pumps used in the industry. It also allows them to take the operating pressure of any pump on a dishwashing machine in a manufacturing plant, or at an installation, and determine from the pump curves the volume of water being pumped over the dishes in any machine.

The volumes and pressure of final rinse water are then determined. The recording potentiometer, attached to thermocouples, permits the staff to continuously measure the temperature build-up in the dishes, or on the dish surfaces as the dishes pass through a dishwashing cycle. Certain dirty dishes, containing a soil which has been baked on at 170° F for 17 hours, are used to measure the ability of the dishwasher to clean dishes.

Other performance tests are available for determining specified wash and rinse times, the area of coverage through the wash and rinse sections of the machines, and for measuring the rinse water pressure at the dish machine. The final rinse pressure is 20 psi at the machine where the water line enters the rinse manifold. This can then be coordinated with the proper volume of rinse delivered through the rinse nozzles.

When performance evaluation has been completed, the next step is general evaluation of the dishwashing

machines. This is done in the same manner as all equipment or products are measured against NSF Standards.

First it is determined whether acceptable materials are used in each of the zones, (product, splash and non-product). Then, the shop drawings and specifications of the manufacturer are examined to see whether there are variations from the details in the Standard.

Next, the equipment is evaluated to determine compliance with the design and construction requirements of the Standard. It is preferable to start at the point where materials are received and then follow the lines of fabrication until the finished product is reached. In this way it is easy to see whether there are hidden or built-in harborage areas for insects or vermin, and whether the details of the Standard are being followed.

What NSF Seal Means to Public Health Officials

The NSF Seal identifies items of equipment, devices, or products meeting high standards of sanitary significance. The Seal signifies compliance with NSF Standards which have been jointly developed by all parties concerned. The NSF Seal is a copyrighted device and no manufacturer can use the Seal without proper authorization.

However, the fact that an item of equipment carries the NSF Seal does not mean that it be accepted without proper examination. For the most effective use of the Standards and Seal program, all local, state, and federal sanitation officials should make thorough examination of equipment as it is installed.

Where discrepancies are noted or construction is questioned, the office of the testing laboratory is notified. It then handles the matter with the manufacturer to assure compliance with the standards, and to prevent future violations.

About The Seal

Companies authorized to use the NSF seal on products must affix the seal at the point of fabrication. This precludes sending the seal through the mail or placing it on equipment in the field.

The seal may be stamped into the equipment data plate or it may be in the form of a "foil" label. In any event, each item of equipment bearing the seal must be identified as to manufacturer. This may be done either by the name on the data (name) plate or the number on the seal.

All equipment listed by model number must have a data (name) plate. Custom equipment need only have the NSF seal (with number). If the seal number is all you have to go by, you would begin with Part III in the listing book. If the seal is part of the data (name) plate which bears the manufacturer's name, you would begin with Part I. When the seal is on the data (name) plate with the manufacturer's name, there need not be a seal number also.



Microbial Injury Reviewed For the Sanitarian

J. L. SMITH and S. A. PALUMBO

Eastern Regional Research Center*
 Philadelphia, Pennsylvania 19118

"Since the potential exists for the injury of microorganisms during food processing and the subsequent repair of these injured cells in foods, it is imperative that food microbiologists and sanitarians be aware of the phenomenon of microbial injury and repair."

Knowledge of stress-induced microbial injury is important to food microbiologists and sanitarians because injured cells are not detected on the usual bacteriological selective media. Failure to detect injured microorganisms present in food may be hazardous, because under the proper conditions, the injured cells may repair the injury, grow and produce food poisoning. The site of injury,

regardless of the type of stress, is usually considered to be the microbial membrane; concomitant with membrane damage, cellular constituents leak out of the cell which, if repair is prevented, eventually leads to death. RNA synthesis is necessary for repair of injured cells but additional requirements may be essential to the repair process depending on the microbial species in question. In order to determine the microbiological status of a processed food, detection of both injured and non-injured cells is necessary; therefore, the injured microorganisms must be resuscitated prior to placing them in a selective medium. The sample, containing both injured and non-injured microorganisms, is placed in a non-selective medium for a short period to effect repair of the injured cells and is then placed in a selective medium. Examples of resuscitation media used for food borne pathogens are described.

Microbial injury caused by sub-lethal stress is a phenomenon that every sanitarian—and indeed all concerned with food safety—should understand and be alert for in the surveillance of the food and water supply. Microorganisms, are considered to be injured when they: 1) cannot grow on a medium which is otherwise satisfactory for the growth of non-injured cells; and 2) can recover under appropriate culture conditions and resume normal growth and biochemical activity. The laboratory technician, using a particular medium on which injured cells cannot grow, may report that a heated food is free of a particular pathogen when actually it contains large numbers of injured organisms.

Injured pathogens undetected in foods present a potential hazard because these injured cells could repair, grow, and produce food poisoning. Indeed, detection media now used to determine the presence of food and waterborne pathogens will not support the growth of injured cells. These media have no apparent effect on non-injured cells.

There appears to be no documented case in which microorganisms, injured during food processing, have repaired the injury and subsequently caused food poisoning. However, stress induced injury and its repair have been demonstrated repeatedly in the laboratory under conditions simulating actual food processing operations (8,11). Therefore, the potential for food poisoning caused by food products containing injured but repaired microorganisms is very real. However, it is difficult to distinguish between this type of food poisoning (or food spoilage, for that matter) and that caused by post processing contamination of the food with a similar microorganism. Since the potential exists for the injury of microorganisms during food processing and the subsequent repair of these injured cells in foods, it is imperative that food microbiologists and sanitarians be aware of the phenomenon of microbial injury and repair.

Stresses That Induce Microbial Injury

Certain environmental and chemical stresses applied at sub-lethal levels can produce injury in micro-

* Agricultural Research, Science and Education Administration, U.S. Department of Agriculture.

* * Abbreviations used in text: Tryptic Soy agar, TSA; TSA + 7% NaCl, TSAS; TSA + 1% sodium pyruvate, TSAP; TSA + 9% NaCl, TSAX; Tryptone Soya agar, T(One)SA; T(One)SA + 0.075% sodium deoxycholate, T(One)SAD; Levine's Eosin Methylene Blue agar + 2% NaCl, EMBS; Trypticase Soy agar, T(ase)SA; Trypticase Soy broth, T(ase)SB; colony forming unit, CFU.

organisms (4,5,7). Such stresses include (a) heat, (b) refrigeration temperatures, (c) drying, (d) irradiation, (e) changes in nutritional environment, (f) chemicals, such as sanitizers, food preservatives, and acids, (g) freeze-drying, and (h) freezing and thawing. Many of the unit operations of food processing, as well as combinations of them, may also lead to injury.

Many species of bacteria, yeast, and fungi show injury when subjected to sub-lethal stress. Bacteria important in public health situations which show stress-induced injury include: *Escherichia coli*, *Salmonella* species, *Vibrio parahaemolyticus*, *Yersinia enterocolitica*, *Staphylococcus aureus*, *Bacillus cereus*, *Clostridium botulinum*, and *C. perfringens*.

Detection of Injured Cells

Injured cells escape detection because they are sensitive to inhibitory compounds present in some bacteriological media. For example, sodium chloride is added to media used to isolate *Staphylococcus aureus* from food products because the microorganism is resistant to high levels of salt (>10%); however, after injury, the cells lose their salt tolerance. A complete picture of the extent of injury in *S. aureus* can be obtained by comparing counts on a medium lacking NaCl with counts on a medium containing a high level of salt (6).

Figure 1 shows an example of detection of injured *S. aureus* from a food product. At timed intervals, *S. aureus* present in sausages undergoing a lactic fermentation were plated on both TSA and TSAS. Injured and non-injured cells form colonies on TSA (injured cells re-

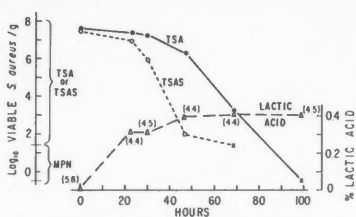


Fig. 1. Acid injury to *Staphylococcus aureus* in sausages, with 1% glucose and lactic acid starter culture, during fermentation at 35 C; numbers in parentheses are pH values (data from reference 34). (Final cell counts were determined using a 3-tube MPN to detect small numbers of cells. These values are designated by "X".) Difference in cell counts on TSA and TSAS indicates magnitude of injury.

paired their injury rapidly in the absence of salt and formed colonies); only non-injured cells form colonies on TSAS. The difference in counts between TSA and TSAS measures bacterial injury. Data in Fig. 1 show that little injury occurred at 20 h fermentation; as lactic acid accumulated (indicated by pH decrease), the acid-induced injury increased. At 50 h, the number of injured cells (difference in count between TSA and TSAS) was quite large. After 70-80 h, however, colony counts on TSA and TSAS converge, indicating that the acid was killing the staphylococci (since TSA supports the growth of both non-injured and injured cells, a decrease in the count on TSA means that the cells are dead; i.e., unable to form a colony on any medium). Therefore, sausages fermented for relatively short times have the potential to contain large numbers of injured *S. aureus*.

In a study of freeze-thaw injury, beef contaminated with *E. coli* was placed in frozen storage and sampled at intervals (Fig. 2). After thawing,

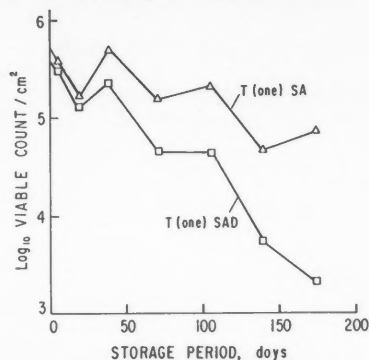


Fig. 2. Freeze-thaw injury in *Escherichia coli* during storage at -5 C in beef (data adapted from reference 22). Difference in cell counts on T(one)SA and T(one)SAD indicates magnitude of injury.

aliquots were plated on T(one)SA and T(one)SAD. Injured cells did not form colonies on T(one)SAD; however, non-injured cells grew well. Both non-injured and injured *E. coli* formed colonies on T(one)SA. Difference in counts between T(one)SA and T(one)SAD indicate a substantial freeze-thaw injury to *E. coli* in frozen beef stored for more than 150 days. Some cell death was evident as shown by a decrease in count on T(one)SA. The use of a detection medium containing deoxycholate will thus indicate low numbers of *E. coli* and not give a true indication of the extent of bacterial contamination of the frozen beef.

Other plating systems have been proposed for the detection and quantitation of injured cells. Lee and Goepfert (21), working with heat-stressed *S. typhimurium*, used Trypticase Soy agar plus 0.2% yeast extract for both injured and non-injured cells and EMBS for non-injured cells. Plate count agar (for non-injured and injured cells) and plate count agar plus 2.5% NaCl (for

non-injured cells) were used for heat-stressed vegetative cells of *B. cereus* (30). Other examples can be found in the references cited by Busts (4) and Tomlins and Ordal (39).

Cellular Damage Resulting from Sub-Lethal Stress

The primary site of sub-lethal heat damage in bacteria appears to be the limiting cell membrane (i.e., the membrane responsible for selective permeability) because early indications of injury are leakage of cellular components from the cell into the external milieu (16) and damage to membrane transport mechanisms (18). Cellular materials that leak out of the cell include species that absorb ultraviolet radiation at 260 nm (nucleic acids) and 280 nm (proteins); sodium, potassium, and magnesium ions; membrane lipids and phospholipids; and amino acids. Degradation of cellular macromolecules also occurs during injury and includes breakdown of ribosomes, breakage of single strand DNA, and destruction or inactivation of enzymes which impair bacterial metabolism.

Membrane damage also occurs following low temperature and freeze-thaw stress (23), freeze-drying, and exposure to chemicals such as solvents or cationic detergents (2). Leakage of ultraviolet-absorbing materials, however, was not observed in acid-injured *E. coli* (29) or *S. aureus* (Smith and Palumbo, unpublished observations). Stresses may differ in their effects on bacterial membranes. Stevenson and Graumlich (36) indicated that yeast and fungi also suffer membrane damage after injury with heat, low temperature, or freeze-thaw stress.

Bacterial spores, though more resistant to stresses than are vegetative cells, also can be injured. The effect of sub-lethal heat on bacterial spores appears to be more complicated than heat stress on vegetative cells (1,16). Sub-lethal heat stress can affect the germination and outgrowth of the spore into a multiplying, vegetative cell. Heat injury at the germination stage probably involves inactivation of a germination initiation enzyme. Injury of the outgrowth process involves damage to the spore membrane: germination occurs but outgrowth to a multiplying, vegetative cell does not.

Factors That Affect Microbial Injury

A variety of factors can change the pattern of bacterial injury, including the presence of solutes, cell age, cell growth temperature, injury medium composition, as well as other environmental, chemical, and physiological factors (2,4).

Cryoprotectants such as glycerol, sucrose, or NaCl protected gram-negative bacteria from freeze-thaw injury (2,23). Yeast were not injured by freeze-thaw stress when glycerol was present in the freezing medium (36).

S. aureus was protected from heat injury when heated in the presence of solutes (Fig. 3). TSAP, which allows growth of both injured and non-injured cells, and TSAX, which allows the growth only of non-injured cells, were used to measure the extent of injury. The presence of NaCl, glycerol, or sucrose protected *S. aureus* cells from heat injury, as shown by increased counts on TSAX in the presence of solutes (Smith and Palumbo, unpublished observations).

Patterson and Jackson (26) showed that the cells of *S. aureus* or *E. coli*

grown to the exponential stage of growth (young cells) were more susceptible to injury by low temperature storage (4 C) than cells grown to the stationary stage (old cells). Similar results were obtained with a variety of gram-negative species (2).

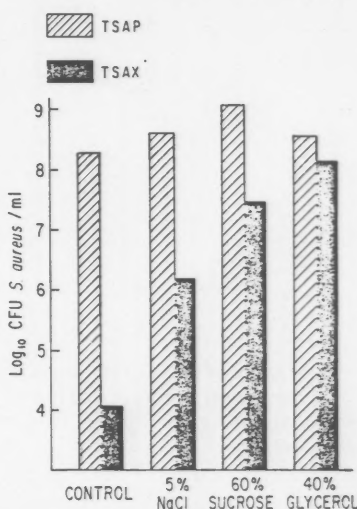


Fig. 3. Protection by solutes of *S. aureus* in 25% ground beef slurry heated for 90 min at 49 C.

S. aureus became increasingly more resistant to acid injury with increasing growth temperature of the culture (Fig. 4). As the growth temperature increased from 25 to 43 C, the amount of injury decreased as shown by an increase in count on TSAS (Smith and Palumbo, unpublished observations).

The composition of the suspending medium in which injury is to be detected may be important in determining the extent of injury. For example, *Salmonella anatum* subjected to freeze-thaw stress showed fewer injured cells in milk than in water (20).

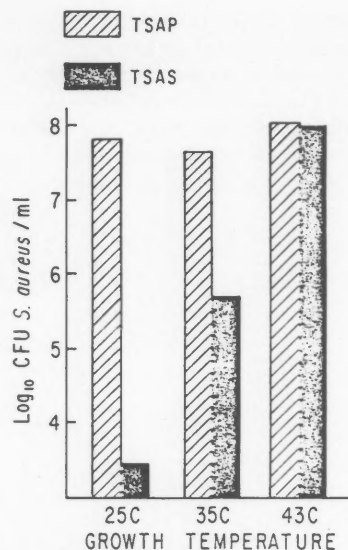


Fig. 4. Effect of growth temperature of *S. aureus* on susceptibility of cells to acid injury (acetate buffer, 0.2 M, pH 4.6-4.7, 90 min at 40 C).

Thus, in processed food, the effect of stress on contaminating microorganisms may be modified by the pH, presence of additives, water activity, ionic strength, age of the cells, and cell growth temperature. The effect of a specific stress on bacterial injury in a food product, therefore, may differ markedly from that in a simple laboratory system.

Restoration of the Normal Activities of Injured Cells

Injured cells can repair the damage incurred during stress, then grow and divide normally. Upon repair, cells of *S. aureus* injured by heat or freeze-drying have been shown to regain the salt tolerance lost during the stress treatment, to grow, and to produce enterotoxin similar to unstressed cells (8,11,17).

Repair is measured by observing the restoration of tolerance for the restrictive agent(s) utilized in the media for detection of injured cells. Repaired cells of *S. typhimurium* regain their tolerance for dyes and salt and form colonies on EMBS (40). Data in Fig. 5 show the repair of heat-injured *S. typhimurium*. Cells heated in phosphate buffer at 48 C were injured as shown by the decrease in count on EMBS (Fig. 5a). After 30 min of heating, the cells were centrifuged and then resuspended in T(ase)SB incubated at 37 C to allow repair. After 3 h in the broth, the count on EMBS was similar to that on T(ase)SA, indicating that the injured cells had repaired the damage and regained tolerance to the inhibitory substances

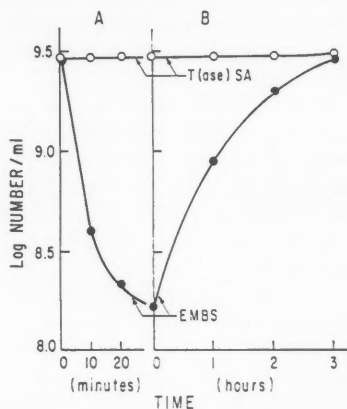


Fig. 5. Injury and repair in heated *Salmonella typhimurium*. A. Cells were heated in 0.1 M phosphate buffer, pH 6.0, at 48 C; at intervals, samples were plated on T(ase)SA and EMBS. B. Cells in A were concentrated by centrifugation and added to T(ase)SB incubated at 37 C on a rotary shaker; at intervals, samples were plated on T(ase)SA and EMBS (data modified from reference 40).

in EMBS (Fig. 5b). Cell division of non-injured cells was not responsible for regaining inhibitor tolerance because no increase in total cells, as measured by counts on T(ase)SA, occurred during the 3 h repair period in broth (Fig. 5b).

Tomlins and Ordal (39) and Pierson et al. (27) have reported that there is an extended lag (with no cell division) during repair; during this extended lag, the cells synthesize membrane lipids and phospholipids, protein, ATP, ribosomal RNA, ribosomes, and repair breaks in single strand DNA. Specific details of the repair process differ with different bacterial species. Actinomycin D, which interferes with DNA-mediated RNA synthesis, prevented return to salt tolerance in heat-injured *S. aureus* (i.e., prevented repair). However, chloramphenicol, penicillin, and cycloserine did not prevent repair (18). Chloramphenicol interferes with protein synthesis, whereas penicillin and cycloserine inhibit bacterial cell wall synthesis. Thus, synthesis of RNA, but not of protein or cell wall(s), is necessary for repair of heat-injured *S. aureus*.

Data obtained by the use of inhibitors of repair indicate that thermally-injured bacteria from different species show different sites of stress damage. Heat-injured *Vibrio parahaemolyticus* required synthesis of cell wall ribosomal RNA and protein for repair (14). Tomlins and Ordal (37) showed that repair in heat-injured *S. typhimurium* depended on synthesis of ribosomal RNA, ATP, and new protein but did not require DNA synthesis (and cell division). They used a citrate-containing repair medium in which 2,4-dinitrophenol was used to un-

couple microbial oxidative phosphorylation. They could thus demonstrate a need of ATP synthesis for repair of heat-injured *S. typhimurium*. Use of glucose instead of citrate would have permitted microbial synthesis of ATP through substrate-level phosphorylation which is not sensitive to 2,4-dinitrophenol. A medium containing citrate, phosphate, NH_4^+ , and trace metals permitted repair of heat-injured *S. typhimurium*; a complex source of nitrogen was not required (38). Heat-injured *S. aureus* required a nitrogen source (complex mixture of amino acids), phosphate, and an energy source (glucose) in the repair medium (19). However, Hughes and Hurst (15) could not show a requirement for glucose during the repair of heat-injured *S. aureus* but did indicate absolute requirements for phosphate and a complex mixture of amino acids. The addition of magnesium ions facilitated repair. The nutritional requirements for repair thus vary greatly and probably depend on the bacterial species (or even strain) as well as on the type and extent of injury.

Resuscitation of Injured Cells for Food and Water Analysis

Many of the selective media currently in use for the detection, isolation, and quantitation of microorganisms from food and water are not suitable for the examination of foods that have undergone drying, heating, freezing, or some other such treatment or for water that has been treated chemically. An appropriate resuscitation (i.e., to restore from apparent death) medium for stressed microorganisms is necessary for

microbiological analyses of food. During the food processing water treatment and other kinds of purification technology, microbial contaminants are exposed to a variety of stresses which may cause cell injury. The level of chlorine added to drinking and recreational water can decrease as a result of its reaction with organic matter or by dilution and can cause injury instead of death to microorganisms. The nutritionally adequate resuscitation medium must consider any cellular damage which the stress produced in the microorganism and support the repair of any stress-induced damage (e.g., regeneration of ribosomes and enzymes, synthesis of proteins and membrane lipids, and repair of damaged DNA).

Among factors that must be considered in the formulation are: type of stress, species and/or strain of microorganism, physical and chemical conditions before and during stress, and the chemical and physical environment of resuscitation. These factors have been discussed in an excellent review by van Schothorst (33). Other reviews giving specific details for resuscitation of injured bacteria from food are: injured coliforms in frozen foods (35), injured spores (32), stressed staphylococci (9), injured coliforms and salmonellae (13), and stressed coliforms and *Vibrio parahaemolyticus* (31). The importance of resuscitation of injured cells is being recognized increasingly by food microbiologists. The Compendium of Methods for the Microbiological Examination of Foods (25) has a chapter detailing specific procedures to be followed for detecting and enumerating injured bacteria in foods. Articles in recent issues of

Journal of Food Protection, Applied and Environmental Microbiology, Journal of Applied Bacteriology, and Journal of Food Science may then be consulted for further examples of resuscitation procedures for various stressed microorganisms.

There are two approaches for resuscitation and detection of stressed microorganisms in foods: liquid-repair or solid-repair (31). In the liquid-repair method, the food sample is blended in a non-selective broth followed by incubation at optimum repair temperature for a suitable length of time to allow repair of injured cells. An aliquot of the repair broth is transferred to selective liquid medium or diluted and plated on selective agar. The liquid-repair system is suitable for Most Probable Number (MPN) determinations, for presence/absence tests, and for isolation of organisms. It may not be suitable for regulatory purposes when enumeration is done on selective agar because the count reflects not only repair of injured cells in the repair broth but also multiplication of non-injured cells in that broth. Thus, an accurate bacterial count suitable for regulatory purposes cannot be made on solid media. Another disadvantage of liquid-repair is the addition of potential inhibitors (e.g., salt or acids) from the food to the repair broth.

In the solid-repair method, the food sample is blended with a phosphate diluent, and aliquots (0.1-3.3 ml) are transferred to petri dishes. A non-selective agar is poured into the plate (approximately 5 ml). The plates are incubated at a suitable temperature and time to obtain repair. A selective agar (approximately 10 ml) is then poured

over the non-selective agar. Plates are incubated at a suitable temperature until countable colonies are formed. The solid-repair method allows a direct count suitable for the use of regulatory agencies, since each colony represents either an original injured cell that had repaired or a non-injured cell. However, the method is not suitable for foods with low bacterial counts (<10/g).

Freeze-thaw injured *E. coli* were enumerated by use of a solid-repair system in which the suspension of *E. coli* was pour-plated with 10-12 ml of T(ase)SA. Plates were incubated at 35 C for 2 h to allow repair; then 10-12 ml of Violet Red Bile agar was poured over the T(ase)SA. Plates were incubated at 45.5 C for 24 h. Typical colonies were counted and confirmed as *E. coli* (28). A similar method was used by Hackney et al. (12) for determination of coliforms from seafoods and marine environments.

Enterococci were recovered from marine environments and frozen seafoods by pour-plating the sample with 5 ml (T(ase)SA and incubating the plates at room temperature for 2 h to effect repair. Ten to twelve ml of selective KF Streptococcal agar was poured over the T(ase)SA, and plates were incubated at 35 C for 48 h. Typical colonies were counted and confirmed as enterococci (12).

Low temperature and freeze-thaw stressed *V. parahaemolyticus* were recovered from seafood by a liquid-repair method (31). The sample was blended with T(ase)SB and incubated at 35 C for 2 h. Sufficient sterile NaCl (20%) was then added to make the final salt concentration to 3%. Salt is necessary for optimum growth of *V. parahaemolyticus*, but must be added after some repair has

occurred because injured cells are sensitive to it. The T(ase)SB + NaCl tubes were incubated overnight at 35 C. A portion was transferred to selective Glucose Salt Teepol broth and incubated at 35 C for 6 h; then a loopful of this broth was streaked onto Thiosulfate Citrate Bile Salts Sucrose agar plates and incubated at 35 C. Plates were examined for typical colonies of *V. parahaemolyticus*, and the MPN was determined.

Other workers have managed to plate injured cells directly onto selective agars by neutralizing the inhibitory effect of the selective agent on injured cells but still retain the selectivity of the agars for the desired organisms. Hydrogen peroxide accumulation appears to be associated with cellular injury due to sub-lethal stress (24). Addition of catalase or pyruvate (both act by decomposing peroxide) to TSA + 7% NaCl or Vogel Johnson agar (containing 0.02% tellurite) permitted repair and growth of heat-injured *S. aureus* even though stressed *S. aureus* cannot repair and grow on such media in which catalase or pyruvate are omitted (24). Baird-Parker agar is a pyruvate-containing selective medium for stressed and unstressed staphylococci which permits plating of food samples without a prior repair period in a nonselective medium and is available commercially. Martin et al. (24) also demonstrated that addition of catalase to the selective agars used for detection of *S. typhimurium*, *Pseudomonas fluorescens*, and *E. coli* permitted direct enumeration of stressed forms of these bacteria.

As indicated above, direct plating is not suitable for the detection of low numbers of cells in foods. A liquid MPN medium is necessary to

determine small populations. Brewer et al. (3) modified the MPN procedure for *S. aureus* by adding catalase or pyruvate to T(ase)SB + 10% NaCl. They demonstrated that the use of the modified T(ase)SB permitted direct MPN determinations of *S. aureus* in foods without use of a prior repair medium. Confirmation of the MPN tubes was done on Baird-Parker agar. The Bacteriological Analytical Manual for Foods (10) recommends T(ase)SB + 10% NaCl for the MPN determination of *S. aureus* but neglects the possibility of injured cells. Addition of catalase or pyruvate to the broth should improve the MPN determination of staphylococci.

The addition of peroxide decomposing agents such as catalase or pyruvate to selective media should find wide-spread use in the food industry and regulatory agencies. It would permit inoculation of food or water samples containing stressed organisms directly into the selective media without the use of non-selective repair media. Use of such procedures would result in a savings in time, money, and equipment and permit more widespread monitoring of the bacteriological quality of processed foods.

REFERENCES

1. Adams, D. M. 1978. Heat injury of bacterial spores. *Adv. Appl. Microbiol.* 23:245-261.
2. Beuchat, L. R. 1978. Injury and repair of gram-negative bacteria with special consideration of the involvement of the cytoplasmic membrane. *Adv. Appl. Microbiol.* 23:219-243.
3. Brewer, D. G., S. E. Martin, and Z. J. Ordal. 1977. Beneficial effects of catalase or pyruvate in a most-probable-number technique for the detection of *Staphylo-*

- coccus aureus*. Appl. Environ. Microbiol. 34:797-800.
4. Busta, F. F. 1976. Practical implications of injured microorganisms in food. J. Milk Food Technol. 39:138-145.
 5. Busta, F. F. 1978. Introduction to injury and repair of microbial cells. Adv. Appl. Microbiol. 23:195-201.
 6. Busta, F. F. and J. J. Jezeski. 1963. Effect of sodium chloride concentrations in an agar medium on growth of heat-shocked *Staphylococcus aureus*. Appl. Microbiol. 11:404-407.
 7. Busta, F. F. and L. B. Smith. 1976. Bacterial injury and recovery, pp. 301-315. Proceedings of 29th Annual Reciprocal Meat Conference and the American Meat Science Association, Chicago, Illinois.
 8. Collins-Thompson, D. L., A. Hurst, and H. Kruse. 1973. Synthesis of enterotoxin B by *Staphylococcus aureus* strain S6 after recovery from heat injury. Can. J. Microbiol. 19:1463-1468.
 9. Flowers, R. S. and Z. J. Ordal. 1979. Current methods to detect stressed staphylococci. J. Food Prot. 42:362-367.
 10. Food and Drug Administration. 1976. Bacteriological analytical manual for foods, 4th ed. Published by Assoc. Official Anal. Chemists, Washington, D.C.
 11. Fung, D. Y. C. and L. L. Vandenbusch. 1975. Repair, growth, and enterotoxinogenesis of *Staphylococcus aureus* S-6 injured by freeze-drying. J. Milk Food Technol. 38:212-218.
 12. Hackney, C. R., B. Ray, and M. L. Speck. 1979. Repair-detection procedure for enumeration of fecal coliforms and enterococci from seafoods and marine environments. Appl. Microbiol. 37:947-953.
 13. Hartman, P. A. 1979. Modification of conventional methods for recovery of injured coliforms and salmonellae. J. Food Protection 42:356-361.
 14. Heinis, J. J., L. R. Beuchat, and F. C. Boswell. 1978. Antimetabolite sensitivity and magnesium uptake by thermally stressed *Vibrio parahaemolyticus*. Appl. Environ. Microbiol. 35:1035-1040.
 15. Hughes, A. and A. Hurst. 1976. Magnesium requirement of *Staphylococcus aureus* for repair from sublethal heat injury. Can. J. Microbiol. 22:1202-1205.
 16. Hurst, A. 1977. Bacterial injury: A review. Can. J. Microbiol. 23:935-944.
 17. Hurst, A., D. L. Collins-Thompson, and H. Kruse. 1973. Effect of glucose and pH on growth and enterotoxin B synthesis by *Staphylococcus aureus*, strain S6, after heat injury in sodium or potassium phosphate buffer. Can. J. Microbiol. 19:823-829.
 18. Iandolo, J. J. 1974. Repair of stress-induced macromolecular alterations in *S. aureus*. Ann. New York Acad. Sciences 236:160-174.
 19. Iandolo, J. J. and Z. J. Ordal. 1966. Repair of thermal injury of *Staphylococcus aureus*. J. Bacteriol. 91:134-142.
 20. Janssen, D. W. and F. F. Busta. 1973. Influence of milk components on the injury, repair, and death of *Salmonella anatum* cells subjected to freezing and thawing. Appl. Microbiol. 26:725-732.
 21. Lee, A. C. and J. M. Goepfert. 1975. Influence of selected solutes on thermally induced death and injury of *Salmonella typhimurium*. J. Milk Food Technol. 38:195-200.
 22. Mackey, B. M., C. M. Derrick, and J. A. Thomas. 1980. The recovery of sublethally injured *Escherichia coli* from frozen meat. J. Appl. Bacteriol. 48:315-324.
 23. MacLeod, R. A. and P. H. Calcott. 1976. Cold shock and freezing damage to microbes. pp. 81-109. In T. R. G. Gray and J. R. Postgate (eds.), The survival of vegetative microbes, 26th Symposium of Soc. Gen. Microbiol., Cambridge University Press, New York.
 24. Martin, S. E., R. S. Flowers, and Z. J. Ordal. 1976. Catalase: Its effect on microbial enumeration. Appl. Environ. Microbiol. 32:731-734.
 25. Ordal, Z. J., J. J. Iandolo, B. Ray, and A. J. Sinskey. 1976. Detection and enumeration of injured microorganisms. pp. 163-169. In M. L. Speck (ed.), Compendium of methods for the microbiological examination of foods. American Public Health Assoc., Washington, D.C.
 26. Patterson, T. E. and H. Jackson. 1979. Effect of storage at 1 and 4 C on viability and injury of *Staphylococcus aureus* J. Appl. Bacteriol. 46:161-167.
 27. Pierson, M. D., R. F. Gomez, and S. E. Martin. 1978. The involvement of nucleic acids in bacterial injury. Adv. Appl. Microbiol. 23:263-285.
 28. Powers, E. M. and T. G. Latt. 1979. Rapid enumeration and identification of stressed fecal coliforms. J. Food Protection 42:342-345.
 29. Przybylski, K. S. and L. D. Witter. 1979. Injury recovery of *Escherichia coli* after sublethal acidification. Appl. Environ. Microbiol. 37:261-265.
 30. Rappaport, H. and J. M. Goepfert. 1978. Thermal injury and recovery of *Bacillus cereus*. J. Food Protection 41:533-537.
 31. Ray, B. 1979. Methods to detect stressed microorganisms. J. Food Protection 42:346-355.
 32. Roberts, T. A. 1970. Recovering spores damaged by heat, ionizing radiations, or ethylene oxide. J. Appl. Bacteriol. 33:74-94.
 33. van Schothorst, M. 1976. Resuscitation of injured bacteria in foods. pp. 317-328. In F. A. Skinner and W. B. Hugo (eds.), Inhibition and inactivation of vegetative microbes. Soc. Appl. Bacteriol. Symposium Series #5, Academic Press, New York.
 34. Smith, J. L. and S. A. Palumbo. 1978. Injury to *Staphylococcus aureus* during sausage fermentation. Appl. Environ. Microbiol. 36:857-860.
 35. Speck, M. L. and B. Ray. 1977. Effects of freezing and storage on microorganisms in frozen foods: A review. J. Food Protection 40:333-336.
 36. Stevenson, K. E. and T. R. Graumlich. 1978. Injury and recovery of yeasts and molds. Adv. Appl. Microbiol. 23:203-217.
 37. Tomlins, R. I. and Z. J. Ordal. 1971a. Requirements of *Salmonella typhimurium* for recovery from thermal injury. J. Bacteriol. 105:512-518.
 38. Tomlins, R. I. and Z. J. Ordal. 1971b. Precursor ribosomal ribonucleic acid and ribosome accumulation in vivo during the recovery of *Salmonella typhimurium* from thermal injury. J. Bacteriol. 107:134-142.
 39. Tomlins, R. I. and Z. J. Ordal. 1976. Thermal injury and inactivation in vegetative bacteria. pp. 153-190. In F. A. Skinner and W. B. Hugo (eds.), Inhibition and inactivation of vegetative microbes. Soc. Appl. Bacteriol. Symposium Series #5, Academic Press, New York.
 40. Tomlins, R. I., G. L. Vaaler, and Z. J. Ordal. 1972. Lipid biosynthesis during the recovery of *Salmonella typhimurium* from thermal injury. Can. J. Microbiol. 18:1015-1021.

Maintaining Your USPH Rating

HOWARD COBB

*Quality Control Director
NEDCO
Syracuse, NY 17302*

Sanitary rating officers check your farm each year and are concerned with what they see at the time. They don't take into consideration what you plan to do tomorrow. Therefore it is of utmost importance to keep a running check list to be assured that your farm and your milk supply meets all sanitary requirements.

Interstate Milk Shippers procedures require each milk supply to be rated no less frequently than once every 24 months, no more often than 15 days from the date of the last rating. Without exception, check ratings of state supplies are asked to be made with no greater frequency than the official rating.

In other words, a milk supply can have both a USPH rating and a check rating within a 24-month period.

The maintenance of an acceptable rating and check rating allows each supply to be sold in interstate commerce. Without the acceptable rating, markets for the sale of that milk are considerably limited. In such cases, producers generally will receive less income from the sale of their milk.

Rating officers debit faulty sanitation items on farms as they observe them during inspection. They can't be concerned with what the producer "did yesterday," or what he "plans to do tomorrow." They must observe and respond to only what they see at the moment. Little, if any, prior notification is given that a rating or check rating is to be made. Consequently, for this and other reasons, farms must maintain satisfactory sanitary conditions at all times.

Some additional considerations to keep in mind are:

Impression. It's unquestionable that a good impression in approaching the milkhouse and milking barn is very important. Weeds should be cut and the area around the milkhouse and barn cleaned up. Junk and garbage should not be visible. As the rating officer enters the milkhouse, he develops a favorable impression if he sees a brightly painted, clean milkhouse, with no flies or cobwebs and all milking equipment clean and properly stored. Windows and lights should be clean and bright.

Milking stables should be whitewashed or painted and floors treated, where necessary. Adequate lighting with clean bulbs and windows is important. A good impression is far more important than the 2 or 3 point debit for cleanliness.

Inspectors should concentrate at each inspection on the five basic items on the score sheet carrying the most points. Work to have all farms acceptable on the last bacteria count or examination for abnormal milk, particularly when in a 2 out of 4 situation. It's only the last count which determines whether or not a farm will be debited. Sanitarians must check continuously for submerged waterline inlets in stock tanks and for such situations as an unacceptable old water bucket being used to replace a broken bucket. Look for cross connections between a potable water supply and a non-potable water supply, especially during a dry spell. Be sure all vacuum breakers are in good condition and are working. Check that all house sewage, including that from sinks and washing machines, is underground, with none coming to the surface of the ground in the leach bed.

Unfortunately, the most difficult sanitation item to control is keeping equipment clean and properly sanitized. Equipment can be clean today and dirty tomorrow. And the farmer generally views his milking equipment at wash-up time, when it's wet and nearly impossible to discern a protein film or slight build-up of milkstone. Farmers are apt to assume that automatic washers and CIP systems are always adequate for cleaning bulk tanks, pipelines and claw clusters. They push a button and leave without noting whether the automatic soap dispenser is working properly, or if the agitator is turning in order to clean both surfaces. They assume generally that all is working well, but the washer jet holes could be plugged with debris. The very first indication that equipment isn't cleaning properly may be a high bacteria count. Very often an element will burn out on an electric hot water heater and washing procedures will be done through several milkings with inadequate amounts of hot water. It's important to always check water temperature at the wash vats. Remember---90% clean is still 10% dirty.

Dirty equipment is a 10 point debit, which drops the rating to the 90 point cut-off score. Dirty cows are

another item that may cause the dairyman to lose more than the standard 3 point debit. A herd of dirty cows gives a very bad impression to a rating officer as to the farmer's general managerial ability. It creates in the officer a concern for the farmer's ability to produce quality milk.

Keep in mind that over 50% of the total points on a farm rating score sheet come from only eight items. It is necessary, of course, that those items be given primary attention at all times, even though there are 93 items, including subitems, which are subject to debiting. Very few items greatly influence the survey results. These eight items are: bacteria; abnormal milk; water; sewage; and clean, sanitized equipment; clean cows; and proper cooling of milk.

If basic sanitation items are in compliance with the USPHS code, it's fairly certain the public will receive a clean, safe, wholesome milk supply. It takes only a few minutes a day to keep less critical items in good, sanitary condition. Dairymen can readily change rough inflations, keep spider webs swept down, and make sure corners of the milkhous are cleaned out. Nevertheless, these and other items should be checked periodically and corrections made, for those are the progressive dairymen.

Calendar

March 15-24---UNIVERSITY OF MARYLAND 32nd ANNUAL ICE CREAM SHORT COURSE. College Park, MD. Contact: Dr. Joseph Mattick, Dept. of Dairy Science, Animal Sciences Center, College Park, MD 20742, 301-454-3926.

March 22-26---MID-WEST WORKSHOP IN MILK AND FOOD SANITATION. The Ohio State University. Contact: John Lindamood, Dept. of Food Science and Nutrition, 2121 Fyffe Road, The Ohio State University, Columbus, OH 43210.

Mar. 22-26, 1982---MICROANALYTICAL SANITATION SERIES II (Intermediate Quantitative Interpretive), Melbourne, FL. Course sponsored by American Association of Cereal Chemists, 3340 Pilot Knob Road, St. Paul, MN 55121.

March 23---IOWA ASSN. MILK, FOOD AND ENVIRONMENTAL SANITARIANS CONFERENCE. Starlite Motel, Ames, IA. Contact: Hale Hansen, Dept. of Health, Lucas Bldg., Des Moines, IA. 50319.

March 24---IOWA DAIRY INDUSTRY CONFERENCE. Starlite Motel, Ames, IA. Contact W. S. LaGrange, Food Technology, Iowa State University, Ames, IA. 50010.

March 25---UNIVERSITY OF MARYLAND 32nd ANNUAL ICE CREAM CONFERENCE. Center of Adult Education, College Park, MD. Contact: Dr. Joseph Mattick, Dept. of Dairy Science, Animal Sciences Center, College Park, MD 20742, 301-454-3926.

March 31---NINTH CNA/IFT/ISMS NUTRITION SYMPOSIUM, "Current Issues Facing Food, Nutrition and Health Professionals." Ramada O'Hare, Des Plaines, IL. Sponsored by Chicago Nutrition Association, Chicago Section of Institute of Food Technologists, and Illinois State Medical Society. Contact: Chicago Nutrition Association, CNA/IFT/ISMS Symposium, PO Box 87664, Chicago, IL 60680 or Theresa M. Gargano, 312-998-3576.

April 2-4---1982 WESTERN CONVENTION-EXHIBIT of Vending and Foodservice Management, Brooks Hall, San Francisco. (Expected Attendance, 3,000). Contact: Walter Reed, National Automatic Merchandising Association, 7 South Dearborn Street, Chicago, IL 60603, 312-346-0370.

April 5-6-7---MISSOURI AFFILIATE MEETING. Ramada Inn. Columbia. MO.

April 13-15---FLORIDA AFFILIATE MEETING. University of Florida. Gainesville. FL.

April 21-23---57th ANNUAL MEETING of the American Dry Milk Institute and the 11th Annual Meeting of the Whey Products Institute will be held jointly at the Chicago Marriott O'Hare Hotel, 8535 West Higgins Road (at O'Hare Airport), Chicago, IL.

April 22-23---PACIFIC NORTHWEST FOOD SCIENCE AND TECHNOLOGY CONFERENCE. "Electronic Control in the Food Industry--Microprocessors to Computers." Tyee Inn, Olympia, Washington. Contact: Jean Canfield, WSU Conference Assistant, 4525 Libby Rd., NE, Olympia, WA 98506, 206-754-6870.

April 22-23---SOUTH DAKOTA ENVIRONMENTAL HEALTH ASSOCIATION ANNUAL MEETING. SDSU, Brookings, SD. For more information contact: Ron Stangeland, SDSU, Brookings, SC.

Aug. 22-26---IAMFES ANNUAL MEETING. Galt House, Louisville, KY. Contact: Earl Wright, IAMFES, PO Box 701, Ames, IA 50010, 515-232-6699.

August 6-11, 1983---IAMFES ANNUAL MEETING. Stouffers, St. Louis, MO.

1984---IAMFES ANNUAL MEETING, Edmonton, Alberta, CN. Dates and details later.

News and Events

Dolan Receives Honorary Sanitarian Award

On October 13 and 14, 1981, the California Association of Dairy and Milk Sanitarians hosted a Dairy Industry Conference at the Holiday Inn in Ontario, California. The meeting and speakers were very good and attended by approximately 125 people. In addition, there were 21 exhibitors and sponsors contributing to the success of the conference.

All the sessions were well attended and some of the highlights of the program were: Raw Milk - why some believe and some don't; and a panel on the status of antibiotic testing.

Another special event at the annual banquet was the presentation of the Honorary Sanitarian Award. This year the recipient was Pat Dolan, a well respected member of both the IAMFES and the California Association of Dairy and Milk Sanitarians.

Pat Dolan's background includes 36 years with the California State Department of Food and Agriculture, Bureau of Milk and Dairy Foods.

Since retirement in 1977, Dolan is still active in dairy related associations including:

Executive Secretary Treasurer of the California Dairy Industries Association, working with 1250 members.

Pat is also a Trustee of the California Dairy Museum Board, where he has acted as Finance Chairman and Vice President of that organization.

He is active on the 3A Sanitary Standards Symbol Council and attends national meetings twice a year to fulfill duties associated with the council.

Pat is an independent Dairy Foods Consultant who specializes in dairy equipment and legislation related to the dairy industry. He serves on a Dairy Institute Committee representing one of his clients. Other jobs have included consultation and supervision of equipment specifications, selection, and installation.

A.I.M.F.E.S. Annual Meeting Highlights

Dr. Roy Upham, Chief of the newly devised Division of Food, Drugs, & Dairies, Illinois Department of Public Health, highlighted the annual meeting and seminar of the Associated Illinois Milk, Food, and Environmental Sanitarians.

Dr. Upham's address to the well over one hundred in attendance, was his first appearance before an assembled group of dairymen, sanitarians, and regulators since assuming his new responsibilities. He emphasized the role of the Supervisors, calling for stronger regional supervision and stressing the importance for the Supervisor to know his territory and the people therein.

Dr. Upham realizes the significance of the Inspectors, and the need for them to be like a partner to the producer and processor, and recommended that Inspectors be required to have a minimum college degree in Food or Dairy Technology.

Dr. Upham advocated that future standards of product quality be more in accordance with sanitation standards, and less reliant upon sample testing and bacterial counts and the like.

Following Dr. Upham's remarks the Associated Illinois Sanitarians presented The Paul "Pete" Riley Award to Mr. Harold McAvoy in honor of his retirement and in appreciation for his thirty-eight years of service to the IDPH, and his devotion as Director of the Milk Control Division. Mr. William Kempiners, Director of IDPH, was also in attendance at the meeting.

Dairy Council Supports Nutrition Education

A team of nutrition experts sponsored by National Dairy Council will spotlight current nutrition issues for nearly two dozen American medical schools in 1982.

Twenty-five doctors and scientists are available as the messengers in NDC's Visiting Professorship in Nutrition program. Their college visits are designed to relay the most up-to-date information on a wide spectrum of nutrition topics. The professors' research and experience include such issues as diet and cancer, food sensitivity, the effects of food fads and special dietary problems of the elderly.

"The program goes far beyond what is found in the textbooks," said Philip Lofgren, Ph.D., assistant director of nutrition research for NDC. Lofgren helped organize the program, which began last June.

The visiting professorship program helps bridge the nutrition "knowledge gap" seen by many medical professionals. A recent American Medical Association survey of 124 American medical schools indicated a growing interest in nutrition education. It also underlined the need for further nutrition training in many medical college curriculums. Almost 75 percent of the schools surveyed did not have a required nutrition course in 1978. Faculty members cited tight budgets and crowded class schedules as obstacles blocking plans for strong nutrition programs.

"Nutrition is too often kind of an orphan in many medical schools," explained Dr. Joseph Barboriak, director of the Interdisciplinary Nutrition Group at the Medical College of Wisconsin. "By providing these experts in the nutrition field NDC helps remind everyone nutrition is important in medicine."

The Medical College of Wisconsin was one of 16 schools that hosted visits in 1981. The typical visit lasted two days, and included formal lectures, seminars and clinical rounds.

The program's professors represent such recognized medical facilities as Mayo Clinic, in Rochester, Minn.; Massachusetts Institute of Technology, in Cambridge, Mass.; and Memorial Sloan-Kettering Cancer Center in New York, New York.

The program is popular: it's booked through 1982. A list of participating professors and their topics for 1983 will be available from NDC in midsummer.

Dairy Council supports the medical community's nutrition education efforts through the Visiting Professorship in Nutrition program. The dairy industry believes good health begins with a well-balanced diet.

Aflatoxin Contamination Research

Cows fed moldy grain may not only produce less milk, but the milk they do produce might be toxic to humans.

Certain molds can contaminate feed with aflatoxins, substances that are both toxic and cancer-causing, and can end up in dairy products at levels potentially harmful to humans, according to Elmer H. Marth, food scientist at the University of Wisconsin-Madison.

Marth conducted research in which he introduced known amounts of aflatoxin into cows' digestive systems and then evaluated toxin levels in their milk and in products made from contaminated milk.

When aflatoxins are present in feed, Marth says, from 1 to 3 percent consumed by the cow shows up as aflatoxin in milk. This has usually been changed in the cow's liver to an aflatoxin which is similar, but around 90 percent less carcinogenic, than the aflatoxin the cow originally ate, he says.

Marth's studies establish a general rule, however: if raw milk is contaminated with aflatoxin, any products from that milk -- including dried milk, cultured milks, natural or processed cheeses, and butter -- will be contaminated.

His research also shows that certain heat treatments associated with milk processing appear to inactivate a portion of the aflatoxin in contaminated milk. But whatever aflatoxin is left is associated with the milk's casein fraction -- the protein portion of milk used to make cheese, Marth says.

Cheese produced from contaminated milk contains at least as much aflatoxin as the milk itself, he says. In

cheeses, because the casein is more concentrated than in milk, aflatoxin may be found at much higher levels than in the milk from which it was made.

Standards for aflatoxin in milk are tough. Marth says at least 18 states regularly monitor their milk for contamination, and the U.S. Food and Drug Administration does not permit milk containing more than 0.5 part per billion aflatoxin -- the minimum level detectable by routine monitoring methods -- to be shipped between states.

Aflatoxins are produced by some common molds of the genus *Aspergillus*, which, given the right conditions, can grow on feeds and on many foods. Several aflatoxins have been identified. All are toxic and, to various degrees, carcinogenic.

One particular aflatoxin is a common contaminant of feed made moldy by a toxin-producing *Aspergillus*. When consumed by dairy cattle, the toxin may produce symptoms including unthriftiness, loss of appetite and decreased milk production, according to Marth's research.

"These feeds do not always respect state boundaries," he says, warning that Wisconsin is geographically on the edge of the area having aflatoxin problems.

Contamination of milk was discovered in Illinois this year, aflatoxin-contaminated corn has been observed in Iowa, and contaminated cottonseed has in the past been distributed over wide areas, Marth says.

The problem was first identified in feed materials which were improperly stored. Under the right circumstances, however, corn can be infected with the mold, and toxin can be produced while the ear is still on the stalk. This contamination persists in the grain during storage.

Corn need not be contaminated in the field to be toxic; molds also can grow on it during storage, however, particularly if it is stored with moisture content too high. Even condensation on the inside of storage bins which is caused by changes in temperature, can lead to conditions that are just right for mold to flourish, says Marth.

Not all molds produce aflatoxins. But moldy cattle feed, whether toxic or not, can affect animal health and production, he says.

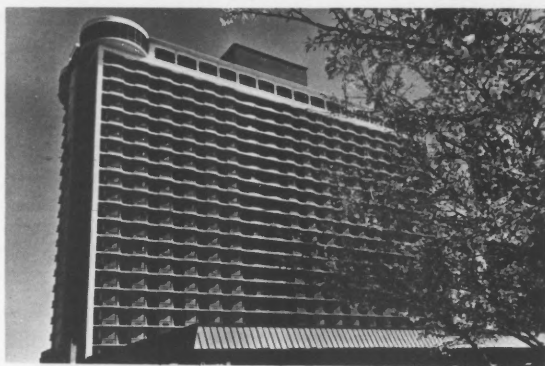
Marth has successfully experimented with several substances for eliminating aflatoxin from milk: chemical elimination using potassium sulfite; physical adsorption of the toxin using bentonite clay; and deactivation using hydrogen peroxide and riboflavin or the enzyme lactoperoxidase.

"These methods work, but there's a lot more to be done," he says. Experiments are still needed to prove their safety and effectiveness, and to make sure that milk's quality can be maintained when treated.

For more information contact Elmer Marth, College of Agricultural and Life Sciences, University of Wisconsin-Madison, Madison, WI 53706, 608-263-2004.

Louisville in '82!

Welcome to Louisville, "Derby City, USA". We invite you to attend the 69th Annual Meeting of IAMFES, August 22-26, 1982 at the Galt House, Louisville, KY. During the meeting a variety of events are planned, ranging from a cheese & wine reception to a cruise on the Belle of Louisville (a paddle-powered, triple decked, stern-wheeler). Music and an outstanding buffet will also be a part of this cruise. Spouses' entertainment will also be a big attraction at the '82 meeting. See you there!



1982 IAMFES ANNUAL MEETING

Advance Registration Form for the 69th Annual Meeting, Aug. 22-26, Louisville, KY.

Mail to:

Joe Schureck, Registration Chairman
Milk Control Branch
Health Services Building
275 East Main Street
Frankfort, Kentucky 40621

Please check where applicable:

Affiliate Delegate	<input type="checkbox"/>	Speaker	<input type="checkbox"/>
Past President	<input type="checkbox"/>	Affiliate Member	<input type="checkbox"/>
Executive Board	<input type="checkbox"/>	IAMFES Member	<input type="checkbox"/>
30 yr. IAMFES Member	<input type="checkbox"/>	50 yr. IAMFES Member	<input type="checkbox"/>
Non Member	<input type="checkbox"/>		

Make checks payable to IAMFES Meeting Fund

Advance register and save – refundable (prior to June 30) if you don't attend

ADVANCE REGISTRATION FEE (prior to July 1)

REGISTRATION FEE AT DOOR

	* Member	Spouse of Member	Student	• Member	Spouse of Member	Student	Non Member
Registration	\$20.00	\$10.00	no chg.	\$25.00	\$12.00	no chg.	\$30.00
Banquet & Cocktail Hr.	15.00	15.00	\$15.00	17.00	17.00	17.00	17.00
Cruise- Belle of Louisville (entertainment & dinner)	12.00	12.00	12.00	15.00	15.00	15.00	15.00
Total	\$47.00	\$37.00	\$27.00	\$57.00	\$44.00	\$32.00	\$62.00

Name (Member) _____

Children's First Names and Ages _____

Employer _____

Address _____

City _____ State _____ Zip _____

Means of Transportation _____

GALT HOUSE

Fourth & River Rd.
Louisville, KY 40202
Telephone 502-589-5200

Arrival Date _____

Arrival Time _____

Name _____

Address _____

City _____

Arrangements have been made for a flat rate of \$42.00 per room with a maximum of 4 people to the room. These rooms will have 2 double beds.

Reservations must be received by July 15, 1982.

Departure Date _____

Means of Transportation _____

Name _____

State _____ Zip _____

State _____ Zip _____

Mail directly to Galt House, Fourth and River Rd.,
Louisville, KY 40202

Committee Reports

SAMPLING OF MILK IN TRANSPORT TANKS SUB-COMMITTEE

Some progress has been noted in the sampling of milk in transport tanks. Jay Boosinger, Florida Department of Agriculture and Consumer Services, reported at the Farm Methods Committee Meeting held in conjunction with the National Mastitis Council on February 20, 1978, in Louisville, Kentucky, on trials conducted by Elbert Cammack, Chief, Bureau of Dairy Laboratories, Tallahassee, Florida. High speed agitation in the over-the-road tanker for five minutes was adequate in obtaining a representative sample. The interval fat testing was used as an index for getting a representative sample that then could be used for compositional, bacteriological and other testing.

Dr. Edward P. Glass, Department of Food Sciences at the Pennsylvania State University, is conducting tests on the use of an automatic sampler that shows promise in obtaining representative samples to perform fat, bacteriological and obtaining a representative sample from a tank truck.

A nationwide survey of current tank truck sampling practices is to be conducted using a questionnaire that will be sent to milk cooperatives, proprietary milk plants and state milk sampling surveillance officers. This information will be helpful in preparing a guideline for sampling tank trucks prior to or during the unloading of the milk from the tank truck. It has been suggested a pamphlet be printed on "Procedures for Sampling".

SUBCOMMITTEE MEMBERS:

R. Farst
P. Ahalt
W. Arledge
R. Belknap
M. Campbell
B. Schieb
F. Balliet
V. Grace (Chairman)

WATER TREATMENT AND PROTECTION SUB-COMMITTEE

An adequate source of clean, safe water is necessary on each dairy farm. Without it, milk quality and safety can be jeopardized.

In many areas of the country, dairy farms obtain water from private water systems, such as wells or springs, which serve a single farm and are owned by the dairyman.

Historically, the potential for hazard on this type of system has proven to be real. Water supplies on dairy farms are subject to rigorous local state and federal regulation.

New FDA Grade A Model Ordinance Adopted Some Improvements No Major Construction Requirement Changes

The "Grade A Pasteurized Milk Ordinance 1978 Recommendations of the United States Public Health Service/Food and Drug Administration" (1978 PMO) has been completed and was approved by the National Conference on Interstate Milk Shipments. Since July 1, 1980, the 1978 PMO has been the standard for Grade A milk shipped interstate as a raw or finished product. Many states are adopting the 1978 PMO or some modification of it to govern the sale of milk.

The 1978 PMO replaces the 1965 PMO and is very similar to it. Water supply construction and operation requirements remain substantially the same. There is, however, one significant change. In addition to the testing required by the 1965 PMO, the 1978 PMO asks that all farm water supplies be bacteriologically tested every three years. This is an improvement that should upgrade public health protection.

The 1978 PMO position on buried well seals remains the same as in the 1965 PMO. Buried well seals on wells constructed before 1965 need not be brought to the surface as long as semi-annual bacterial tests are satisfactory and the water system is not changed.

Committee Endorses Educational Materials

Two EOA manuals, EPA - 430/9-74-007 "Manual of Individual Water Supply Systems" and EPA - 430/9-73-002 "Cross-Connection Control Manual", provide excellent resource material for a comprehensive guide to water supplies. They cover construction, bactericidal treatment, mineral content control, and prevention of contamination by non-potable water. These are available from any local office of EPA. Limited numbers are free.

Water Supply Construction Approval Urged

It is recommended by the Committee that the farmer carefully plan new construction or remodeling of a water

supply. The farmers plans and the well location should be carefully reviewed by the appropriate regulatory agency prior to the beginning of well drilling.

Plan reviews should also be made of expansions of cowyards, feed lots, holding areas, manure disposal systems, housing areas, and similar developments to be sure that these changes will not cause the water supply to be too close to a major source of potential contamination.

Plastic Well Casings and Seals - Regulatory Opinion Divided

NSF approved plastic well casings and seals have been approved in some states and local jurisdictions across the board. These casings and seals have been disapproved in other states and local jurisdictions.

Before such casings or seals are installed, the Committee recommends that the farmer ask the appropriate regulatory agency about approval within that jurisdiction.

Disinfection Equipment - Questions Still Exist

Chlorination is the most commonly used disinfecting method in this country. In small volume water systems, problems have been experienced with mechanical chlorine dispensers. These machines sometimes meter inaccurately or stop all together.

Batch chlorination of a continuously fed water tank is normally less than satisfactory because of fluctuations in the chlorine level.

Iodine is not as hard on continuous dispensing equipment. However, nutritionists are concerned about the excessive iodine already in the American diet. Disinfecting large surfaces with iodine may increase iodine levels in milk.

Effective ultraviolet light water purification equipment is too expensive for the owners of most small volume water systems. Less expensive ultraviolet light equipment sold as adequate to do the job has not yet been proven to be effective.

Summary

If dairymen and regulatory agents work together, each system can be located, designed, constructed, disinfected, operated, and sampled properly. This professional teamwork can go a long way toward guaranteeing clean, safe, adequately protected water for use on the farm.

SUBCOMMITTEE MEMBERS:

R. Mills
J. Black
C. Gillman
G. Ronald
K. Seaman
H. Atherton
S. Sims (Chairman)

Certificate of Merit Award

The Executive board has approved a Certificate of Merit Award to be given to individual sanitarians for outstanding work on a local and state basis who would not likely be considered as a candidate for one of the national awards. The candidates must be submitted by the state affiliates and not by individual members. The certificates will be given at the association's annual meeting each year.

Rules for Certificate of Merit are as follows:

Certificate of Merit

1. Candidates nominated shall be submitted by state affiliates as an organization and not from individual members.
2. State affiliates may submit no more than two candidates per year. A brief summary of the candidates' achievements must accompany the nominations.
3. Deadlines for nominations shall correspond with deadlines set for other IAMFES awards.
4. All nominees shall at the time of their nominations, be a member of the state affiliate making the nomination and also be a member of IAMFES.
5. Nominees shall not previously have received one of the other awards given by IAMFES.
6. Criteria for making nominations shall include:
 - a. Years active service to the affiliate
 - b. Years active service to IAMFES
 - c. Specify outstanding service rendered at the state or IAMFES level. This may be several activities over a period of time or one outstanding contribution made.
7. Final determinations shall be made by the IAMFES Awards Committee.
8. Nominations shall be submitted to the IAMFES Awards Committee.

Food Service Sanitation Notes



Food Service Sanitation Notes is written by the National Sanitation Foundation. Write to the NSF with your questions on food service sanitation, problems for which you need answers, or issues you feel should be aired. They'll be included in a future issue of Dairy and Food Sanitation.

Q. How does NSF consider lighting for walk-in refrigerators? - seminar question

A. NSF Standard 7, Food Service Refrigerators and Storage Freezers, covers prefabricated walk-in units in Section 5. This section does not address itself to the quantity of lighting.

Since the largest majority of these units are fabricated in panel sections which are erected at the use site, the manufacturer cannot control the lighting. The lighting requirements should be determined during the design phase and specified accordingly.

NSF does list under Criteria C-2, Special Equipment and/or Devices, various lighting fixtures, guards, and shields. The NSF Manual on Sanitation Aspects of Installation of Food Service Equipment provides general guidance on installation of walk-in units.

Q. There seems to be a great deal of controversy over the NSF requirements for thermometers in refrigeration units. How do we go about upgrading these requirements?

-from Southeastern Michigan Food Sanitation Standards Committee

A. The best way to have a modification to a standard considered is to contact a member of the NSF Joint Committee on Food Equipment Standards. There are at this time 29 members of this group representing a wide range of professional and trade interests.

Any current issue of an NSF Food Equipment Standard will provide you with the name, address, and affiliation of each member. Since the membership of this committee changes from year to year, be sure you are using a current list.

In contacting the joint committee it is essential that you provide full and complete information relating to your concerns or interests. If you have any specific questions on the process, contact Standards Development, NSF.

ADDRESS any problems or questions you wish clarified or answered to:

Food Service Sanitation Notes
National Sanitation Foundation
3475 Plymouth Road
P.O. Box 1468
Ann Arbor, Michigan USA 48106

Book Reviews

Developments in Food Analysis Techniques. 2. R. D. King, ed. Applied Science Publishers Ltd. Ripple Rd., Barking, Essex, England. 268 pages. 1980.

This book is one of a number of the "Development in" series books published by Applied Science Publishers Ltd. with emphasis on recent developments in particular areas. It is the second volume dealing with developments in food analysis techniques. Its six chapters deal with a variety of subjects such as food texture and color, fluorimetric techniques and optical microscopy used in food analysis, determination of lipids in foods, and detection and determination of vegetable proteins in meat products. The authors selected for each of the areas covered were well versed in their subject.

The first chapter is a thorough review of methods used in measuring food texture. Its 78 pages represents almost 1/3 of the book, and includes 278 references. In it, as in most of the book, well established methods and techniques are described as well as recent developments. In a few places in this chapter, additional diagrams would have been useful. Nevertheless, the extensive material covered is well worth reading for anyone interested in food texture.

In the chapter on determination of food colors, the author's description of tristimulus values and CIELAB method of quantifying color is not adequate for the novice. Part of this is due to a failure of the author to pre-define terms. Also, the FD&C approved color list is not current. A reference citation would be in order to establish the currency of approved synthetic colors.

The chapter on fluorimetric techniques covered the subject very well. The author describes the useful application of fluorimetric detectors coupled with HPLC and phosphorescence detection on TLC and synchronous excitation and emission wavelength scanning coupled to multichannel analyzer. There were several minor errors in this chapter including typo or printer's errors and incorrect formulae.

I particularly enjoyed the chapter on the optical microscope in food analysis. The author opened the door to uses of the light microscope that I had overlooked. The subject is covered well and enthusiastically to give those with a casual interest an overview of optical microscopy. However, the literature cited should be adequate for those with a more serious interest in the subject.

The title of the fifth chapter, *The Determination of Lipids in Foods*, might be misleading from a casual look at the book. It does not deal with determination of crude lipid (proximate analysis) rather it involves analyzing the

components of food lipids. I believe much of the current literature covered will be useful to those persons working with lipid analysis.

The last chapter will be particularly useful to those involved with or interested in analyzing meats for foreign proteins. It is an excellent compilation of recent methods for detection of vegetable proteins in meats. The authors give limitations of existing methods and a general evaluation of the state of the art.

In general, I found this book very interesting and would recommend it for those with interests in the subject matter covered.

R. Bassette, Dept. of Animal Sciences and Industry, Kansas State University, Call Hall, Manhattan, KS 66506

Food Safety. Howard R. Roberts (ed.), 1981. John Wiley & Sons. 339 pp.

This is a well-written book which very thoroughly discusses a subject important to everyone: food safety. It includes both interesting historical facts and recently published scientific material.

The book is divided into seven major sections: Food Safety in Perspective; Foodborne Hazards of Microbial Origin; Nutritional Hazards; Environmental Contaminants; Food Hazards of Natural Origin; Food Additives; Food Safety and Toxicology. Well organized and thorough discussions of important topics are included, such as essential nutrients and their functions, vitamin and mineral toxicity, natural and industrial contaminants, sources, incidence and control of foodborne illness, federal food laws and regulatory control, the risks from food hazards, and safety of the diet as a whole.

I recommend this book to all food scientists as an excellent reference text as well as a student text for Food Science courses. It should also appeal to a wide variety of readers. In addition to the scientific community and other regular readers of scientific material, the title is very likely to catch the eye of many general readers who want to know more about the food they buy and consume.

Nelson A. Cox, Russell Research Center, USDA, Athens, Georgia 30613

Microbial Ecology of Foods: Volume Two Food Commodities; by the International Commission on Microbiological Specifications for Foods; 997 pages.

Volume two of *Microbial Ecology of Foods (Food Commodities)* is an extensive text of applied food microbiology. *Food Commodities* is written for those involved in the food processing sciences: processors, quality control personnel, food microbiologists and technologists. It is also intended for public health professionals with regulatory responsibilities in the food industry.

Educators will also find *Food Commodities* an excellent source of reference materials for food science classes. Where else could you find such little known facts as the water activity of various kinds of candy or that the pathogen *Clostridium perfringens* is used as the leavening agent in salt-rising bread. Corporate sanitarians in the food processing industry will find this volume a valuable tool in solving quality control problems.

Individual chapters in volume two are devoted to meats, poultry, milk, eggs, fish, vegetables, juices, cereals, spices, confectioneries, mineral waters and even pet foods. Each chapter provides information on the microflora contributing to spoilage as well as pathogens or public health importance. I have found *Food Commodities* very useful in updating lesson plans for food sanitation classes. It has also been of considerable value in the interpretation of food codes.

Food Commodities is a must for the corporate sanitarian and other environmental health professionals in the food processing industry. It would be of benefit to educators and those involved in research as a reference to current literature. Public health officials with regulatory responsibilities should not be without this text to avoid misinterpretation of food sanitation codes.

Homer C. Emery, Ph.D., Maj MSC, Academy of Health, Fort Sam Houston, TX

Margalith, Pinhas Z. 1981. *Flavor Microbiology*. Charles C. Thomas, Pp. 309. \$31.50.

This book describes the production of various flavor compounds by microorganisms in controlled and uncontrolled fermentation. The problem of flavor defects in foods is also presented. The title, however, is a bit ambiguous. At first glance one might think Dr. Margalith is presenting material on the occurrence and significance of microorganisms in flavoring essences or materials which might affect the quality and stability of those materials. A more appropriate title would be *Food and Beverage Flavors: Microbial Considerations*.

The first chapter is a superficial presentation of microbiology. This presentation is not designed to teach a novice microbiology but provides a general refresher for one with a background in microbiology. To cover the entire field of microbiology in 16 pages (pp 3-18) is unrealistic. The second chapter is about the sensation of flavor. The author presents taste and odor from the physiological standpoint.

The next 6 chapters make up the essence of the book. Each chapter deals with microbiology and biochemistry of microorganisms during production of flavor-enhancing compounds by microorganisms in controlled fermentation.

Each chapter is well written and address the topic involved in detail with appropriate data presentation and summaries. An extensive bibliography is provided for each chapter.

The author also provides the readers with a philosophical message at the beginning of each chapter as "flavor for thought" while reading the chapter. The one I like most is E. C. Stakeman's "Microorganisms are among man's best friends and his worst enemies, but it took him a million years to find out!"

I recommend this book to Food Scientists interested in the role of microbes in the production of flavors in foods. It could be used as a text book for a course in Food Flavor.

Daniel Y. C. Fung, Ph.D., Chairman and Associate Professor, Food Science Graduate Program, Kansas State University, Manhattan, Kansas

Cold and Frozen Storage Manual. Second Edition by Hallowell, E. R. 1980. AVI Publishing Co., West Point, Connecticut.

The manual has a total of 24 chapters or subsections grouped under 3 major sections. The first section includes discussion on the principle of refrigeration and the types and characteristics of refrigerants. In addition, it has a chapter on energy conservation, a topic which is of interest to people who are working in the area of refrigeration and freezing. The second section includes discussion on such topics as construction of different types and sizes of cold storage and freezers, insulation and machineries required in these facilities, and the operation and maintenance of cold storage and freezers. The third section basically includes discussion on the types of cold storage and freezer facilities required for the proper preservation of meat, poultry, fish, different types of fruits, nuts and vegetables. It also includes a chapter dealing with safety of the workers working in such facilities.

The topics are presented mainly in the form of discussion that could be understood by most, especially

by the people who are interested in the subject but do not have the background on the technicalities in the areas of refrigeration and freezing. The materials include some appropriate historical background, general discussion, advantages and disadvantages - the type of materials that could be of considerable help to people who are associated with the operation of cold storage and freezers. In addition, each chapter has necessary

references. Also the manual has two appendixes that include definition of terms and conversion tables.

The manual cannot be used as a text in this subject, but could be used as a reference text. However, this could be very useful for the owner or operator of cold storage and freezers.

Ray Bibek, Assoc. Professor, Food Microbiology, Food Science Section of Animal Science Division, University of Wyoming, Laramie, WY

IAMFES WANTS YOU

AS A MEMBER FOR 1982

Receive both outstanding journals each month
PLUS benefits of membership

This is YOUR professional organization . . .

1. PLEASE CHECK ONE
2. Enclose check including your state dues
3. Mail TODAY . . . don't miss a single issue

Yes, I want to be a member and support my profession, as well as to continue to educate myself monthly with the journals

PLEASE ONE

- Journal of Food Protection (12 issues)
Dairy and Food Sanitation (12 issues) BOTH JUST \$50
- Dairy and Food Sanitation (12 issues) \$28
- Journal of Food Protection (12 issues) \$40

YOUR NAME _____

CO. NAME _____

ADDRESS _____

CITY _____

STATE _____

ZIP _____

MAIL TO:
IAMFES Dept. 1W
413 Kellogg
Ames, IA 50010

clip & mail today

Holders of 3-A Symbol Council Authorizations on February 15, 1982

Questions or statements concerning any of the holders of authorizations listed below, or the equipment fabricated, should be addressed to Earl O. Wright, Sec'y.-Treas., P.O. Box 701, Ames, Iowa 50010-0701.

01-06 Storage Tanks for Milk and Milk Products

28	Cherry-Burrell Corporation (unit AMCA Int'l) 575 E. Mill St. Little Falls, New York 13365	(10/ 3/56)
102	Chester-Jensen Company, Inc. 5th & Tilgham Streets Chester, Pennsylvania 19013	(6/ 6/58)
2	CREPACO, Inc. 100 C.P. Avenue Lake Mills, Wisconsin 53551	(5/ 1/56)
117	DCI, Inc. St. Cloud Industrial Park St. Cloud, Minnesota 56301	(10/28/59)
76	Damrow Company 196 Western Avenue Fond du Lac, Wisconsin 54935	(10/31/57)
115	DeLaval Company, Ltd. 113 Park Street South Peterborough, Ontario, Canada (not available in USA)	(9/28/59)
109	Girton Manufacturing Company State Street Millville, Pennsylvania 17846	(9/30/58)
127	Paul Mueller Company P.O. Box 828 Springfield, Missouri 65801	(6/29/60)
31	Walker Stainless Equipment Co. Elroy, Wisconsin 53929	(10/ 4/56)

02-08 Pumps for Milk and Milk Products

325	Albin Motor Aktiebolag Box 139, S-681 01 Kristinehamn Sweden (not available in USA)	(12/19/79)
214R	Ben H. Anderson Manufacturers Morrisonville, Wisconsin 53571	(5/20/70)
212R	Babson Bros. Co. 2100 S. York Rd. Oak Brook, Illinois 60621	(2/20/70)
29R	Cherry-Burrell Corporation (unit AMCA Int'l) 2400 Sixth St., Southwest Cedar Rapids, Iowa 52406	(10/ 3/56)
63R	CREPACO, Inc. 100 CP Avenue Lake Mills, Wisconsin 53551	(4/29/57)
205R	Dairy Equipment Company 1919 South Stoughton Road Madison, Wisconsin 53716	(5/22/69)

65R	G & H Products, Inc. 5718 52nd Street Kenosha, Wisconsin 53140	(5/22/57)
145R	ITT Jabsco Incorporated 145 Dale Way Costa Mesa, California 92626	(11/20/63)
348	ITT MARC Division, England ITT Jabsco Limited 3200 Bristol-Suite 710 Costa Mesa, CA 92626	(12/ 3/81)
314	Len E. Iverson, Inc. 3100 W. Green Tree Road Milwaukee, Wisconsin 53223	(12/22/78)
26R	Ladish Co., Tri-Clover Division 9201 Wilmot Road Kenosha, Wisconsin 53140	(9/29/56)
319	Mono Group, Inc. (Mfg. by SSP Pumps Ltd.) 847 Industrial Drive Bensonville, IL 60106	(3/21/79)
241	Puriti S. A. Alfredo Noble #39, Industrial Pte. de Vigas Tlalnepantla, Mexico (not available in USA)	(9/12/72)
148	Robbins & Myers, Inc. 1895 W. Jefferson St. Springfield, OH 45506	(4/22/64)
306	Stamp Corp. 2410 Parview Road Middleton, WI 53562	(5/ 2/78)
332	Superior Stainless, Inc. 211 Sugar Creek Rd. Delavan, WI 53115	(12/10/80)
72R	L. C. Thomsen & Sons, Inc. 1303 43rd Street Kenosha, Wisconsin 53140	(8/15/57)
219	Tri-Canada Ltd. P.O. Box 4589 Buffalo, NY 14240	(2/15/71)
175R	Universal Milking Machine Div. Universal Cooperatives, Inc. 408 South First Ave. Albert Lea, MN 56007	(10/26/56)
329	Valex Products Corp. 20447 Nordhoff St. Chatsworth, Calif. 91311	(6/10/80)
52R	Viking Pump Div. Houdaille Industries, Inc. 406 State Street Cedar Falls, Iowa 50613	(12/31/56)
5R	Waukesha Foundry Company 1300 Lincoln Ave. Waukesha, Wisconsin 53186	(7/ 6/56)
04-03 Homogenizers and High Pressure Pumps of the Plunger Type		
344	ALFA-LAVAL, Inc. 2115 Linwood Avenue Ft. Lee, New Jersey 07024	(8/24/81)

247	Bran and Lubbe, Inc. 1241 Rand Rd. Des Plaines, IL 60016	(4/14/73)	25	Walker Stainless Equipment Co. New Lisbon, Wisconsin 53950	(9/28/56)
87	Cherry-Burrell Company (unit AMCA Int'l) 2400 Sixth Street, Southwest Cedar Rapids, Iowa 52404	(12/20/57)	08-17 Fittings Used on Milk and Milk Products Equipment and Used on Sanitary Lines Conducting Milk and Milk Products		
37	CREPACO, Inc. 100 CP Avenue Lake Mills, Wisconsin 53538	(10/19/56)	291	Accurate Metering Systems, Inc. 1731 Carmen Drive Elk Grove Village, IL 60007	(6/22/77)
75	Gaulin, Inc. 44 Garden Street Everett, Massachusetts 02149	(9/26/57)	79R	Alloy Products Corporation 1045 Perkins Avenue Waukesha, Wisconsin 53186	(11/23/57)
237	Graco Inc. P.O. Box 1441 Minneapolis, Minnesota 55440	(6/ 3/72)	349	A.P.N., Inc. 400 West Lincoln Caledonia, MN 55921	(12/15/81)
309	General Dairy Equipment (Mfg. by Rannie A/S, Denmark) 434 Stinson Boulevard Minneapolis, Minnesota 55413	(7/19/78)	245	Babson Brothers Company 2100 South York Road Oak Brook, Illinois 60521	(2/12/73)
256	Liquipak International, Inc. 2285 University Avenue St. Paul, Minnesota 55114	(1/23/74)	284	Bristol Engineering Company 210 Beaver Street Yorkville, Illinois 60560	(11/18/76)
05-13 Stainless Steel Automotive Milk Transportation Tanks for Bulk Delivery and/or Farm Pick-up Service					
70R	Brenner Tank, Inc. 450 Arlington Fond du Lac, Wisconsin 54935	(8/ 5/57)	82R	Cherry-Burrell Company (unit AMCA Int'l) 2400 Sixth Street, Southwest Cedar Rapids, Iowa 52406	(12/11/57)
40	Transportation Equipment Corporation 900 Sixth Ave., Southeast Minneapolis, Minnesota 55114	(10/20/56)	260	CREPACO, Inc. 100 CP Avenue Lake Mills, Wisconsin 53551	(5/22/74)
66	Dairy Equipment Company 1919 South Stoughton Road Madison, Wisconsin 53716	(5/29/57)	322	ALFA-LAVAL LIMITED (not available in USA) 113 Park St. So. Peterborough, Ontario Canada K9J 3R8	(7/16/79)
45	The Heil Company 3000 W. Montana Street Milwaukee, Wisconsin 53235	(10/26/56)	304	VNE Corp. (Mfg. by Egmo Ltd.-Israel) 1415 Johnson St., P.O. Box 187 Janesville, WI 53545	(3/16/78)
297	Indiana Tank Co., Inc. P.O. Box 366 Summitville, Indiana 46070	(8/29/77)	271	The Foxboro Company Neponset Street Foxboro, Massachusetts 02035	(3/ 8/76)
305	Light Industrial Design Co. 8631-A Depot Road Lynden, WA 98264	(3/23/78)	67R	G & H Products, Inc. (Some Models Mfg. by Alfa-Laval AB-Sweden) 5718 52nd Street Kenosha, Wisconsin 53140	(6/10/57)
338	Murphy's Inc. P.O. Box 18 Avon, MN 56310	(4/20/81)	203R	ITT-Grinnell Company, Inc. DIA-FLO Div 33 Centerville Rd. Lancaster, Pennsylvania 17603	(11/ 7/68)
201	Paul Krohnert Mfg., Ltd. 811 Steeles Avenue Milton, Ontario, Canada L9T 2Y3 (not available in USA)	(4/ 1/68)	34R	Ladish Co., Tri-Clover Division 9201 Wilmot Road Kenosha, Wisconsin 53140	(10/15/56)
85	Polar Tank Trailer, Inc. Holdingford, Minnesota 56340	(12/20/57)	350	Rosita, Inc. 808 North Central Avenue P.O. Box 685 Wood Dale, IL 60191	(1/ 7/82)
47	Pullman Trailmobile 701 East 16th Avenue North Kansas City, Missouri 64116	(11/ 2/56)	287	Sanitary Processing Equipmt. Corp. (Mfg. by Koltek OY-Finland) P.O. Box 26 Dewitt, New York 13214	(1/14/77)
121	Technova Inc. Gosselin Division 1450 Hebert c.p. 758 Drummondville, Quebec, Canada J2C 2A1 (not available in USA)	(12/ 9/59)			
189	A. & L. Tougas, Ltee 1 Tougas St. Iberville, Quebec, Canada (not available in USA)	(10/ 3/66)			

239	LUMACO Box 688, Teaneck, New Jersey 07666	(6/30/72)	11-03 Plate-type Heat Exchangers for Milk and Milk Products	
200R	Paul Mueller Co. P.O. Box 828 Springfield, Missouri 65801	(3/ 5/68)	316	Agric Machinery Corp. P.O. Box 6 Madison, NJ 07940 (2/ 7/79)
295	Precision Stainless Products (Mfg. by Toyo Stainless Co. Ltd.) 5636 Shull St. Bell Gardens, CA 90201	(8/11/77)	326	American Vicarb Corporation (Mfg by Vicarb S. A. France) 1522 Main Street Niagra Falls, N.Y. 14301 (2/ 4/80)
242	Puriti, S.A. Alfredo Nobel #39 Industrial Pte de Vigas Tlalnepantla, Mexico (not available in USA)	(9/12/72)	20	A.P.V. Equipment, Inc. 395 Fillmore Avenue Tonawanda, New York 14150 (9/ 4/56)
149R	Q Controls Occidental, California 95465	(5/18/64)	30	Cherry-Burrell Corporation (unit AMCA Int'l) 2400 Sixth Street, Southwest Cedar Rapids, Iowa 52404 (10/ 1/56)
334	Stainless Products Inc. 1649 72nd Ave., Box 169 Somers, WI 53171	(12/18/80)	14	Chester-Jensen Co., Inc. 5th & Tilgham Streets Chester, Pennsylvania 19013 (8/15/56)
73R	L. C. Thomsen & Sons, Inc. 1303 43rd Street Kenosha, Wisconsin 53140	(8/31/57)	38	CREPACO, Inc. 100 CP Avenue Lake Mills, Wisconsin 53551 (10/19/56)
300	Superior Stainless, Inc. 211 Sugar Creek Rd. Delavan, Wisconsin 53115	(11/22/77)	120	DeLaval Company, Ltd. 113 Park Street South Peterborough, Ontario, Canada (not available in USA) (12/ 3/59)
191R	Tri-Canada, Ltd. P.O. Box 4589 Buffalo, NY 14240	(11/23/66)	342	General Dairy Equipment Co. (Mfg. by Pasilak-Therm, Denmark) 437 Harding Street, N.E. Minneapolis, MN 55413 (7/6/81)
250	Universal Milking Machine Div. of Universal Cooperatives 407 First Ave, So. Albert Lea, Minnesota 56007	(6/11/73)	279	The Schluter Co. (Mfg. by Samuel Parker Ltd.) 112 E. Centerway Janesville, WI 53545 (8/29/76)
278	Valex Products 20447 Nordhoff St. Chatsworth, California 91311	(8/30/76)	17	ALFA-LAVAL, Inc. (Mfg. in Sweden) 2115 Linwood Ave. Ft. Lee, New Jersey 07024 (8/30/56)
86R	Waukesha Specialty Company, Inc. Darien, Wisconsin 53114	(12/20/57)	15	Kusel Equipment Company 820 West Street Watertown, Wisconsin 53094 (8/15/56)
09-07 Instrument Fittings and Connections Used on Milk and Milk Products Equipment				
321	Anderson Instrument Co., Inc. R.D. #1, Fultonville, New York 12072	(6/14/79)	12-04 Tubular Heat Exchangers, for Milk and Milk Products	
315	Burns Engineering, Inc. 10201 Bren Road, East Minnetonka, MN 55343	(2/ 5/79)	248	Allegheny Bradford Corporation P.O. Box 264 Bradford, Pennsylvania 16701 (4/16/73)
206	The Foxboro Company Neponset Avenue Foxboro, Massachusetts 02035	(8/11/69)	243	Babson Brothers Company 2100 S. York Road Oak Brook, Illinois 60521 (10/31/72)
285	Tank Mate Company 2269 Ford Parkway St. Paul, Minnesota 55116	(12/ 7/76)	103	Chester-Jensen Company, Inc. 5th & Tilgham Street Chester, Pennsylvania 19013 (6/ 6/58)
32	Taylor Instrument Process Control Div. Sybron Corporation 95 Ames Street Rochester, New York 14601	(10/ 4/56)	307	G&H Products, Inc. 5718-52nd St. Kenosha, WI 53141 (5/ 2/78)
10-00 Milk and Milk Products Filters Using Disposable Filter Media, As Amended				
35	Ladish Co., Tri-Clover Division 9201 Wilmot Road Kenosha, Wisconsin 53140	(10/15/56)	217	Girton Manufacturing Co. Millville, Pennsylvania 17846 (1/23/71)
296	L. C. Thomsen & Sons, Inc. 1303 43rd St. Kenosha, Wisconsin 53140	(8/15/77)	252	Ernest Laffranchi P.O. Box 455 Ferndale, California 95536 (12/27/73)
			238	Paul Mueller Company P.O. Box 828 Springfield, Missouri 65801 (6/28/72)

96	C. E. Rogers Company P.O. Box 188 Mora, Minnesota 55051 13-06 Farm Milk Cooling and Holding Tanks	(3/31/64)	186R	Marriott Walker Corporation 925 East Maple Road Birmingham, Michigan 48010	(9/ 6/66)
240	Babson Brothers Company (Mfg. by CREPACO, Inc.) 2100 S. York Road Oak Brook, Illinois 60521	(9/ 5/72)	273	Niro Atomizer Inc. 1600 County Rd F. Hudson, WI 54016	(5/20/76)
11R	CREPACO, Inc. 100 CP Ave. Lake Mills, Wisconsin 53551	(7/25/56)	299	Stork Food Machinery, Inc. (Mfg. by Stork-Friesland B.V.) P.O. Box 816 Somerville, New Jersey 08876	(11/16/77)
119R	DCI, Inc. St. Cloud Industrial Park St. Cloud, Minnesota 56301	(10/28/59)	311	Wiegand Evaporators, Inc. 5585 Sterrett Place Columbia, Maryland 21044	(8/28/78)
4R	Dairy Equipment Company 1919 South Stoughton Road Madison, Wisconsin 53716	(6/15/56)	17-06 Fillers and Sealers of Single Service Containers For Milk and Milk Products		
92R	Alfa-Laval Limited 350 Dutchess Turnpike Poughkeepsie, N.Y. 12602	(12/27/57)	346	B-Bar-B, Inc. E. 10th & McBeth Streets P.O. Box 909 New Albany, IN 47150	(10/20/81)
49R	Alfa Laval, Inc. (DeLaval Agricultural Division) (Mfg. by Alfa-Laval, Canada) 11100 N. Congress Ave. Kansas City, Missouri 64153	(12/ 5/56)	351	BRIK PAK INC. 2775 Villa Creek Suite 165-D Dallas, TX 75234	(1/ 7/82)
10R	Girton Manufacturing Company Millville, Pennsylvania 17846	(7/25/56)	192	Cherry-Burrell Corporation (unit AMCA Int'l) 2400 Sixth St., Southwest Cedar Rapids, IA 52404	(1/ 3/67)
356	Meyer D. Haberer P. O. Box 220 Bowdle, S.D. 57428	(2/3/81)	324	ERCA S.A.B.P. 54 Z.I. de Courtabeouf Avenue de Pacifique, 91943 Les Ulis Cedex, France (not available in USA)	(11/29/79)
179R	Heavy Duty Products (Preston), Ltd. 1261 Industrial Road Preston, Ontario, Canada (not available in USA)	(3/ 8/66)	137	Ex-Cell-O Corporation 2855 Coolidge, Troy, Michigan 48084	(10/17/62)
12R	Paul Mueller Company P.O. Box 828 Springfield, Missouri 65801	(7/31/56)	352	GMS Engineering (Sweetheart Plastics) 2044 Weaver Park Drive Clearwater, FL 33515	(1/12/82)
249	Sunset Equipment Co. 293 Como Ave. St. Paul, Minnesota 55103	(4/16/73)	220	Liquipak International, Inc. 2285 University Ave. St. Paul, Minnesota 55114	(4/24/71)
16R	Zero Manufacturing Company Washington, Missouri 63090	(8/27/56)	330	Milliken Packaging (Mfg. by Chubukikai Co. Ltd.) White Stone, South Carolina 29353	(8/26/80)
16-04 Evaporators and Vacuum Pans for Milk and Milk Products					
254	Anhydro, Inc. 165 John Dietsch Square Attleboro Falls, Massachusetts 02763	(1/ 7/74)	281	Purity Packaging Corporation 800 Kederly Drive Columbus, Ohio 43228	(11/ 8/76)
132R	A.P.V. Company, Inc. Tonawanda Industrial Park 395 Fillmore Ave. Tonawanda, New York 14150	(10/26/60)	211	Twin-Pak Inc. (Canada) (Mfg. by Thimonnier & Cie, France) Steel & Cohen, 745 Fifth Ave. New York, New York 10022	(2/ 4/70)
263	C. E. Howard Corporation 240 N. Orange Avenue City of Industry, California 91746	(12/21/74)	19-03 Batch and Continuous Freezers, For Ice Cream, Ices and Similarly Frozen Dairy Foods, As Amended		
107R	C. E. Rogers Company P.O. Box 118 Mora, Minnesota 55051	(8/ 1/58)	286	O.G. Hoyer, Inc. 201 Broad St. Lake Geneva, WI 53147 (Mfg. by O.G. Hoyer A/S of Denmark)	(12/ 8/76)
277	Alfa Laval Contherm Division Route 1 Rotary, PO Box 352 Newburyport, MA 01950	(8/19/76)	146	Cherry-Burrell Company (unit AMCA Int'l) 2400 Sixth Street, Southwest	(12/10/63)

141 Cedar Rapids, Iowa 52404
CREPACO, Inc. (4/15/63)
100 CP Avenue
Lake Mills, Wisconsin 53551

22-04 Silo-Type Storage Tanks for Milk and Milk Products

168 Cherry-Burrell Corporation (6/16/65)
(unit AMCA Int'l)
575 E. Mill St.
Little Falls, New York 13365

154 CREPACO, Inc. (2/10/65)
100 CP Avenue
Lake Mills, Wisconsin 53551

160 DCI, Inc. (4/ 5/65)
St. Cloud Industrial Park
St. Cloud, Minnesota 56301

181 Damrow Company, Division of DEC (5/18/66)
International, Inc., 196 Western Ave.
Fond du Lac, Wisconsin 54935

262 DeLaval Company Ltd., Canada (11/11/74)
350 Dutchess Turnpike
Poughkeepsie, N.Y. 12602 Canada

155 Paul Mueller Co. (2/10/65)
P.O. Box 828
Springfield, Missouri 65801

312 Sanitary Processing Equip. Corp. (9/15/78)
P.O. Box 26
Dewitt, New York 13208

165 Walker Stainless Equipment Co. (4/26/65)
Elroy, Wisconsin 53929

23-01 Equipment for Packaging Frozen Desserts, Cottage Cheese and Milk Products Similar to Cottage Cheese in Single Service Containers

174 Anderson Bros. Mfg. Co. (9/28/65)
1303 Samuelson Road
Rockford, Illinois 61109

209 Doboy Packaging Machinery Division (7/23/69)
of Nordson Corporation, 215 N. Knowles Ave.
New Richmond, Wisconsin 54017

302 Eskimo Pie Corp. (1/27/78)
530 E. Main St.
Richmond, Virginia 23219

343 O. G. Hoyer, Inc. (7/ 6/81)
(Mfg. by O. G. Hoyer, Denmark)
201 Broad Street
Lake Geneva, Wis. 53147

24-00 Non-Coil Type Batch Pasteurizers

161 Cherry-Burrell Corporation (4/ 5/65)
(unit AMCA Int'l)
575 E. Mill St.
Little Falls, New York 13365

158 CREPACO, Inc. (3/24/65)
100 CP Avenue
Lake Mills, Wisconsin 53551

187 DCI, Inc. (9/26/66)
St. Cloud Industrial Park
St. Cloud, Minnesota 56301

166 Paul Mueller Co. (4/26/65)
P.O. Box 828
Springfield, Missouri 65601

25-00 Non-Coil Type Batch Processors for Milk and Milk Products

162 Cherry-Burrell Corporation (4/ 5/65)
(unit AMCA Int'l)
575 E. Mill St.
Little Falls, New York 13365

159 CREPACO, Inc. (3/24/65)
100 CP Avenue
Lake Mills, Wisconsin 53551

188 DCI, Inc. (9/26/66)
St. Cloud Industrial Park
St. Cloud, Minnesota 56301

177 Girton Manufacturing Co. (2/18/66)
Millville, PA 17846

167 Paul Mueller Co. (4/26/65)
Box 828
Springfield, Missouri 65801

202 Walker Stainless Equipment Co. (9/24/68)
New Lisbon, Wisconsin 53950

26-01 Sifters for Dry Milk and Dry Milk Products

229 Russell Finex Inc. (3/15/72)
156 W. Sandford Boulevard
Mt. Vernon, New York 10550

173 B. F. Gump Division (9/20/65)
Blaw-Knox Food & Chem. Equip. Inc.
750 E. Ferry St., P.O. Box 1041
Buffalo, NY 14211

185 Rotex, Inc. (8/10/66)
(Mfg. by Orville Simpson Co.)
1230 Knowlton St.
Cincinnati, Ohio 45223

176 Koppers Company, Inc. (1/ 4/66)
Metal Products Division
Sprout-Waldron Operation
Munsey, Pennsylvania 17756

172 SWECO, Inc. (9/ 1/65)
P.O. Box 4151
6033 E. Bandini Blvd.
Los Angeles, California 90051

27-01 Equipment for Packaging Dry Milk and Dry Milk Products

313 WPM Systems, Inc. (10/10/78)
Div. of St. Regis Paper Company
4990 Acoma St.
Denver, Colorado 80216

347 Hubbard Consultants, Inc. (10/28/81)
1531 B West Irving Park Rd.
Suite 211
Itasca, IL 60143

28-00 Flow Meters for Milk and Liquid Milk Products

272 Accurate Metering Systems, Inc. (4/ 2/76)
(RZ2A Mfg. by Ringkolbenzahler-Germany)
1731 Carmen Drive
Elk Grove Village, Illinois 60007

253 Badger Meter, Inc. (1/ 2/74)
4545 W. Brown Deer Road
Milwaukee, Wisconsin 53223

223 C-E IN-VAL-CO, Division of Combustion (11/15/71)
Engineering, Inc.
P.O. Box 556, 3102 Charles Page Blvd.
Tulsa, Oklahoma 74101

- | | | | | | |
|-----|----------------------------------------------------------------------------------------------------------------------|------------|-----|--------------------------------------------------------------------------------------------|------------|
| 265 | Electronic Flo-Meters, Inc.
P.O. Box 38269
Dallas, TX 75239 | (3/10/75) | 341 | Letsch Corporation
501 N. Belcrest
Springfield, Missouri 65801 | (6/8/81) |
| 226 | Fischer & Porter Co.
Magnetic Flowmeters
Dept. 372 County Line Road
Warminster, Pa. 18974 | (12/9/71) | 339 | Walker Stainless Equipment Co., Inc.
601 State Street
New Lisbon, WI 53950 | (6/2/81) |
| 224 | The Foxboro Company
Neponset Avenue
Foxboro, Massachusetts 02035 | (11/16/71) | | | |
| 320 | Max Machinery, Inc.
1420 Healdsburg Ave.
Healdsburg, CA 95448 | (3/28/79) | 310 | Allegheny Bradford Corporation
P.O. Box 264
Bradford, PA 16701 | (7/19/78) |
| 270 | Taylor Instrument Company Division
Sybron Corporation, 95 Ames Street
Rochester, New York 14601 | (2/ 9/76) | 289 | Ladish Co., Tri-Clover Division
9201 Wilmot Road
Kenosha, Wisconsin 53140 | (1/21/77) |
| | 29-00 Air Eliminators for Milk and Fluid Milk Products | | 308 | Rath Mfg. Co. Inc.
2505 Foster Ave.
Janesville, WI 53545 | (6/15/77) |
| 340 | Accurate Metering Systems
(Mfg. by Luftabscheider-Germany)
1731-33 Carmen Drive
Elk Grove Village, IL 60007 | (6/2/81) | 335 | Stainless Products Inc.
1649-72nd Ave., P.O. Box 169
Sumers, WI 53171 | (1/4/81) |
| | 30-00 Farm Milk Storage Tanks | | 345 | Trent Tube Division Crucible, Inc.
2188 S. Church St.
East Troy, WI 53120 | (9/16/81) |
| 257 | Babson Bros. Co.
(Mfg. by CREPACO, Inc.)
2100 S. York Road
Oak Brook, Illinois 60521 | (2/ 7/74) | 331 | United Industries Incorporated
1546 Henry Ave.
Beloit, WI 53511 | (10/23/80) |
| | 31-00 Scraped Surface Heat Exchangers | | | | |
| 274 | Contherm Corporation
P.O. Box 352
Newburyport, Massachusetts 01950 | (6/25/76) | 292 | Waukesha Division, Abex Corp.
1300 Lincoln Ave.
Waukesha, WI 53186 | (8/24/77) |
| 322 | Cherry Burrell
2400 6th St. SW
Cedar Rapids, IA 52406 | (7/26/79) | | | |
| 290 | CREPACO, Inc.
100 So. CP Ave.
Lake Mills, WI 53551 | (6/15/77) | 293 | Waukesha Division, Abex Corp.
1300 Lincoln Ave.
Waukesha, WI 53186 | (8/24/77) |
| 337 | Machinefabriek-Holland
Girton Manufacturing Co.
Millville, PA 17846 | (3/30/81) | | | |
| | 32-00 Uninsulated Tanks for Milk and Milk Products | | | | |
| 264 | Cherry-Burrell Company,
(unit AMCA Int'l)
575 E. Mill St.
Little Falls, NY 13365 | (1/27/75) | | | |
| 268 | DCI, Inc.
P.O. Box 1227
St. Cloud, Minnesota 56301 | (11/21/75) | 318 | Anderson Instrument Co., Inc.
R.D. #1 Fultonville, N.Y. 12072 | (4/ 9/79) |
| | | | 317 | C-E Invalco Division of Combustion
Engineering, Inc.
P.O. Box 556
Tulsa, OK 74101 | (2/26/79) |
| | | | 328 | Rosemount, Inc.
12001 West 78th St.
P.O. Box 35129
Eden Prairie, MN 55344 | (5/22/80) |
| | | | | 33-00 Polished Metal Tubing for Dairy Products | |

JFP Abstracts

Abstracts of papers in the February A Journal of Food Protection

Preparation of a Positive Control Sample for Use in the Routine Analysis of Milk and Milk Products for Alkaline Phosphatase. G. K. Murthy, U.S. Department of Health and Human Services, Public Health Service, Food and Drug Administration, Division of Microbiology, 1090 Tusculum Avenue, Cincinnati, Ohio 45226

J. Food Prot. 45:108-111

A method was developed for preparing filter paper impregnated with raw skim milk to serve as positive control samples during the routine analysis of milk and milk products for alkaline phosphatase. Whatman No. 40 filter paper circles (12.5-cm diameter) were dipped in raw skim milk standardized to known concentrations of alkaline phosphatase. Excess milk was removed by draining and blotting between folds of blotting paper. The filter papers were dried over silica gel in a desiccator under continuous vacuum for 5 to 6 days. Disks measuring 0.64-cm were punched out of the dried filter paper circles and stored in screw-cap test tubes at room temperature in the dark until use. The relationship between the alkaline phosphatase contents of milk and the filter paper disks was linearly correlated and characterized by the equation: $[E_{\text{disk}}] = 0.0071 \times [E_{\text{milk}}] + 0.41$, and $r = 0.98$. Reproducibility of preparing impregnated filter paper circles showed coefficients of variation of 3.3 to 15.7%. Statistical analysis of the data relating alkaline phosphatase activity with days of storage by analysis of variance and regression analysis indicated significant differences in the slope of the regression lines at the $\alpha = 0.05$ level. At the end of 406 to 599 days of storage, the estimated decrease in $[E_{\text{disk}}]$ for significant samples ranged from 25.6 to 38.9%, with an average \pm SD of $33.0 \pm 4.4\%$. Data do show, however, that filter paper disks can be prepared to contain known concentrations of alkaline phosphatase and stored at room temperature for several months for use as positive control samples.

Collaborative Study of Alkaline Phosphatase Activity in Filter Paper Disks Impregnated with Skim Milk: Positive Control Sample. G. K. Murthy and J. T. Peeler, U.S. Department of Health and Human Services, Public Health Service, Food and Drug Administration, Division of Microbiology, 1090 Tusculum Avenue, Cincinnati, Ohio 45226

J. Food Prot. 45:112-114

The rapid colorimetric test was used in a collaborative study to determine alkaline phosphatase activity in filter paper disks impregnated with skim milk then dried and stored for several months at room temperature. Five samples of filter paper disks (0 to 6 μg phenol/disk) in duplicate were sent to six collaborators for analysis. Computations of analytical and analyst errors showed variations of 22.2 to 48.8%. Most of the

variations were due to differences among analysts, but some were partly due to differences in the slopes of the calibration curves ($\alpha = 0.05$ level) they prepared at the time of analysis. Collaborator's performance was evaluated by comparing % correct results that were positive (negative) with the expected results. About 95% of the samples were correctly analyzed.

Chinese Foods Relationship Between Hygiene and Bacterial Flora. Timothy Sly and Elmor Ross, Middlesex-London District Unti, 367 Ridout Street North, London, Ontario, Canada N6A 2P1

J. Food Prot. 45:115-118

One hundred and sixteen samples of prepared elements of Chinese-style meals were examined for pathogens and other microbiological indicators of poor sanitary preparation. *Bacillus cereus* was isolated from 9% of samples, while neither *Salmonella* nor *Clostridium perfringens* was found. Egg rolls were shown to be supporting high numbers of organisms; this and the potential hazards from the usual methods of preparation are discussed.

An attempt to correlate the results from bacterial analyses for each restaurant kitchen with scores from a series of hygiene indices is presented. When the strengths-of-association (correlation coefficients) were ranked in order, the result was very close to the expected sequence. The strongest association was high aerobic plate count vs. temperature control.

Ultrastructures of Bacteriophages Active Against *Streptococcus thermophilus*, *Lactobacillus bulgaricus*, *Lactobacillus lactis* and *Lactobacillus helveticus*. G. W. Reinbold, M. S. Reddy and E. G. Hammond, Department of Food Technology, Iowa State University, Ames, Iowa 50011

J. Food Prot. 45:119-124

Several strains of phages active against *Streptococcus thermophilus* and species of *Lactobacillus* were examined with an electron microscope after negative staining with phosphotungstic acid or uranyl acetate. *S. thermophilus* bacteriophage exhibited exceptionally long tails (polytails). The width and structure of the polytail was the same as a normal phage tail, 10 nm, but was 2 to 4 times longer, 480-960 nm. Preparations revealed extensive adsorption of *S. thermophilus* bacteriophage to broken bacterial cell walls. One strain of *S. thermophilus* phage had a spherical structure at the posterior end of its tail. The bacteriophages of *Lactobacillus bulgaricus* and *Lactobacillus helveticus* had a distinct contractile tail sheath, whereas *Lactobacillus lactis* phage did not.

Destruction of Microorganisms During Thawing of Skim Milk, A. Gebre-Egziabher, Beatrice Thomson and G. Blankenagel, Department of Dairy and Food Science, University of Saskatchewan, Saskatoon, Saskatchewan, Canada S7N 0W0

J. Food Prot. 45:125-126

The viability of four species of microorganisms (*Escherichia coli*, *Staphylococcus aureus*, *Pseudomonas aeruginosa* and *Saccharomyces cerevisiae*) during rapid and slow thawing of frozen milk was investigated. Results indicated that the destruction of microbial cells was significantly greater when skim milk was thawed slowly. Recovery of viable organisms by plating was generally slightly higher when peptone water was used as a diluent, although differences were not statistically significant.

Physical and Sensory Properties of Restructured Beef Steaks Formulated with Various Flake Sizes and Mixing Times, P. R. Durland, S. C. Seideman, W. J. Costello and N. M. Quenzer, Departments of Animal Science and Nutrition-Food Science, South Dakota Agricultural Experiment Station, South Dakota State University, Brookings, South Dakota 57007

J. Food Prot. 45:127-131

Restructured cow beef steaks were made using six different flake size formulations: (a) coarse, (b) medium, (c) fine, (d) coarse + medium, (e) medium + fine and (f) coarse + fine meat flakes. Each formulation was mixed for 0, 5, 10 or 15 min, pressed into "logs", frozen and cut into steaks. Steaks were evaluated for physical appearance, fat and moisture content, cooking properties, texture and sensory attributes. Steaks made from the coarse flakes had large fat particles and therefore received lower ($P < 0.05$) ratings for physical appearance. Restructured steaks made from the fine particles were more tender ($P < 0.05$) and received significantly higher ($P < 0.05$) textural desirability and overall palatability ratings than restructured steaks made from coarse particles. A mixing time of 5 min resulted in higher scores ($P < 0.05$) for juiciness and tenderness as compared to restructured steaks made from meat mixed for 15 min. Mixing time had no significant effect on cooking losses or binding strength.

Influence of Milk Aeration on Growth of Psychrotrophic Pseudomonads, M. J. Brandt and R. A. Ledford, Department of Food Science, Cornell University, Ithaca, New York 14853

J. Food Prot. 45:132-134

The psychrotrophic microflora of raw milk from a Cornell University herd was examined and the three most frequently occurring isolates (*Pseudomonas* species) were subjected to oxygen concentrations of 1 to 12 ppm and temperatures of 3 to 9°C in growth studies in raw milk. At 3°C, a reduction in oxygen level from 9-12 to 1-3 ppm resulted in a 63% increase in generation time for *Pseudomonas fluorescens*. However, the reduction in growth temperature from 9 to 3°C at 9-12 ppm oxygen produced a 280% generation time increase for *P. fluorescens*. Similar observations were made for the other isolates. An analysis of variance revealed a significant interaction between the effects of oxygen and temperature on growth of the isolates.

A Survey of Milk Flavor and Quality, R. Bassette, D. Y. C. Fung, H. Roberts and G. Ward, Department of Animal Sciences and Industry Kansas State University, Manhattan, Kansas 66506

J. Food Prot. 45:135-138

Six brands of milk sold at Manhattan, Kansas, retail outlets were evaluated for quality on the day the milk was delivered, and again after being held in display cases for a week. Five of the six were in one gallon plastic jugs; the other one was in a 1/2 gallon carton. Only freshly delivered milks were analyzed for chemical composition. Both freshly delivered and stored samples were examined for bacteria, temperature, flavor and some volatile materials. The study continued five weeks, with fresh samples collected weekly.

Only 3 (all from one processor) of the 30 samples were below the 3.25% legal fat limit for Kansas (considering a 0.1% allowance for Babcock testing); they were 2.4, 3.1, and 3.15%. Temperatures of milks held in the display cabinets were generally lower than milk as delivered; only 2 of the 30 samples exceeded 4.5 C (40 F). Fourteen of the milks as delivered exceeded 4.5 C (40 F), but only one 8.5 C (47 F) exceeded the 7 C (45 F) legal limit.

Most bacterial counts (SPC) of freshly delivered milks were within legal limits, but three of the brands of week-old milks had consistently high counts, and most often were >300,000/ml. Psychrotroph counts of milk from the same 3 brands were consistently >300,000/ml after a week in the display case. Only two SPC and four psychrotroph counts from the other three brands exceeded 20,000/ml after one week in the display case.

All milks showed less than one coliform per ml. Flavors tended to deteriorate after one week storage except in two brands that remained good. One of the two was cartoned milk. Gas liquid chromatographic (GLC) analysis of milks showed increases in acetaldehyde, n-pentanal and n-hexanal, which paralleled increases in off-flavors, in milk held in the display cases. There was no apparent relationship between methyl sulfide concentration and tendency of milk to deteriorate in flavor during one week display-storage.

Rapid Fluorometric Determination of Benzo(a)pyrene in Foods, Yasuhide Tonogai, Shunjiro Ogawa, Masatake Toyoda, Yoshio Ito and Masahiro Iwaida, National Institute of Hygienic Sciences, Osaka Branch, 1-1-43, Hoenzaka, Higashi-ku, Osaka 540, Japan

J. Food Prot. 45:139-142

A simple and rapid fluorometric method for determining benzo (a) pyrene in foods was developed. Benzo (a) pyrene is extracted from foods with n-hexane:ether mixture (4:1), purified through a column of activated alumina and determined fluorometrically. An excitation wavelength of 295 nm and emission wavelength of 403 nm were used for calculating concentrations of benzo (a) pyrene. The peak height at 403 nm and baseline between 392 and 418 nm were employed to derive a standard curve for quantitating benzo (a) pyrene. A calibration curve for between 0.04 - 4 ng/ml of benzo (a) pyrene was used. Recoveries of benzo (a) pyrene from 14 kinds of food spiked at levels of 20 and 2ppb were within the range of 79.5 - 93.8% and 50.0 - 80.6%, respectively. The entire procedure takes only one hour with the detection limit being 0.1 ppb. Benzo (a) pyrene detected was reconfirmed by thin-layer chromatography.

Simplified, Rapid Method to Measure Diameter of Bacteriophage Plaques, M. S. Reddy, G. W. Reinbold and E. G. Hammond, Department of Food Technology, Iowa State University, Ames, Iowa 50011

J. Food Prot. 45:143-144

A procedure is described for accurately determining the diameter of bacteriophage plaques down to .05 mm in diameter.

Inactivation of *Bacillus stearothermophilus* Spores in Soybean Water Extracts at Ultra-High Temperatures in a Scraped-Surface Heat Exchanger, S.-C Shih, R. Cuevas, V. L. Porter and M. Cheryan, Department of Food Science, University of Illinois, 1302 W. Pennsylvania Avenue, Urbana, Illinois 61801

J. Food Prot. 45:145-149

The kinetics of thermal inactivation of *Bacillus stearothermophilus* spores in water extracts of soybeans ("soymilk") was studied using a pilot scale scraped-surface heat exchanger. Survivor curves followed typical first-order inactivation reactions, with D-values ranging from 21.9 sec at 259 F to 5.3 sec at 268 F. The z-value was 15 F, corresponding to an activation energy of 88.6 kcal/mole. Lethal effects in the heating and cooling cylinders accounted for more than 50% of the inactivation above a heater outlet (holding) temperature of 265 F.

***Vibrio parahaemolyticus* in Long Island Oysters**, Anthony A. Tepedino, Food and Drug Administration, Department of Health and Human Services, 850 Third Avenue, Brooklyn, New York 11232

J. Food Prot. 45:150-151

Twelve of 36 samples of Long Island oysters were found to contain *Vibrio parahaemolyticus* with a most probable number range of 3.6 to 23 organisms/g. Six of 10 isolates tested were weakly Kanagawa positive. None was pathogenic by the rabbit ileal loop test.

Fate of *Salmonella typhimurium* and *Staphylococcus aureus* in Meat Salads Prepared with Mayonnaise, M. P. Doyle, N. J. Bains, J. L. Schoeni, and E. M. Foster, The Food Research Institute, University of Wisconsin-Madison, 1925 Willow Drive, Madison, Wisconsin 53706

J. Food Prot. 45:152-156

Staphylococcus aureus and *Salmonella typhimurium* were tested for their ability to survive and to multiply in meat salads prepared with different concentrations of mayonnaise and held at 4, 22, and 32 C. When mayonnaise was added to meat salads in amounts recommended by recipes from a reputable cookbook, it inactivated a substantial portion of the initial population of both *S. aureus* (30-60%) and *S. typhimurium* (20-25%). Salads that were refrigerated at 4 C for 24 h evidenced very little growth of either organism whether mayonnaise was present or not. Storing salads at 22 or 32 C for 5 h resulted in <1.0 log₁₀ increase of either organism with the greatest increase occurring in salads containing no mayonnaise. Mayonnaise retarded but did not prevent the growth of *S. aureus* or *S. typhimurium* in salads stored at 22 or 32 C for 24 h. Increasing the concentration of mayonnaise in salads increased the degree to which growth of these organisms was delayed. Contrary to popular belief, the presence of mayonnaise in meat salads tends to retard rather than enhance growth of food-borne pathogens. However, addition of mayonnaise should not be considered a substitute for refrigeration for preserving meat salads from the growth of food-borne pathogens.

***Staphylococcus aureus* Growth and Toxin Production in Nitrogen-Packed Sandwiches**, R. W. Bennett and W. T. Amos, Division of Microbiology, Food and Drug Administration, Washington, DC 20204

J. Food Prot. 45:157-161

Plastic-enclosed sausage, hamburger and turkey sandwiches were inoculated with enterotoxigenic *Staphylococcus aureus* to evaluate the potential hazard of staphylococcal food poisoning in sealed foods maintained in an N_2 environment. The effect of such food storage on staphylococcal growth and enterotoxin production was determined under varying conditions of time (1-31 days) and temperature (8, 12, and 26 C). At 8 and 12 C, none of the sandwiches became toxic after 31 days of storage; however, at 26 C, sausage and hamburger sandwiches became toxic at days 2 and 4, respectively, while remaining organoleptically acceptable. Turkey sandwiches did not support sufficient growth of staphylococci to allow the production of detectable amounts of enterotoxin at any of the temperatures tested.

Moisture Loss from Agar Plates During Incubation, R. N. Alexander and R. T. Marshall, Department of Food Science & Nutrition, University of Missouri, Columbia, Missouri 65211

J. Food Prot. 45:162-163

Composition of media, quantity of medium in petri plates, incubator relative humidity, placement of plates on upper or lower shelf and time in the incubator were important variables in evaporative losses of weight of agar in Petri plates during incubation. However, the most important variable was temperature.

Influence of Electrical Stimulation on Palatability of Hot-Boned, Pre-Rigor and Cold-Boned, Post-Rigor Frozen Beef Roasts, C. L. Griffin, D. M. Stiffler, E. E. Ray and B. W. Berry

J. Food Prot. 45:164-168

The effects of electrical stimulation on palatability of hot-boned, pre-rigor and cold-boned, post-rigor frozen beef roasts were studied by use of 16 steer carcasses. Both sides of 8 carcasses were electrically stimulated (1.5 amps; 100 - 1 s impulses); sides from the other 8 carcasses served as controls. One side of each carcass was hot-boned and the remaining side was boned following a 48 h chill (2 C). Roasts from the rump portion (anterior one-fourth) of the *biceps femoris* muscle were vacuum-packaged and frozen (-20 C). Following a 48-h thaw (0 C), roasts were weighed, measured for length, width and depth, seasoned, placed in cooking bags and roasted to 62.5 C. Cooking losses were less ($P < 0.06$) for hot-boned, pre-rigor frozen vs. cold-boned, post-rigor frozen roasts. Raw pH (post-freezing) was lower ($P < 0.01$) for hot-boned than cold-boned roasts. No differences ($P > 0.05$) were noted in shape changes for stimulation or chilling. Using triangle tests,

untrained panel members were able to distinguish controls from electrically stimulated roasts and hot-boned from cold-boned roasts when served as thick (1.27 cm) or thin (2 mm) samples. Thick and thin samples of cold-boned roasts were preferred over hot-boned roasts. For roasts from carcasses that were not electrically stimulated, 62.6% preferred cold-boned roasts for thick samples while 61.4% preferred cold-boned roasts for thin samples. Cold-boned roasts from electrically stimulated carcasses were preferred over hot-boned roasts, 56.5% (thick) vs. 51.5% (thin). Warner-Bratzler shear force results indicated that hot-boned, control roasts required 79% more shear force than cold-boned roasts, but roasts from electrically stimulated carcasses required 14% more force to shear hot-boned than cold-boned roasts.

Heat Processing of Oysters Naturally Contaminated with *Vibrio cholerae* Serotype 01, B. K. Boutin, J. G. Bradshaw, and W. H. Stroup, Division of Microbiology and Division of Food Technology, Food and Drug Administration, 1090 Tusculum Avenue, Cincinnati, Ohio 45226

J. Food Prot. 45:169-171

Pathogenic *Vibrio cholerae* 0-Group 1 survived for more than 3 weeks in artificial sea water with little loss in viability. Live oysters placed in such contaminated, artificial sea water took up but did not concentrate *V. cholerae*. Heat treatments provided by an in-can pasteurization process and by preparation of naturally contaminated oysters according to common recipes effectively reduced the numbers of *V. cholerae* by 5 logs/g.

Presence and Activity of Psychrotrophic Microorganisms in Milk and Dairy Products: A Review, M. A. Cousin, Animal Sciences Department and Food Sciences Institute, Purdue University, West Lafayette, Indiana 47907

J. Food Prot. 45:172-207

The presence and metabolic activity of psychrotrophic microorganisms in milk and dairy products are reviewed. Problems involved in adequately defining the microorganisms and temperatures of growth are discussed. The sources and incidences of psychrotrophs in milk and dairy products and methods to control these microorganisms are presented. Methods ranging from simple plate counting techniques to detection of metabolites produced by the psychrotrophs are reviewed. Alterations of protein, lipid and carbohydrate fractions of milk and their effects on the keeping quality of milk and dairy products are discussed. Finally, additional research areas are suggested.

JFP Abstracts

Abstracts of papers in the February B Journal of Food Protection

Physical and Sensory Properties of Chicken Patties Made with Various Levels of Fat and Skin, M. J. Buyck, S. C. Seideman, N. M. Quenzer and L. S. Donnelly, Departments of Animal Science and Nutrition-Food Science, South Dakota Agricultural Experiment Station, South Dakota State University, Brookings, South Dakota 57007

J. Food Prot. 45:214-217

Chicken patties were prepared from spent fowl meat and contained either 0, 10, 20 or 30% added skin and fat. One-half of each of these treatments was coated with a calcium alginate film while the other half served as controls. Percentages of fat, moisture, cooking loss and shrinkage, as well as textural properties and sensory attributes, were determined for patties from each formulation/coating treatment. Patties containing 30% added skin and fat lost more moisture during cooking than the all-meat patties. In addition, patties containing 20 or 30% added skin and fat received lower texture desirability ratings as compared to the all-meat patties. No significant differences were observed in juiciness, flavor desirability or overall palatability due to the level of added skin and fat. Chicken patties coated with a calcium alginate film were rated as being significantly more juicy and palatable than patties without a calcium alginate coating.

A Simple Medium for Isolation of Coagulase-Positive Staphylococci in a Single Step, Leonie Mintzer-Morgenstern and Eliyahu Katzenelson, The A. Felix Public Health Laboratory, Ministry of Health, P.O.B. 8255, Tel Aviv, Israel

J. Food Prot. 45:218-222

An agar medium containing NaCl, egg yolk and tellurite for selective quantitative isolation of coagulase-positive staphylococci from food was developed. Isolation and identification of the staphylococci was achieved in a single step. A properly diluted food sample was spread over the medium and incubated for 24 h at 42 C. Coagulase-positive staphylococci appeared as small grey to dark-grey colonies surrounded by a dense white opacity. Coagulase-negative bacteria which, at times, grow on this medium, did not produce this reaction. The identification on this selective medium of isolates from 683 different food samples as coagulase-positive staphylococci was subsequently confirmed by the coagulase test. Comparative titrations of 29 various coagulase-positive staphylococcus strains on both the selective medium and nutrient agar yielded nearly identical titers. The growth of heat-stressed staphylococci was inhibited by the selective medium. Complete reversal of the inhibition was achieved by a 3-h pre-incubation in brain heart infusion at 37 C.

A Comparative Study of the Microbiology of Commercial Vacuum-Packaged and Hanging Beef, R. W. Johnston, M. E. Harris, A. B. Moran, G. W. Krumm and W. H. Lee, Science, Food Safety and Quality Service (FSQS), United States Department of Agriculture (USDA), 321 ARC-East, Beltsville, Maryland 20705

J. Food Prot. 45:223-228

The microbiological quality of 150 samples of commercial vacuum-packaged beef knuckles and 150 samples of non-vacuum-packaged hanging beef knuckles were tested. Samples were obtained at random from commissaries at several locations just before distribution of the beef to retail stores. In general, the vacuum-packaged beef had 1 to 2 logs higher indicator bacterial levels than the hanging beef. The odor and appearance of all 300 samples of beef were normal, even though some individual beef samples had rather high bacterial counts. *Salmonella* was detected in only 1 sample out of all the 300 tested. *Yersinia enterocolitica* was recovered from 66 samples of vacuum-packaged beef and from only 4 samples of hanging beef. None of the *Y. enterocolitica* recovered from beef contained the virulence plasmid or were virulent to mice. Most probably these rhamnase-positive and esculin-positive *Y. enterocolitica* strains recovered from vacuum-packaged beef are not a potential health hazard.

The Inability of Pyrolysis Gas-Liquid Chromatography to Differentiate Selected Foodborne Bacteria, Norman J. Stern, Meat Science Research Laboratory, Agriculture Research, SEA, Beltsville Agricultural Research Center, Beltsville, Maryland 20705

J. Food Prot. 45:229-233

Pyrolysis gas-liquid chromatography (PGLC) and stepwise discriminant analysis (SDA) were ineffective when used to differentiate selected genera, species and strains of foodborne microorganisms. Each of 18 individual bacterial strains analyzed was grown, harvested and subjected to PGLC analysis. The resulting pyrolysis products were separated on a high resolution capillary column and the elution patterns (pyrograms) were subjected to stepwise discriminant analysis of 26 (a-z) characteristic peaks. Classification with the combination of PGLC and SDA was 87% accurate for gram-negative strains of bacteria and 94% accurate for gram-positive strains of bacteria. PGLC-stepwise discriminant analysis correctly discriminated 80% of the bacterial strains according to the known gram-stain reactions. Only 63% were correctly classified to the genus level when all samples were compared. These findings point out the weak points for this method of bacterial analysis.

Toxin Production by *Clostridium Botulinum* in Media at pH Lower Than 4.6, Nobumasa Tanaka, Food Research Institute, Department of Food Microbiology and Toxicology, University of Wisconsin-Madison, 1925 Willow Drive, Madison, Wisconsin 53706

J. Food Prot. 45:234-237

Clostridium botulinum types A and B were able to produce toxin in media containing high concentrations of proteins at pH well below 4.6. A medium containing 15% pork, 0.5% yeast extract, 0.5% glucose and 0.05% cysteine-HCl at an initial pH between 4.30 and 4.36 produced a toxic sample in as early as one week of incubation at 30 C. Toxin production occurred only when large amounts of precipitated protein were present. The presence of other microorganisms was not required for botulinum toxin production. Media prepared with hydrolyzed protein did not have precipitates and did not support production of botulinum toxin at pH lower than 4.6. Since large amounts of precipitated protein seemed necessary for botulinum toxin production, the possibility of the presence of small, localized pockets of higher pH values within the matrices of precipitated protein could not be ruled out.

Replicate Counting Errors by Analysts and Bacterial Colony Counters, J. T. Peeler, J. E. Leslie, J. W. Danielson and J. W. Messer, Department of Health and Human Services, Public Health Service, Food and Drug Administration, Division of Microbiology, Cincinnati, Ohio 45226 and Food and Drug Administration, Minneapolis Center for Microbiological Investigations, Minneapolis, Minnesota 55401

J. Food Prot. 45:238-240

Replicate counting errors were computed when a plate of a sample of pasteurized milk was counted twice by one analyst and twice by two analysts. The results were used to make recommendations for revising methods for the determination of bacterial counts of milk in *Standard Methods for the Examination of Dairy Products* and to evaluate the counting accuracy of four bacterial colony counters used to enumerate the aerobic plate count of 14 food products.

Inhibition of *Escherichia coli* Trimethylamine-N-oxide Reductase by Food Preservatives, M. Kruk and J. S. Lee, Department of Food Science and Technology, Oregon State University, Corvallis, Oregon 97331

J. Food Prot. 45:241-243

Trimethylamine-N-oxide (TMA-O) reductase activity of resting cells of *Escherichia coli* was inhibited by tetrasodium ethylenediaminetetraacetate (Na₄EDTA), benzoic acid (BA) and methylparaben (MP). The 50% inhibitory concentrations of Na₄EDTA, BA and MP were 20.2, 1.2 and 32.4 mM, respectively. BA at pH 6.5 or below most effectively inhibited the TMA-O reductase. Sorbic acid (SA), up to 0.70 mM, had no effect on TMA-O reductase activity, but SA inhibited the growth and subsequent TMA production in *E. coli* at or above 0.35 mM.

Effect of Pre-Cure Freezing and Thawing on the Microflora, Fat Characteristics and Palatability of Dry-Cured Ham, J. D. Kemp, B. E. Langlois and A. E. Johnson, Food Science Section, Department of Animal Sciences, University of Kentucky, Lexington, Kentucky 40546

J. Food Prot. 45:244-248

Hams were placed in cure after thawing by 3 methods: at 2C, at 16C, and in water at 37C. A fourth group was placed in cure while still frozen. Microbiological populations and fat rancidity tests were determined at various intervals during processing. Sensory scores and tenderness values were determined after 3 months of aging. *Clostridium perfringens*, *Bacillus cereus*, *Escherichia coli*, coliforms and enterococci were not detected after salt equalization. Hams cured without thawing had lower initial bacterial, yeast and mold counts but no differences among thaw groups were observed in counts during aging. Hams thawed in water had lower flavor and overall satisfaction scores than the other groups. Fat breakdown as noted by FFA, TBA and peroxide values increased with aging but were erratic although ham cured without thawing had lower peroxide values. Satisfactory dry-cured aged hams were produced regardless of method of thawing. However, since hams cured without thawing had less weight loss, lower peroxide numbers, lower initial microbial counts and similar final microbial counts and sensory scores, it appears that hams do not need to be thawed to produce dry-cured aged hams.

Surfactants for the Effective Recovery of *Salmonella* in Fatty Foods, J.-Y. D'Aoust, C. Maishment, P. Stotland and A. Boville, Health Protection Branch, Health and Welfare Canada, Sir Frederick Banting Research Center, Tunney's Pasture, Ottawa, Ontario, Canada K1A 0L2

J. Food Prot. 45:249-252

Inhibitory concentrations of 8 surfactants were determined for *Salmonella typhimurium* and *Salmonella enteritidis*. Pure culture work resulted in the exclusion of Tween 20, Teepol 610 and Brij 35 and retention of Tergitol-7 (T-7), Tween 80 (TW 80), Triton X-100 (TX), Myrj 52S (M), and Arlacel 80 + Tween 60 (AT) for a study on the quantitative recovery of *Salmonella* in 45 naturally contaminated fatty foods. Replicate food samples (100 g) were preenriched overnight at 35 C in nutrient broth supplemented with 3% (w/v) surfactant except AT (10%). Serial dilutions of preenrichment cultures were selectively enriched overnight in tetrathionate brilliant green (43 C) and selenite cystine (35 C) broths and streaked on bismuth sulfite and brilliant green sulfa agar media. Recovery with all test surfactants was comparable to that obtained with nutrient broth controls; of 270 preenrichment cultures tested, only 7 false-negative results attributable to TX (3), AT (2), M (1), and nutrient broth control (1) were obtained. None of the surfactants consistently yielded greater populations of *Salmonella* for given foods or food categories; median counts for preenrichment cultures were 10⁴-10⁵ salmonellae/ml for low and high moisture foods and 10⁶-10⁷ salmonellae/ml for animal feeds. These results suggest that use of surfactants to facilitate detection of *Salmonella* in fatty foods is not warranted.

Effect of Temperature and pH on the Survival of *Campylobacter fetus*, F. M. Christopher, G. C. Smith and C. Vanderzant, Department of Animal Science, Texas Agricultural Experiment Station, Texas A&M University, College Station, Texas 77843

J. Food Prot. 45:253-259

Test strains of *C. fetus* subsp. *jejuni* and *C. fetus* subsp. *intestinalis* failed to survive heating in skimmilk at 60 C for 1 min. A few strains survived heating in skimmilk at 55 C for 1-3 min. D_{50C} values for *C. fetus* subsp. *jejuni* and *C. fetus* subsp. *intestinalis* in skimmilk ranged from 1.3-4.5 and from 1.0-3.7, respectively. No survivors of *C. fetus* subsp. *jejuni* and *C. fetus* subsp. *intestinalis* were detected in beef roasts inoculated at levels of 10^6 - 10^7 viable cells per g when the final temperature in the center was 57 and 55 C, respectively. At an internal temperature of 50-53 C, survivors of *C. fetus* were detected in beef roasts. Storage of skimmilk, beef and ground beef inoculated with *C. fetus* at -20, 1, 10, 20, 30 or 40 C resulted in decreases in *C. fetus* count. Survival of *C. fetus* was best at 1 and 10 C. Rapid increases in *C. fetus* counts occurred at 37 C in Brucella broth adjusted to pH 6-8. At pH 5, no survivors were detected after 24 h. At pH 9, counts of *C. fetus* subsp. *jejuni* decreased rapidly while those of *C. fetus* subsp. *intestinalis* increased slightly.

Examination of Poultry Giblets, Raw Milk and Meat for *Campylobacter fetus* subsp. *jejuni*, F. M. Christopher, G. C. Smith and C. Vanderzant, Department of Animal Science, Texas Agricultural Experiment Station, Texas A&M University, College Station, Texas 77843

J. Food Prot. 45:260-262

An MPN procedure was used to determine the presence of *Campylobacter fetus* subsp. *jejuni* in poultry giblets. This procedure consists of (a) subculturing a sample in Brucella broth supplemented with 0.15% agar, 0.05% sodium pyruvate and the following antimicrobial agents per liter: vancomycin 10 mg, trimethoprim 5 mg, polymyxin B sulfate 2,500 IU, amphotericin B 2 mg and cephalothin 15 mg and (b) subsequent streaking of a loopful of Brucella broth held at 42 C for 48 h on plates of Brucella agar supplemented with 10% defibrinated horse blood and the concentrations of antimicrobial agents identified above. *C. fetus* subsp. *jejuni* was present in 85% of the chicken livers and in 89% of the chicken gizzards obtained immediately after evisceration. The organism was not recovered from samples treated with chlorinated water. *C. fetus* subsp. *jejuni* was not recovered from raw milk (bulk tank samples or individual cow samples) or from beef (*infraspinatus* or *biceps femoris* muscles).

Growth of *Salmonella typhimurium* and Mesophilic Organisms on Beef Steaks as Influenced by Type of Packaging, L. S. Luiten, J. A. Marchello and F. D. Dryden, Department of Animal Sciences, University of Arizona, Tucson, Arizona 85721

J. Food Prot. 45:263-267

Two trials, each utilizing 72 samples of fresh beef loin steak, were done to determine the effects of various packing systems upon growth of *Salmonella typhimurium*. Samples were inoculated with 10^5 cells/cm² of the organism and randomly assigned to four packaging treatments: (1) overwrapping in oxygen-permeable film; (2) vacuum packaging; (3) packaging in barrier bags flushed with a 60% CO₂: 40% O₂ gas atmosphere then evacuated and sealed; and (4) packaging in barrier bags filled with a 60% CO₂: 40% O₂ gas atmosphere. Twelve steak samples were inoculated with *S. typhimurium*

and 6 were uninoculated and served as a control in each treatment group. Samples were displayed in retail meat cases at 10 C for 3, 6 or 9 days, when they were evaluated for shrinkage and numbers of mesophilic organisms and *S. typhimurium*. Percent shrinkage was not affected ($P>0.05$) by packaging treatment. Counts of mesophilic organisms were similar ($P>0.05$) for vacuum- and gas-treated steaks, which were significantly lower ($P<0.05$) than counts from film overwrapped samples. Numbers of *S. typhimurium* increased significantly ($P<0.05$) during storage on samples wrapped with oxygen permeable film but remained low and fairly constant for vacuum- or gas-treated steaks. After 9 days of display, the film overwrapped steaks had greater ($P<0.05$) numbers of *S. typhimurium* than those of other treatments, whereas steaks held within the 60% CO₂: 40% O₂ gas atmosphere had lowest numbers overall.

Growth of *Staphylococcus aureus* on Beef Steaks as Influenced by Type of Packaging, L. S. Luiten, J. A. Marchello and F. D. Dryden, Department of Animal Sciences, University of Arizona, Tucson, Arizona 85721

J. Food Prot. 45:268-270

Beef loin steaks were inoculated with 10^5 cells of *Staphylococcus aureus*/cm² in two separate trials to determine the effects of different packaging treatments upon the organism's growth. Each trial utilized 72 samples which were randomly assigned to four packaging treatments: (1) overwrapped in oxygen-permeable film; (2) vacuum packaged; (3) packaged in barrier bags flushed with a 60% CO₂: 40% O₂ gas atmosphere then evacuated and sealed; and (4) packaged in barrier bags filled with a 60% CO₂: 40% O₂ gas atmosphere. In each treatment group, 12 samples were inoculated with *S. aureus* while 6 were uninoculated and used as controls. All samples were displayed under simulated retail conditions at 10 C and enumerated for *S. aureus* after 3, 6 and 9 days. Numbers of *S. aureus* remained relatively constant for all treatments throughout the 9 day period. Results from a comparison of treatments for Trials I and II were variable; however, no significant treatment effects were found when data from both trials were pooled.

Effects of Pre-cure Storage and Smoking on the Microflora and Palatability of Aged Dry-cured Hams, B. E. Langlois, J. D. Kemp and A. E. Johnson, Department of Animal Sciences, Food Science Section, University of Kentucky, Lexington, Kentucky 40546

J. Food Prot. 45:271-275

Forty-two similar weight hams were held 3 and 6 days postmortem at 2 C, dry-cured, and held at 13 C for 4 weeks for salt equalization. Half were then smoked and half were not smoked. All hams were aged for 3 months at 24 C. Six hams from each group were selected for external microbial evaluation and three were selected for internal microbial evaluation before curing, after curing, after salt equalization or smoking, and after aging 1, 2 and 3 months. Aerobic counts were higher in hams held 6 days than in those held 3 days but the difference decreased as processing time progressed. Smoking decreased

surface counts. Enterococci, *Bacillus cereus* and fluorescent pseudomonads counts were initially low and these organisms were virtually absent after aging 1 month. Coliforms were initially low and were not detected after salt equalization. Staphylococci increased through 3 months of aging with very few isolates being coagulase-positive. Yeasts and molds increased gradually through processing and aging. No *Clostridium perfringens* or *Salmonella* were detected in uncured hams. There were no significant differences in palatability traits due either to pre-cure holding time or smoking.

Effect of Nozzle Configuration and Size on Water Absorbed by Meat During Cleaning, M. E. Anderson, R. T. Marshall, W. C. Stringer and H. D. Naumann, U.S. Department of Agriculture, Science and Education Administration, 113 Eckles Hall, University of Missouri, Columbia, Missouri 65211 and Department of Food Science and Nutrition, University of Missouri-Columbia, Columbia, Missouri 65211

J. Food Prot. 45:276-278

Our previous studies suggested the need to study absorption and evaporation of water from meat during cleaning with water sprays. This article describes the effects of type of meat surface, line pressure, size and configuration of nozzle, and speed of meat travel past the nozzle on water absorption and percent shrinkage after 24 h. Cut meat surfaces had a higher percent gain and lower percent shrinkage than did uncut surfaces. Pressure had no significant effect on percent shrinkage. Solid stream nozzles caused a higher percent gain and a lower percent shrinkage than did flat fan nozzles. As the size of the nozzle was increased, the percent gain increased and the percent shrinkage decreased. The slowest speed of meat travel past the nozzles (5 cm/s) caused the highest percent gain in weight.

Bacteriological Quality of Soft-Serve Mixes and Frozen Products, J. J. Ryan and R. H. Grough, Department of Dairy Science, Louisiana Agricultural Experiment Station, Louisiana State University, Baton Rouge, Louisiana 70803

J. Food Prot. 45:279-280

Coliform and total bacteria counts of soft-serve mixes and frozen soft-serve products were collected over a 21 month period. The mix data set consisted of 252 samples of which

10.71% contained >50,000 total bacteria/g and 7.54% contained >10 coliforms/g. The product data set consisted of 817 samples of which 38.51% contained >50,000 total bacteria/g and 51.22% contained >10 coliforms/g. Since mix and product data sets were from sample surveys, it was not possible to determine the specific mix used to produce a specific product.

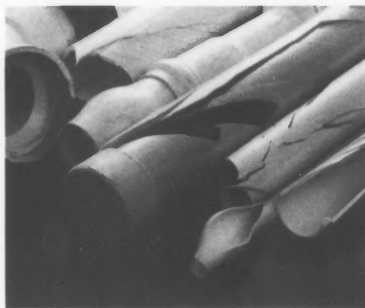
Effect of Chloride Salts and Nitrite on Survival of Trichina Larvae and Other Properties of Pork Sausages, R. N. Terrell, A. B. Childers, T. J. Kayfus, C. G. Ming, G. C. Smith, A. W. Kotula and H. K. Johnson, Meats and Muscle Biology Section, Department of Animal Science, Texas Agricultural Experiment Station and Department of Veterinary Public Health, College of Veterinary Medicine, Texas A&M University, College Station, Texas 77843

J. Food Prot. 45:281-284

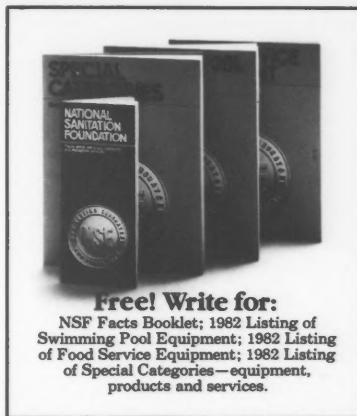
Two experiments were conducted using trichinae-infected pork shoulders. In the first experiment, samples of ground pork shoulder were allocated to the following treatments: (a) sodium nitrite levels of 0, 75 or 150 ppm, and (b) chloride salt levels of 2.5% sodium chloride, 3.18% potassium chloride, 1.35% magnesium chloride and 1.58% calcium chloride (for the latter three chloride salts, ionic strengths equivalent to that of 2.5% sodium chloride were used). In the second experiment, samples of ground pork shoulder were allocated to treatments in which 0, 25, 50, 75 or 100% of the sodium chloride was replaced with a 70:30 mixture of magnesium chloride: potassium chloride. Pork sausage links were made and stored for 12 d in a refrigerated display case. All chloride salts numerically reduced total plate counts compared to controls (no added salts) and calcium chloride or magnesium chloride significantly reduced total plate counts ($P < .05$). However, addition of sodium nitrite (75 or 150 ppm) did not affect total plate counts. Percentages of dead trichina larvae (visually determined) were greater ($P < .05$) for potassium chloride and sodium chloride than for magnesium or calcium chloride. However, in the second study when salts of equivalent ionic strengths were not used, replacement of sodium chloride with a 70:30 mixture of magnesium chloride: potassium chloride did not affect (increase or decrease) pH, total plate count or juice-loss during cooking. Percentages of dead trichina larvae increased for the 75 and 100% replacement levels when compared to controls.

What does NSF do and how do we do it?

The National Sanitation Foundation, known as NSF, is an independent, nonprofit organization of scientists, engineers, technicians, educators and analysts. We serve as a trusted neutral agency for government, industry and consumers, helping these groups to resolve differences and achieve solutions to problems of public health and the environment. Our professional staff is involved in projects related to water treatment, air quality and improved disposal of solid and liquid wastes, including hazardous waste processing. We develop standards and criteria in selected public health and environmental areas and engage in research and testing.



In 1948, the National Sanitation Foundation developed a methodology that could establish uniform national voluntary standards for public health and environmental quality — standards based on facts, sound engineering and fundamental principles. The standard development program which evolved is designed to bring



Free! Write for:

NSF Facts Booklet; 1982 Listing of Swimming Pool Equipment; 1982 Listing of Food Service Equipment; 1982 Listing of Special Categories—equipment, products and services.

together people with mutual interests to study the problem, define the need, outline the necessary research and establish national uniform voluntary sanitation requirements.

These procedures have resulted in the publication of nearly fifty standards and criteria relating to food service equipment, water and wastewater treatment equipment, swimming pool water circulation equipment, radiation monitoring, health care equipment and plumbing products for mobile homes and recreational vehicles.

The NSF building in Ann Arbor, Michigan, houses the testing

laboratory and staff. Actually, this facility is a number of laboratories which carry out specialized functions in physical, chemical and microbiological testing. The laboratory evaluates products which are shipped to Ann Arbor, hopefully to gain authorization to use the NSF seal, and retests products which already have the seal. This retesting is done to assure continued compliance with the standards under which these products are produced.

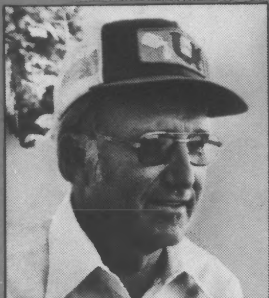
If you have a question regarding standards, listings or field services call Tom S. Gable, Senior Vice President, (313) 769-8010. If you prefer to write, our address is listed below.



National Sanitation Foundation

Offices and laboratories, P.O. Box 1468, Ann Arbor, MI 48105 Phone: (313) 769-8010

SOMEONE YOU SHOULD KNOW IN THE DAIRY INDUSTRY



Ed Kaeder, Milk Quality Fieldman

Mr. Kaeder is Field Supervisor, member services for Mid-America Dairymen Inc., Northern Division—a regional dairy cooperative. He was born and raised on a dairy farm and graduated from the University of Minnesota in dairy husbandry in 1944. He worked as an extension fieldman before becoming involved in milk quality control more than 30 years ago.

"The anatomy of a good fieldman involves being familiar with milk products from the cow all the way through to the customer's table. Since fieldmen work with dairy farmers whose livelihood is production of milk, it is only right to note that milk is probably the most regulated agricultural product in America today. In many cases, government regulates the flow of products, sets minimum prices, and makes rules under which we operate. Basically the fieldman functions as the milk plant's personal contact with its members and is a goodwill ambassador.

"There are many reasons a fieldman will contact members, but the main reason is usually quality. Other calls may be about Grade A requirements, herd health, flavor control, farm building plans, milking equipment installations, arrangements for purchase of equipment, member relations dealing with problems and complaints.

Knowledge And Testing Important

"There are many tools for the fieldman to use in assisting the producer of high quality milk. Among these are the numerous tests done by every dairy plant. The fieldman must be familiar with these tests: raw count, pasteurized count, cell counts and keeping quality.

"Care of milking equipment is important as well because no other piece of equipment on the farm will get an unsuspecting or careless operator into trouble faster than a faulty or poorly operated milking machine. Lack of proper sanitation will increase bacteria counts, and poor operation will contribute to poor udder health.

"The fieldman must be thoroughly familiar with cleaning and sanitizing compounds and their various uses. He must be in a position to help the dairy producer set up a cleaning program to be followed after each milking, and assure there are no shortcuts in the procedure.

"Requirements for the production of Grade A milk are spelled out in detail in the Grade A Pasteurized Milk

Ordinance (PMO), a publication of the FDA and U.S. Public Health Service. We must be able to translate and interpret these requirements for members so they can and will maintain a Grade A status.

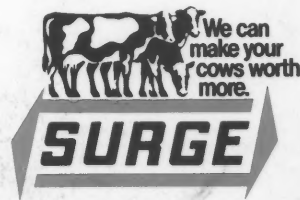
"We are involved in herd health with dairymen too, especially in areas relating to causes and prevention of mastitis. We must be able to make use of tools and testing devices because they can tell a great deal and be an aid in educating the dairyman.

"The problem of antibiotics in the milk supply seems to require more and more of our time and attention. Processors can't make cheese and cultured products from antibiotic milk because desirable bacteria will not grow, and any drug residues are unacceptable in milk.

"Working closely with milk haulers is another important aspect for the fieldman since most haulers have the closest and most frequent contact with members. A conscientious hauler is invaluable to us in performing effective fieldwork for the dairyman.

"Today dairy farmers account for only about 0.1% of the population. The distance between active dairy farms becomes longer and, in the interest of energy conservation, and making the most of the dairyman's time, a daily plan of farm calls in a given area is outlined so a minimum amount of time and miles will be expended in driving.

"In summary, I will say that the anatomy of a good fieldman is public relations. In this analogy public relations means selling yourself by being interested, optimistic and enthusiastic about the job at hand, and being informed on all aspects of milk, the industry and your organization."



7