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DAIRY, FOOD AND ENVIRONMENTAL

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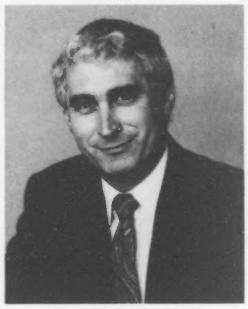

By
Michael P. Doyle
IAMFES President

Seldom does a day go by that we don't read in the morning newspaper or hear on the evening news about some issue related to the safety of food. Whether it be *Salmonella enteritidis* in eggs, *Listeria* in cheese, *E. coli* O157:H7 in ground beef, hepatitis virus in seafoods, or *Salmonella* in cantaloupes, there are constant reports raising concerns about the safety of our foods. However, thanks to the efforts of scientists researching these problems, quality assurance personnel implementing appropriate control strategies, and food hygienists verifying the use of sanitary practices in food production and processing, our food is safer than ever before.

The success of our efforts to provide safe food is largely dependent on education and the dissemination of timely information related to food protection. Education and information transfer are important functions of professional societies. There are several professional societies that address food safety issues as part of their agenda. However, very few organizations consider food safety to be the focal point of their mission. A need exists for a professional society that focuses principally on issues of food safety. **IAMFES** is the organization to fill this role.

What, you might ask, qualifies **IAMFES** to assume this role? The answer is (1) a membership of more than 2800 scientists, quality assurance personnel, or food hygienists with an interest in food safety, (2) a journal *(Journal of Food Protection)* that is recognized as a leading publication of scientific articles on the microbiological safety of foods, (3) a magazine *(Dairy, Food and Environmental Sanitation)* that provides timely practical information to the practicing food hygienist, (4) a composite of Professional Development Groups that publish authoritative documents on sanitary practices and equipment standards and on foodborne disease, (5) an audiovisual library for use in food safety training, and (6) an annual meeting that addresses international issues in food safety. Clearly, **IAMFES** is poised to be the leader in the food safety arena.

It is my goal to establish **IAMFES** as **THE INTERNATIONAL FORUM FOR ISSUES ON FOOD SAFETY**. What needs to be done to make this goal a reality? First, we need to increase our membership. Certainly there are more than 2800 professionals in the world who are involved in research, food production or processing, or regulatory affairs which relate to food safety. Secondly, we need to increase the participation of our membership in **IAMFES** activities. There are many opportunities for **IAMFES** members to not only contribute to the workings of the organization, but also, through their participation in **IAMFES** activities, contribute to the improved safety of our food supply internationally.

The challenge is before us. Our organization is poised to serve the role. Let's seize the opportunity to make **IAMFES** **THE INTERNATIONAL FORUM FOR ISSUES ON FOOD SAFETY.**

On My Mind . . .

By
Steven K. Halstead, CAE
IAMFES
Executive Manager

is TROUBLE . . .

Isn't it amazing how the inappropriate actions of a few within an industry can cause everybody else in that industry trouble. Charitable organization's are under fire because of the actions of a few at United Way. Congress is under fire because of the actions of a few bad check writers. Athletes are under scrutiny because a few have used steroids. The dairy industry is being criticized because of a few dairies' problems in adding vitamins to milk.

The following article appeared in the May 11, 1992 issue of *TIME* magazine, on page 17. (Ignore the fact that the article doesn't support the headline!)

A Problem with Milk — Vitamin D routinely added by dairies usually goes in at the wrong dosage

No one knew why eight patients entered New England hospitals with vitamin D overdoses, but researchers wanted to find out. Too little of this crucial vitamin can lead to bone weakness and rickets, the deforming of bones in growing children. That's why D, found naturally in only a few foods (including the seriously disgusting cod liver oil), has been routinely added to milk since the 1930s. But too much of the vitamin is no bonus; the symptoms range from fatigue to urinary-tract stones to kidney malfunction — and, in infants, the condition known as "failure to thrive," which can lead to death.

A little medical detective work revealed that none of the patients were taking vitamin supplements, the usual source of such overdoses. But all eight routinely drank milk from a single dairy. And when doctors tested samples of the milk, they were shocked to find that it had up to 500 times the vitamin D level marked on the label and recommended by the FDA. Worse yet, a wider study covering 13 brands of milk in five Eastern states turned up levels well below or appreciably above the suggested dosage. Infant formulas tended to be the highest, while some skim milk had no D at all. The doctors, whose report appeared in last week's New England Journal of Medicine, don't recommend eliminating vitamin D from milk; that was tried in England, and rickets cases shot up. But they do say milk monitoring, which is the states' responsibility, has got to be done much more often, and more carefully.

Clearly, quality control got away from somebody and purchasers ended up buying milk containing too much vitamin D in some cases, and none at all in others.

Now, the entire industry is in trouble because of the actions of a few.

Because of this incident, there is an outcry for more government regulation in the dairy industry to ascertain that milk contains the proper amount of Vitamin D. Ignoring the tempting bait to discuss the issue that the public always cries for more government regulation, I would rather focus on the actions of the people involved.

How much longer would it have taken to do the job right the first time? Was it really faster just to guess at the right amount and pour away?

Did the person responsible know that too much vitamin D can cause problems, or did he/she hold that all too common belief in our health conscious society that "if one vitamin pill is good, two are better and three is best?" With that kind of attitude, who would not choose to add too much instead of too little.

Often, the question is asked, is quality control a question of management or is it totally within the realm of production? The guru of Total Quality Management, W. E. Demers, holds that the worker needs to be not only responsible for quality control, but also to be held accountable for it.

If the worker can be held accountable, then the possibility of repeats of the above are diminished. With fewer incidents of this nature, we'll have less need for regulation. With less regulation we can perhaps see improvement in the lives of our overworked and underpaid sanitarians.

I doubt that the persons involved created this trouble intentionally. But, the trouble is here and the entire dairy industry will suffer for it.

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Control of Pathogens in Ready-to-Eat Meats

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The following article originally appeared in the March, 1991 issue of SCOPE, a quarterly technical bulletin published by Silliker Laboratories Group, Inc., Chicago Heights, IL.

ABSTRACT

From 1983 to 1987, bacterial pathogens accounted for the largest number of outbreaks (66%) and cases (92%) among foodborne illness outbreaks of known etiology, according to the Centers for Disease Control (CDC).[5] Other known causes including chemical agents (26% of outbreaks and 2% of cases); parasites (4% of outbreaks and < 1% of cases); and viruses (5% of outbreaks and 5% of cases) pale in comparison.

The causative agents of bacterial foodborne illness attributable to consumption of meat or meat products are usually those found in the environment of the living meat animal, on the animal's body, or in its alimentary tract. Because of the defense mechanisms functioning in the healthy, living animal, and the physical barriers of the gastrointestinal tract and the animal's skin, muscle tissue is essentially sterile. Even so, sanitary slaughtering operations with antemortem and postmortem veterinary inspection can only control the numbers of pathogenic bacteria in the raw meat supply, not eliminate them completely.

Therefore, hygienic processing, handling, and preparation are essential whether in the home of the consumer, in the manufacture of ready-to-eat products, or in the food service establishment. Application of current and developing knowledge of microbial ecology is necessary in product development, and scale-up of new product concepts and commercial processes in order to avoid problems with illnesses caused by foodborne pathogens.

Ready-to-eat (RTE) meat products have been grouped according to common processing techniques and finished product characteristics that determine their organoleptic and microbiological characteristics and storage stabilities.[44] These categories with product characteristics and examples are listed in Table 1. Although this report will focus on RTE meat products of the perishable, cooked cured, and uncured varieties, the relatively shelf-stable products are included in Table 1 for comparison.

FOODBORNE PATHOGENS OF CONCERN

Bacterial pathogens may be of concern in RTE meat products because: 1) certain pathogens have a history of involvement in foodborne illness with a given product; 2) the pathogens have been shown to be present in and able to survive processing of a given product; 3) they may survive or may be introduced by post-cooking contamination and proliferate in the product under specific conditions; or 4) they may be linked epidemiologically to a particular disease syndrome without cultural confirmation. The association of bacterial pathogens with meat or meat products and the contributing factors involved have been subjected to fairly extensive reviews.[4,5,11,21,26]

Salmonellosis

In the United States and Canada, *Salmonella* spp. (other than *S. typhi*) cause the greatest number of foodborne illness cases annually.[42,43] Red meat items were associated with 32.5% of traceable salmonellosis outbreaks occurring in the U.S. between 1977 and 1984.[11] Genegeorgis[21] concluded that under-cooking, cross-contamination, and inadequate cooling were the principle contributing factors leading to outbreaks of meatborne salmonellosis when processing plants were the source of the problem.

Outbreaks of salmonellosis from consumption of rare roast beef occurred during the mid 1970's.[12,13,28,33] In response, the USDA promulgated regulations requiring that all commercially cooked beef (water-cooked, roast, and corned beef) be processed to a minimum internal temperature of 145°F (62.7°C),[1] making commercial production of "rare" roast beef unattainable. Subsequently, industry-sponsored studies[23] resulted in expansion of the regulations to permit retention of rare roast beef internal color (<135°F or 57.2°C) while assuring a 7-D kill of inoculated Salmonellae (e.g., 130°F, 121 min.). Subsequent outbreaks of salmonellosis traced to roast beef have been due to post-cooking cross-contamination or failure to adhere to the established heating and holding regimens.[27]

Campylobacter

Over the past decade thermophilic *Campylobacter* sp. (*C. jejuni*, *C. coli*, and *C. laridis*) have been recognized as potential foodborne pathogens.[7,14] From 1978 to 1982, 234 cases of foodborne campylobacteriosis were reported in the U.S. and Canada.[42,43] However, campylobacteriosis is believed to be one of the more severely under-reported food-

Table 1. Categories and characteristics of ready-to-eat meat products (1).

Category	Characteristics	Examples	Spoilage Microorganisms	Pathogens
1. Raw salted, cured meats	≥4 oz. salt may be cold (e.g., 37.8°C)	Dry-cured hams (Prosciutto, country style)	yeast & mold growth (high humidity)	*Staphylococcus aureus*
2. Perishable, cooked uncured	Minimum int. temp. (MIT) 62.8 - 71.1°C depending on product. Refrigerated or frozen, may be MAP* packaged not in rigid container	Cooked beef patties meat pies, roast beef or pork, poultry rolls, cooked deboned poultry meat, bratwurst	Dependent on packing Pseudomonas spp. (aerobic) lactic acid bacteria (anaerobic) yeasts and mold	*salmonellae*, *C. botulinum* *C. perfringens*
3. Perishable cooked, cured products	Minimum Int. temp. 58.3 - 76.7°C depending on product. Stored at 72°C or less. Usually vacuum packaged	Ham, franks bologna, corned beef, lunch meats, jellied meats	Same as above, *Brochothrix thermosphacta* *Proteus* spp., *Enterobacter* *Hafnia* ssp. *Lactobacillus*	*C. botulinum* *S. aureus*
4. Perishable canned cured	≥3.0% brine 15c ppm nitrite MIT 65.6 - 68.3°C storage 4.4 - 7.2°C up to 1 year	Perishable canned ham	*Lactobacillus viridescens* *Clostridium putrefaciens*	*C. botulinum* (If improperly processed)
5. Shelf-stable canned cured products	1. Fo>2.78	1.) Vienna sausage, corned beef, meat spreads	*micrococci* (poor vacuum, reduced brine, residual nitrate	*C. botulinum* (If improper thermal processing)
	2. Fo>0.1-0.7	2.) Shelf stable canned hams ≤3 lb.		
	3. Low water activity products. (A_w≤0.92)	3. Sliced dried beef in jars, bacon bits		
	4. Low pH (pickled) products	4.) Pickled sausages pigs feet	None published	
6. Shelf-stable canned uncured products	1. Fo≥2.78 e.g., Fo = 6.0) and pH) 4.6	1). Roast beef with gravy, beef stew chili can carnie, whole chicken, Spaghetti with meat balls		None published
	2. pH≤4.6 Fo≤2.78	2). Sloppy joe and spaghetti sauce mixes with meat		
7. Dried Meats	Moisture: Protein ratios e.g., 0.75; 1 2.0:1	beef jerky, beef sticks, freeze dried meat and poultry	*Aspergillus* spp.	*C. Botulinum* (improper preparation)

(1) Adapted fromTompkin[44].
*Modified atmospheric packaging.

borne illness[3], and conservative estimates approach 190,000 cases per year for the U.S. and Canada.[42,43] Levels of contamination in dressed carcasses of red meat animals and poultry are high.[14,31,41] However, the organism is sensitive to heat (D_{57C} = 1 min), cannot grow below 30°C, and declines in numbers during storage (slowly under refrigeration, more rapidly at room temperature).[6]

C. jejuni has also been shown to be sensitive to NaCl (1.75% NaCl maximum for growth).[16] These factors, together with the strictly microaerophilic and capnophilic (CO_2-loving) nature of the organism (optimum atmospheric composition: 5% O_2, 8-10% CO_2, 85% N_2), may account for the relatively low incidence levels of campylobacteriosis reported. Most outbreaks of campylobacteriosis have been caused by under-pasteurized milk or contaminated water.[8] Foodborne outbreaks have been attributed to consumption of raw or under-cooked meat or poultry or to recontamination after cooking.[21]

Pathogenic *Escherichia coli*

Several types of pathogenic *Escherichia coli* have been recognized as causes of diarrheal illness. Collectively the

types are termed "enteropathogenic *E. coli*:"[15,30]

- "Classical" enteropathogenic *E. coli* (EPEC) - Serotypes associated with infantile diarrhea.
- Facultative enteropathogenic *E. coli* (FEEC)- Serogroups associated with the normal intestinal flora but causing sporadic diarrhea or enteritis. (Note: This group was listed by Kornacki and Marth [30] but has been deleted by subsequent reviewers.[15,21]
- Enterotoxigenic *E. coli* (ETEC) - Serotypes associated with traveler's diarrhea. May produce a heat stable (ST) or heat labile (LT) enterotoxin or may produce both ST and LT.
- Enteroinvasive *E. coli* (EIEC) - Serotypes associated with dysentery due to invasive infection of the gastrointestinal tract.
- Enterohemorrhagic *E. coli* (EHEC) — *E. coli* O157:H7 is the single serotype associated with hemorrhagic colitis, hemolytic uremic syndrome (HUS), an acute kidney disorder, and thrombotic thrombocytopenic purpura (TTP), acute kidney disorder with central nervous system involvement, seizures and coma. (Note: EHEC was not included in the review by Kornacki and Marth.[30])
- EPEC, ETEC, and EIEC have been linked world-wide to outbreaks involving water and various types of foods, usually associated with unhygienic conditions.[30]

The involvement of *E. coli* O157:H7 with hemorrhagic colitis and HUS outbreaks associated with under-cooked ground beef were recently reviewed.[15] From 1978 to 1982, 67 foodborne cases of *E. coli* O157:H7 were reported with over 20,000 estimated cases.[42,43] In one survey, incident levels for *E. coli* O157:H7 were 3.7% in beef, 1.5% in poultry, and 2.0% in lamb samples [15] indicating that the organism is not a rare contaminant of animal products. The authors reported isolating *E. coli* O157:H7 from a frozen chicken nugget removed from an open box from which meals were prepared in a household including infected persons.

Under-cooking has been considered an important factor in *E. coli* O157:H7 outbreaks involving ground beef. Doyle and Schoeni [17] reported D-values for *E. coli* O157:H7 of 4.5 and .40 min at 140°F and 145°F, respectively, with a z-value of 7.38°F. This compared to D-values of 5.43 and 0.54 min, respectively, for the same temperatures for a mixed strain *Salmonella* spp. inoculum in ground beef.[23] This suggests that *E. coli* O157:H7 is somewhat more susceptible to moist heat than *Salmonella* spp. at the temperatures tested. There is preliminary evidence, however, that this may not be the case in fatty beef at lower heating temperatures (Table 2).[32] The organism has also been shown to survive in ground beef at -20°C for nine months with only a slight reduction in numbers.[17]

Table 2. Comparison of D-values and z-values for *E. coli* O157:H7 and *Salmonella* spp. in ground beef.

Heating Temp. °F	*E. coli* O157:H7[1]	*E. coli* O157:H7[2]	*Salmonella* spp.[3]
125	115.5		54.3
135	5.3	4.5	5.43
145	0.47	0.40	0.54
z-values, °F	8.37	7.38	10.0

[1]Data derived for fatty beef (30.5) from Line et. al (32).
[2]Data derived from Doyle and Schoeni (17). (17 to 20% fat).
[3]Data derived from Goodfellow and Brown (23) at 125°F, data at 135° and 145° extrapolated from 125°F data.

Foodborne Shigellosis

Although nearly 500 cases of shigellosis are reported and over 170,000 have been estimated to occur annually in the U.S. and Canada, [42,43] perishable meat products have not been a common vehicle for the disease.[40] Poor personal hygiene among food handlers has been the chief contributing factor and most foodborne outbreaks have been associated with food service establishments.[40] Perishable RTE meat products, if contaminated by an infected food handler could, therefore, serve as a vehicle for foodborne shigellosis.

Staphylococcal Food Poisoning

Staphylococcal intoxication continues as an extremely important foodborne illness, second in estimated economic impact only to salmonellosis in the U.S. and Canada (combined estimated cost: Salmonellosis approximately $3,022.50 million vs. staphylococcal intoxication approximately $537.60 million).[42,43] From the mean numbers of reported cases per year in the U.S. and Canada (1,992 cases), Todd[42,43] has estimated that over 1.25 million cases per year occur in the U.S. and Canada.

Historically, hams, whether of the perishable or shelf-stable variety, have been the predominant vehicle for staphylococcal food poisoning.[21] Bryan[11] reported that ham was the vehicle in 50 of 175 (28.6%) of staphylococcal food poisoning incidents in the U.S. from 1977 to 1984. Most staphylococcal meatborne outbreaks involve cross-contamination, often from infected food handlers, or contaminated equipment, and subsequent temperature abuse during slicing or other preparation prior to serving. The salt and cure content of the ham inhibit the aerobic microflora of the product, but do allow for growth and enterotoxin production by *S. aureus*.

***Clostridium perfringens* Food Poisoning**

Clostridium perfringens was the etiological agent in 24 outbreaks involving 3,743 cases of foodborne illness from 1983 to 1987.[5] Roast beef, turkey, meat-containing Mexican foods, and other meat dishes have been commonly implicated as vehicles in *C. perfringens* enteritis.[11] Roast beef and other types of cooked beef were associated with 33.9 percent of 115 outbreaks of *C. perfringens* enteritis in the U.S. from 1977 to 1984.[11] Major contributing factors to *C. perfringens* outbreaks are improper cooling or improper hot holding after cooling.[21] The short generation time of this organism (7-8 min at optimum temperature) is of special significance to the food service industry.[21]

Botulism

The occurrence of *Clostridium botulinum* spores in meat and meat products in the U.S. and Canada is low (1-2 spores

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per 10 kg).[35] Of 74 outbreaks reported from 1983-1987,11 involved meat or meat products and 55 were due to food prepared in the home. Simunovic [39] reviewed the literature on the incidence of *C. botulinum* in meat and meat products. He concluded that definitive data was lacking and that processes involving heating short of sterilization followed by extended holding under refrigeration should be carefully studied due to the possibility of growth and toxin production by the non-proteolytic, psychotrophic types B,E, and F.

Foodborne Listeriosis

Listeria monocytogenes has received considerable notoriety as a foodborne pathogen in recent years and has been epidemiologically linked to consumption of unheated turkey frankfurters and under-cooked chicken.[37]

The mean annual number of cases of foodborne listeriosis in the U.S. and Canada (1981-1986) is 78 with an estimate over 27,000 including unreported cases.[42,43] However, the CDC has confirmed only one case of human foodborne listeriosis linked to meat products, and that case involved consumption of commercially processed turkey hot dogs by a previously immunocompromised person.[4] Recently published studies revealed that the conveyor from the casing peeler was a source of the same strain of *L. monocytogenes* isolated from the patient.[46] This was one of only two positive samples found out of the 41 environmental surfaces sampled in the turkey frank processing plant during this study. The product involved was found to have over 1,100 *L. monocytogenes* MPN per gram.[2] Despite the fact that the evidence linking red meat to listeriosis is tentative, Johnson et. al.[26] after a thorough review of the literature, concluded that the linkage of listeriosis to red meat cannot be eliminated.

A number of studies have examined the effects of processing parameters on *L. monocytogenes* in RTE meat product. Studies with "beaker" sausage and pepperoni have shown that *L. monocytogenes* was inactivated when the product reached an internal temperature of 62.8°C, and that the lactic starter cultures used were bacterostatic for *L. monocytogenes*.[22] Some bacteriocin-producing strains of lactic acid bacteria exhibit antagonistic effects toward *L. monocytogenes*.[24] However, *L. monocytogenes* (109 CFU/g) survived levels of 120 ppm $NaNO_2$ and 3% NaCl in fermented sausage at pH 4.6.[29] Direct application of liquid smoke to surface inoculated frankfurters has been shown to yield more than 99.9% reduction in *L. monocytogenes* after 72 hours refrigerated storage.[34]

The effects of heating in various meat products and processes is currently under study by a number of workers. Palumbo et. al.[36] reported that cooking processes requiring 25 minutes to raise the internal temperature of frankfurters to 160°F (56.9°C) should kill the levels of *Listeria monocytogenes* commonly encountered in meat (MPN/ per gram < 0.03 to 5.0).[10] In *L. monocytogenes* inoculated ground beef, (80% lean) heating to 50°C (122°F), 60°C (140°F), and 65°C (149°F), gave 0.2-0.9,1.6-3.4, and 4.4 to 6.1 log reductions in *L. monocytogenes* from an initial inoculation level of 8.08 log CFU per gram.[9] Fain et. al.[18] determined D-values for *L. monocytogenes* at 145°F (62.8°F) in lean (2.0% fat) and fatty (30.0% fat) ground beef to be 0.6 and 1.2 minutes, respectively.

Control of Pathogens in Refrigerated RTE Meat Products

The prevention of foodborne illness due to bacterial pathogens in RTE meat products can be accomplished by a combination of two general approaches: 1) control of post-cooking contamination, and; 2) control of growth or survival in the product under normal refrigerated storage or abuse conditions.

Control of contamination of processed product, especially after heat treatment, is dependent on the control of the organism in the food processing environment. This involves elimination of microbial growth niches which are directly or indirectly accessible to the product stream by: 1) design of plants and equipment to eliminate entrapment of water and product residue; 2) proper maintenance practices to prevent cross-contamination and microbial growth niches (e.g., unsanitized tools and makeshift repairs with water absorbing materials); and 3) assurance of adequate cleaning and sanitation of equipment by use of proper equipment and chemicals and thorough training of sanitation crews.[20]

Design of products and processes to incorporate effective combinations of interacting growth-limiting factors has been suggested to control survival and out growth of foodborne pathogens and improve the microbial stability of food products (hurdles concept).[38] Such factors include water activity, pH, use of preservatives (salt, nitrate, TBHQ, BHA, sorbates, and phosphoric, citric, and lactic acids), temperature (heat-treatment and refrigerated storage), and modified atmospheres during storage.[38,45] Antibiotics (nisin),[45] lysozyme,[25] and irradiation[45] have also been considered.

Wilson[47,48] has outlined the Listeria Control recommendations of the American Meat Institute's Meat Safety Working Group. The recommendations called for total commitment of management and personnel to a long-term, traditional approach involving intense attention to Good Manufacturing Practices (GMPs). Specific recommendations addressed manufacturing facility requirements, cleaning and sanitizing procedures, materials, and equipment, and production and process controls (temperature control, control of rework, and elimination of cross-contamination). The critical role of line employees and the need for their proper training and instruction were stressed. Dr. Wilson stated that "experience has demonstrated that an accurate measure of progress relies on specific testing for *Listeria* in the plant environment." He further recommends that finished product testing should be reserved for measuring the effectiveness of controlled studies.

Environmental Monitoring Procedures

Procedures for microbiological monitoring of the food processing environment include the rinse solution method, swab contact method A (cotton swab), swab contact method B (cellulose sponge swab technique) and RODAC plate (Direct Agar Contact) Method.[19] Because of the ability to effectively sample large areas of equipment and environmental surfaces, the cellulose sponge technique is particularly useful for detecting pathogens such as *Salmonella* and *Listeria*. The method is very effective in identifying areas which may harbor or transmit these organisms.

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Consumer Perceptions of Consumer Type Time-Temperature Indicators for Use on Refrigerated Dairy Foods

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ABSTRACT

This study undertook a consumer survey employing both focus groups and a larger consumer survey to determine whether the concept of the use of a consumer readable shelf life (time-temperature indicator) tag in conjunction with open dating would be a useful practice for the dairy industry to follow. The respondents of the consumer survey were particularly receptive to this concept. However, limitations of the application of the TTIs used as consumer tags on refrigerated dairy products were brought out in the focus group sessions. The limitations signal that consumer tag implementation success is a function of consumers' education about food spoilage and the dependability of the CT technology. This suggests that consumer education will be a necessary part of this program.

INTRODUCTION

Many fresh, refrigerated foods such as dairy products demand strict temperature control from production to consumption, especially the new controlled atmosphere (CAP/MAP) packaged prepared meals that are in test marketing (Sills-Levy, 1989; Labuza and Taoukis, 1990). The penalty for mishandling at any stage can be severe and very costly with respect to quality loss and the potential for human harm because of the possibility of botulism, listeriosis, and salmonellosis among others. Recently four individuals contracted botulism from a CAP/MAP shredded cabbage product that they temperature abused. A properly implemented temperature monitoring and control system is vital to help reduce the risk that could result from poor control in refrigerated distribution where abuse due to high temperatures often occurs. This is especially true for fluid milk, since as noted by Cherng and Zall (1989), it takes only a few hours at 40°C to cause a lot of milk to spoil, and consumers would not know that a given package was unacceptable until they opened the container at home.

Because of the high temperature sensitivity to temperature change, generally the rate of quality loss for refrigerated products increases by three to eight times for a 10°C increase in temperature, which is called the Q_{10} (Labuza, 1983). Thus, most refrigerated food manufacturers date these foods with some type of open date to help distributors and marketers properly turnover older products as well as help the consumer identify when the food should be consumed by. This dating system helps to easily implement a first-in first out (FIFO) stock rotation plan to insure rapid turnover on the market shelf. There are 26 states that require open dating on some foods with Minnesota having the strictest standard, requiring it on all foods of less than 90 days shelf life (OTA, 1979). Open dates fall into many different types including the pack date, sell by date, use by date, freeze by date and a best if used by date, yet even the most appropriate open date on a food package falls short since it is usually based on some assumed average distribution condition and does not account for the fact that the actual distribution condition of individual packages may be very different. Thus some type of device on the package itself that would show the temperature history of the food and indicate whether abuse has occurred and/or indicate the actual shelf life left could improve the quality delivered to the consumer.

Unfortunately mechanical and computerized temperature recorders cannot be attached to each food package. However, a very simple system exists today in the form of time-temperature integrator tags (TTIs) for monitoring temperature abuse on an individual food package. These devices can be designed as simple go/no go tags for use as a consumer readable tag (CT) to supplement open dating or as a scanner tag for use in distribution control to supplant the typical FIFO logistics management with a least shelf life left-first out system (LSFO). Tags also could be readable on the supermarket check out to prevent sale of out of date material. Wells and Singh (1988b) in a study with tomatoes indicated the degree of data needed about the quality loss rates of the food so as to be able to employ a tag and indicated a lack of data from the manufacturers on the temperature response of the commercial tags available. More recently Taoukis and Labuza (1989a, 1989b) have published on the reliability and applicability of three TTI type tags that could have application to refrigerated foods such as milk.

Cherng and Zall (1989) in a study with one type of tag, showed that the actual distribution effective temperature for commercial pasteurized milk from one dairy plant in New York was 6.5 to 8.8 °C rather than the necessary 4.4 °C to insure high quality and desired shelf life. Another plant having the same open data on the milk had an average

effective temperature of 3.4 to 3.9°C in two trials. They measured this kinetic temperature with the use of a computer scanner type TTI (LifeLines) attached to the milk cartons. Thus the milk from the first plant had a much shorter shelf life than the milk from the second plant, yet they both had similar sell by dates. This study supported their previous work in monitoring the quality of UHT milk (Zall et al. 1986).

Generally, a time-temperature integrator (TTI) can be described as a simple, inexpensive device that can show an easily-measurable, time-temperature-dependent change that reflects the full or partial temperature history of a food product to which it is attached. TTI operation principles are based on diffusional, chemical, or enzymatic systems that change irreversibly from the time of activation. The rate of change is temperature-dependent, increasing at higher temperatures in a manner similar to most physico-chemical reactions and generally can be modeled by the Arrhenius equation (Taoukis and Labuza, 1989a) in which the rate increases logarithmically with the reciprocal of absolute temperature. Fu et al. (1991) has shown the Arrhenius model as well as the square root of rate model to be acceptable for predicting the loss of shelf life based on microbial growth in a milk system in a varying temperature distribution. When TTIs are attached to individual consumer packages, they are referred to as "Consumer Tags" or quality monitors and thereby establishes a control system that does not depend on the unrealistic assumption that all products go through a uniform handling and distribution time/temperature sequence and in which the date the product was processed predicts its remaining shelf-life. Time-temperature indicators have been identified as the way to resolve the need for a cost-effective way to individually monitor the condition of products throughout the distribution cycle while at the same time providing consumers with much sought after information on product freshness. Chen and Zall (1987) have shown them to be effective for monitoring the quality of fresh processed orange juice while Mistry and Kosikowski (1983) and Gruisius et al. (1987) demonstrated their applicability for fluid pasteurized milk. Most of the earlier studies with tags were aimed at frozen food shelf life (Nicol, 1960; Hayakawa and Wong, 1974; Londahl, 1977; Sanderson-Walker 1979; Rodriguez and Zaritsky, 1983; Wells and Singh, 1985; Singh and Wells, 1985; LeBlanc 1988), however the increased demand for fresh refrigerated foods has stimulated the TTI industry to develop tags for the refrigeration temperature range. Wells and Singh (1988a) more recently showed the applicability of TTIs to quality management for tomatoes, lettuce and UHT milk. They noted the need for more exact measures of quality loss rates of foods as a function of temperature in order to employ the tags properly.

Recently, Malcata (1990) addressed the question of whether the difference in temperature of the product in the package to that of the surface of the package where the TTI is placed would lead to significant error in over prediction of quality loss. He presented some simple mathematical formulae based on the thermal properties of the food which would correct for this difference. For liquid products like milk, the internal convective currents would minimize this problem.

Palmiter (1988) has predicted the increased use of TTIs by the dairy industry as the public becomes more concerned with quality and they begin to understand how to use TTIs as part of their purchasing decision. Freeman (1988) has also found an increased interest in these tags by the packaging buyers in the food industry.

In this study a TTI produced by LifeLines Technology Inc. (Morris Plains, N.J.) called "FreshCheck" was explored as a consumer readable tag (CT). Its operation is based on the solid state polymerization of a colorless thinly coated diacetylinic monomer that appears as the center part of a "bulls-eye" pattern. The outer, non-polymer part of the bulls-eye is a reference color ring; an example is shown in Table 1. As the TTI and the product to which it is attached are subjected to time-temperature exposure, the center gradually darkens. The end point, marking the end of shelf life of the food, is reached when the color of the center becomes the same or just darker than the outer reference ring. Sherlock et al. (1991) evaluated the kinetics of the tags as well as the ability of consumers to visually observe the correct end point as compared to an instrumentally determined end point. The tags were found to have a Q_{10} of about 2 to 3, and the end point could be found by consumers with a CV of less than 2%. Thus a TTI attached to individual packaged products can serve as a dynamic or active shelf-life labeling instead of or in conjunction with open-date labeling. The CT would assure the consumer that the product was properly handled and would indicate remaining shelf-life based on the actual time and temperature conditions experienced during distribution and handling.

This idea of using a CT in conjunction with open dates has yet to be introduced in the mass market for lack of a clear understanding of how the consumer will react. The purpose of this study was to explore such an idea for use on dairy foods.

What Will Consumers Think?

Underlying the study of consumer behavior is the belief that a relationship exists between consumers' attitudes toward a product and their purchasing behavior. In this study, an attempt is made to measure consumers' attitudes so as to predict if consumers would be more or less likely to purchase a refrigerated dairy food product with a consumer tag on it. An investigation of consumers' concerns, needs, existing attitudes, and purchasing behaviors was done for this purpose. Two methods of investigation were used in this study, focus group sessions and a consumer survey. While focus group interviews are more qualitative, a consumer survey is more quantitative intended to estimate the extent to which the consumer population would subscribe to specific purchase behaviors.

Previous Consumer Surveys

Many surveys have shown that consumers want open dating of food packages, (Food and Drug Packaging, 1976; FDA Consumer, 1978; Food Product Development, 1978; Food Engineering,1979; National Food Review, 1979, Summer 1980; The National Provisioner, 1981; The Lempert Report, 1987). Previous work in this area has concentrated on the assessment of consumers' attitudes toward food

freshness and the effectiveness of open date labeling as a technique by which freshness information is conveyed to consumers.

Most of these surveys were done in the late 1970s and early 80s when open date labeling emerged as a topic of great concern to the FDA and to consumer groups and it was the time when several states began their legislation. Hearings held in five US cities in the late summer and early fall of 1978 were part of a cooperative undertaking by the FDA and the FTC to get first hand information about what consumers thought and their suggestions concerning several major aspects of food labeling including open-date labeling. Also in 1978, the consumer based Food Labeling Survey, part of FDA's multipurpose food and cosmetics survey, was designed and directed by the staff of the division of consumer studies of the Bureau of Foods (now the Center for Food Safety and Applied Nutrition) of the FDA (FDA Consumer, 1979). Response Analysis Corporation of Princeton, NJ conducted over 1300 interviews with food shoppers. In 1979, USDA's Economic Research Service and the Consumer Research Institute cooperated on a project to gather information on consumer attitudes toward freshness in foods and determine whether open dating had any effect on consumers' buying practices and retail store operations. Also in 1978-79, Congress asked their research branch to investigate whether open date legislation on a federal level was meaningful. OTA issued a report at that time stating the research needs including a necessity to further investigate the use and technology of TTIs, mainly because of the variability in exposure history for any given food package (OTA, 1979). In 1981, an IFT expert panel on food safety and nutrition published a status summary entitled "Open Shelf Life Dating of Food" (IFT, 1981). In their report, the scientists commented on consumer attitudes, problems of forecasting the actual shelf life of foods, possible techniques by which freshness information could be conveyed to the consumer, and regulatory and enforcement aspects of open dating.

These studies and others done by federal agencies and consumer groups concluded that there was a real consumer concern for food freshness and the confusion and misunderstanding surrounding open date labeling. The studies found that public interest in open dating ranked high, just behind nutrition and ingredient labeling in most cases. Also, these studies found that when asked if they used open dates to determine purchasing decisions, about three-fourths of consumers said they did and less than 2% of these consumers said that they were confused about the exact meaning of open dates while at the same time, when asked what the exact meaning of the date was, most did not know.

Perhaps the most notable finding that these studies have repeatedly confirmed is that while consumers tend to measure freshness according to the amount of time a food package spends on the way from the processor to the retail shelf, there is little evidence to support that there is actually a direct relationship between open shelf life dating and the actual freshness of food products as perishability varies according to the time and temperature distribution profiles from the manufacturer to the retailer. More recently, open dating surveys have again documented consumer concerns about food freshness and the confusion and misunderstanding surrounding open date labeling. (National Food Review, Summer 1980; Dairy Field, 1980, Supermarket News, 1987).

Although the problems and difficulties in selecting an open date for food packages have been addressed, and consumers do accept the validity of such open dates, there has been little consumer research other techniques to convey the degree of freshness of food items such as the use of Consumer Tags on individual food packages. One study done by Business Marketing Research Inc. has been repeatedly cited in trade journals and business reviews. Business Marketing Research Inc. conducted interviews at five different locations across the U.S. aimed at determining consumer needs relative to judging product freshness and safety and elicited reactions and opinions on the CTs. This survey showed a strong preference among consumers for perishable food products equipped with a clear, consumer-readable indicator of time and temperature exposure as a means of judging freshness and safely (Poultry & Egg Marketing, 1989; Supermarket Business, 1989; Prepared Foods, 1989).

METHODOLOGY

Focus Groups

A total of three "mini" focus groups (6-8 participants) with both female and male heads of households responsible for the majority of the grocery shopping and food preparation were conducted in Omaha, Neb. All respondents: were 21 to 57 years of age, regularly purchased a variety of refrigerated dairy products, had an annual household income of at least $23,000 per year, and had at least a four year degree from a college or university.

The majority of the respondents were from a two to four member household, at least half of the participants with children under the age of 18 living at home. The interviews were conducted March 24-26, 1990. The procedures as described by Rossi et al. (1983) were used.

Consumer Survey

A questionnaire was constructed to elicit attitudes about the appropriate use of CTs on dairy and other related refrigerated, perishable food products. Dairy was chosen as prior reports suggested that this was an area of most concern, and there are so few CAP/MAP type products, consumers would have little prior history of their use. Questions were asked to direct the respondents' attention toward their purchase of refrigerated items. The survey also had a sample consumer tag on it explaining its function.

The questionnaire consisted of instructions, sixteen questions, and demographics. The questions are listed in Table 1, along with a depiction of a potential tag. This study was conducted at the end of a Central Location Test commissioned by the Pillsbury Company, (Grand Metropolitan plc. Minneapolis, Mn.). One hundred four participants were recruited by phone and asked to participate in a twenty-five minute test evaluating a variety of pizza products. They were also asked to complete the three page questionnaire on open dating when they were done. Participants were paid twenty dollars by the Pillsbury Company to complete the pizza study and were not paid extra to complete this questionnaire, but the response was 100%.

TABLE I. OPEN DATING QUESTIONNAIRE

Please answer the following questions regarding date codes on dairy products such as milk, yogurt, cottage, cheese, and sour cream:

1. Please rate the IMPORTANCE OF PRICE when purchasing dairy products.

Not Important at all — Neutral — Extremely Important

2. Please rate THE IMPORTANCE OF FRESHNESS when purchasing dairy products.

Not Important at all — Neutral — Extremely Important

3. Please rate THE IMPORTANCE OF THE BRAND NAME when purchasing dairy products.

Not Important at all — Neutral — Extremely Important

4. Please rate THE IMPORTANCE OF THE DATE LABEL when purchasing dairy products.

Not Important at all — Neutral — Extremely Important

5. How RELIABLE do you think a date label is as an indicator of product freshness?

Not Important at all — Neutral — Extremely Important

This is an adhesive label that can be placed on food packages that turns color when the food has become unacceptable due to the effects of time and temperature exposure-both of which act to cause loss of quality. It has been tested and proven effective in many scientific studies.

Fresh-Check® Indicator
Do not use if center is darker than outer ring

PLEASE ANSWER THE FOLLOWING QUESTIONS ABOUT THE LABEL DESCRIBED ABOVE:

6. Would you consider this label a desirable addition to the information already available on the product package?

Not Desirable — Neutral — Extremely Desirable

7. Would the combination of a label like this and a date stamp on a package cause you to have more confidence in the freshness of a dairy product?

Not at All — Neutral — Extremely Confidence

8. Would you be more likely to purchase a product with this type of a label on it?

Not Likely at all — Not Sure — Much More Likely

9. If you were thinking about buying a dairy product and the date stamp indicated it was fresh, but a label like the one shown above indicated that it was not, what is the likelihood that you would purchase this product?

Not Likely at all — Not Sure — Much More Likely

10. If you were thinking about buying a dairy product and a label such as the one above indicated that the product was fresh, but the date stamp indicated that it was not, what is the likelihood that you would purchase this product?

Not Likely at all — Not Sure — Much More Likely

11. Do you believe that a date stamp alone is sufficient for determining the freshness of dairy products?

Not Sufficient — Neutral — Sufficient

12. Do you believe that a label such as the one shown above is sufficient for determining the freshness of dairy products?

Not Sufficient — Neutral — Sufficient

13. Do you believe that both a date stamp and a label such as the one shown above is needed in order to determine the true freshness of dairy products?

No — Neutral — Yes

14. If your favorite brand of dairy product did not have a freshness indicator on it and a very similar brand dairy product did have an indicator on it, would you be likely to try the similar brand with the indicator on it? (Only because of the fact that an indicator was present).

Not at all more Likely — Neutral — Much more Likely

THANK YOU VERY MUCH FOR YOUR PARTICIPATION!

RESPONDENT DEMOGRAPHICS

One-hundred four respondents participated in the survey. Over 80% of the respondents (84.6%) came from households with over three people in them, and also over 80% of the households reported having children in their households. The majority of the respondents were between the ages of 25-54 years of age, 62% were female and 42% were male. About 24% of the respondents graduated from high school, 42% had some college or technical school, and 25% graduated from a 4 year college, while another 7% had finished some graduate work. Household incomes ranged from 20,000 to over 60,000 dollars per year.

RESULTS

Focus Groups

The focus groups, concluded that open-dating was both misunderstood and highly valued by the consumer at the same time. Although people's perceptions about CTs include seeing them as clever, neoteric devices, a consumer tag is not likely to supersede the perceived proficiency of current open-dating techniques as seen in the consumer's eye in the near future. Consumer Tags can definitely be used to differentiate products with a value-added characteristic, but a combination of lack of understanding of food spoilage, the entrenched feelings about the nature of dairy products, and the unyielding devotion to date labeling may limit the ability of CTs to act as a key marketing tool in product positioning unless a plethora of education is disseminated to consumers and a very clever marketing and promotion campaign is designed to show the benefits that CTs offer this product category, over and above open dating.

Based on the outcome of the focus group sessions, the use of CTs on refrigerated dairy products would probably not significantly have an impact on consumers' purchasing decisions. It is possible, however, that other product categories especially in the frozen foods group or freshly prepared refrigerated entree category would be perceived by the consumer as a more appropriate candidate for a consumer tag. However, a more quantitative consumer survey described in the next section shows a more positive picture for the refrigerated dairy product category.

Consumer Survey

Average linkage and centroid hierarchical cluster analysis as described by Babbie (1982) did not yield any significant relations between responses. Frequencies and mean scores for all responses were tabulated and shown in Table II.

Table II: Responses to Open-Dating Questionnaire.

Q1. IMPORTANCE OF PRICE, NOT IMPORTANT AT ALL-EXTREMELY IMPORTANT

response	frequency	percent
not important at all	8	7.7
2	5	4.8
neutral	12	11. 5
4	7	6.7
5	25	24.0
6	16	15.4
extremely important	31	29.8

Q2. IMPORTANCE OF FRESHNESS, NOT IMPORTANT AT ALL-EXTREMELY IMPORTANT

response	frequency	percent
neutral	1	1.0
4	4	3.8
5	10	9.6
6	12	11.5
extremely important	77	74.0

Q3. IMPORTANCE OF BRAND NAME, NOT IMPORTANT AT ALL-EXTREMELY IMPORTANT

response	frequency	percent
not important at all	5	4.8
2	4	3.8
neutral	41	39.4
4	6	5.8
5	22	21.2
6	17	16.3
extremely important	9	8.7

Q4. IMPORTANCE OF DATE LABEL, NOT IMPORTANT AT ALL-EXTREMELY IMPORTANT

response	frequency	percent
not important at all	1	1.0
2	2	1.9
neutral	3	2.9
4	4	3.8
5	13	12.5
6	14	13.5
extremely important	67	64.4

Q5. RELIABILITY OF DATE LABEL, NOT RELIABLE-EXTREMELY RELIABLE

response	frequency	percent
2	3	2.9
not sure	23	22.1
4	11	10.6
5	29	27.9
6	23	22.1
extremely reliable	15	14.4

Q6. CONSIDER CONSUMER TAG A DESIRABLE ADDITION TO PACKAGE, NOT DESIRABLE-EXTREMELY DESIRABLE

response	frequency	percent
not desirable	1	1.0
2	2	1.9
neutral	7	6.7
4	6	5.8
5	9	8.7
6	28	26.9
extremely desirable	51	49.0

Q7. WOULD A CONSUMER TAG CAUSE YOU TO HAVE MORE CONFIDENCE IN THE FRESHNESS OF A DAIRY PRODUCT?, NOT AT ALL MORE CONFIDENT-MUCH MORE CONFIDENT

response	frequency	percent
not at all more confident	1	1.0
neutral	2	1.9
4	3	2.9
5	10	9.6
6	21	20.2
much more confident	67	64.4

Q8. BE MORE LIKELY TO PURCHASE IF A CONSUMER TAG WAS ON THE PACKAGE, NOT AT ALL MORE LIKELY-MUCH MORE LIKELY

response	frequency	percent
not likely at all	2	1.9
not sure	10	9.6
4	6	5.8
5	17	16.3
6	21	20.2
much more likely	48	46.2

Q9. DATE STAMP INDICATED FRESHNESS, CONSUMER TAG INDICATED NOT FRESH, NOT LIKELY AT ALL-MUCH MORE LIKELY TO PURCHASE

response	frequency	percent
not likely at all	83	79.8
2	9	8.7
not sure	7	6.7
4	1	1.0
5	1	1.0
6	1	1.0
much more likely	2	1.9

Q10. DATE STAMP INDICATED NOT FRESH, CONSUMER TAG INDICATED FRESHNESS, NOT LIKELY AT ALL-MUCH MORE LIKELY TO PURCHASE

response	frequency	percent
not likely at all	51	49.0
2	16	15.4
not sure	26	25.0
4	5	4.8
5	4	3.8
6	1	1.0
much more likely	1	1.0

Q11. IS A DATE STAMP SUFFICIENT TO DETERMINE THE FRESHNESS OF DAIRY PRODUCTS?, NOT SUFFICIENT-SUFFICIENT

response	frequency	percent
not sufficient	26	25.0
2	16	15.4
neutral	38	36.5
4	15	14.4
sufficient	9	8.7

Q12. IS A CONSUMER TAG SUFFICIENT TO DETERMINE THE FRESHNESS OF DAIRY PRODUCTS?, NOT SUFFICIENT-SUFFICIENT

response	frequency	percent
not sufficient	15	14.4
2	28	26.9
neutral	36	34.6
4	17	16.3
sufficient	8	7.7

Q13. ARE BOTH A DATE STAMP AND A CONSUMER TAG NEEDED TO DETERMINE THE FRESHNESS OF DAIRY PRODUCTS?, NO-YES

response	frequency	percent
no	10	9.6
2	2	1.9
neutral	14	13.5
4	21	20.2
yes	57	54.8

Q14. WOULD YOU BE MORE LIKELY TO PURCHASE A DAIRY PRODUCT IF IT HAD A CONSUMER TAG ON IT THEN IF IT DID NOT?, NOT AT ALL MORE LIKELY-MUCH MORE LIKELY

response	frequency	percent
not at all more likely	5	4.8
2	9	8.7
neutral	15	14.4
4	4	3.8
5	5	4.8
6	12	11.5
7	12	11.5
8	13	12.5
much more likely	29	27.9

When the quantitative survey was performed and people were obligated to respond more quickly on a non-interactive level, different results than were found in the focus groups were obtained as follows:

1. Freshness is extremely important to consumers: About 74% of the respondents said that freshness was extremely important when purchasing dairy products while 31% indicated that price was extremely important and only 8.7% said that the name brand was extremely important to them when purchasing dairy products.
2. The date label was rated as extremely important when purchasing dairy products. Over 94% of the respondents said that the date label was important and 64% said that it was extremely important. However, when asked how reliable they thought the date label was as an indicator of product freshness, only 14% indicated that the date code was extremely reliable. About 25% stated that they were not sure if the date code was reliable or they doubted the reliability of the date code.
3. After the consumers were given a brief description of a time temperature indicator and shown a sample indicator attached to their questionnaire, over 90% said they would consider such an indicator as a desirable addition to the information already available on the product package. Forty nine percent indicated that the CT would be extremely desirable.
4. The presence of an indicator on a package would cause over 95% of the participants to have more confidence in the freshness of that product and would cause over 64% of the participants to have much more confidence in the freshness of that package.
5. Purchasing decisions may be greatly influenced by the presence of a consumer tag, as over 96% said they would be more likely to purchase a product with this type of a label on it and over 46% said they would be much more likely to purchase a consumer tagged item.
6. Respondents were asked which index they would rely on more if the date stamp and the consumer tag conflicted: 5% said they would still be likely to purchase a product if the date stamp indicated that the product was fresh, when the CT indicated it was not. About 10% said they would still be likely to purchase a product if the date stamp said it was not fresh, but the consumer tag said that it still was okay.
7. When asked if the date stamp was sufficient alone for determining the freshness of food products, the same distribution of responses was obtained as when asked if the CT alone was sufficient for determining product freshness; about 40% answered no, they were not sufficient alone, about 35% answered that they were neutral about it, and about 24% said that either one alone would be sufficient.
8. Participants were asked if both a date stamp and a CT were needed to determine optimal product freshness. Almost 75% of the people responded that both were needed in order to determine the true freshness of refrigerated food products.
9. When participants were asked if they would be more likely to purchase a consumer tagged item versus their favorite brand of dairy product without a consumer tag, over 70% said they would be more likely to purchase the product that had the consumer tag, and 28% said they would be much more likely to purchase the consumer tagged item.

CONCLUSIONS

In the conceptual sense, the respondents were particularly receptive to the idea of using consumer tags on refrigerated dairy products when the date code was also used. However, limitations of the application of the TTIs used as consumer tags on refrigerated dairy products were brought out in the focus group sessions. The limitations signal that consumer tag implementation success is a function of consumers' education about food spoilage and the dependability of the CT technology. The noted perceived benefits will be better understood and more likely to be taken to heart if consumers are better informed.

Although certain issues may limit their immediate acceptance until consumers become more educated, this study shows that the general attitudes consumers have about consumer tags are very positive, and the general questionnaire supports the fact that consumer tags would improve consumer confidence in a food product.

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Sanitization in Food Service Establishments

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Sections 5-101 to 5-105 of the *Food Service Sanitation Manual* (2) discuss the cleaning and sanitization of equipment and utensils. If a violation is observed, item #20 on their inspection form is debited; it is one of 13 critical violations noted on the form. Many state (local) inspection forms are based on the federal form.

Following is a short discussion of some principles pertaining to sanitization in food service establishments. A recently updated text (1) discusses the subject matter more thoroughly.

Sanitization defined: bactericidal treatment with heat (hot water, steam) or chemicals to reduce the bacterial count (flora), including pathogens, to safe levels; implies a degree of physical cleanliness.

For sanitization to be effective proper cleaning, involving the removal of food particles, fats, and other gross soil with suitable detergents and the use of friction (hand-activated or mechanical), must be accomplished on food-contact surfaces of equipment, utensils, and dishware. Thorough rinsing must follow for proper sanitizing.

HOT WATER. Use water of at least 170° F (77° C) for at least 30 seconds. This would normally require either a booster heater or an electrical element which is directly immersed in the water. An employee could not place hands in this hot water and would need to use tongs or racks to handle articles. Hot water is used as the sanitizing agent in the rinse cycle of a mechanical dishwasher. Clean-in-place sanitizing could be accomplished in larger pieces of equipment by running hot water through it for a proper period of time. Steam sanitization can be achieved on large equipment that cannot be immersed; steam used on assembled equipment should be at least 200° F (93.3° C) [note: time element is important; steam is quite hot when leaving its source, but cools quickly in contact with a cool object].

CHEMICALS. It is usually more practical to use a chemical sanitizer. The proper use (concentration) of an approved chemical can be as effective as hot water. These compounds are regulated by EPA, with strict labeling requirements. Label information should include what concentrations to use, data on effectiveness, and warnings of any health hazards. Three common chemicals approved for food establishment use are chlorine (as a hypochlorite), iodine (iodophors), and quaternary ammonium compounds (quats). Chemical sanitizing is done in two ways: either by immersion in the correct concentration of sanitizer; or by rinsing, swabbing or spraying with double the immersion concentration (exception: quats concentration is the same for both methods).

* CHLORINE - *Concentration*: 50 parts per million (ppm) for immersion of at least 0.5 minutes; 100 ppm for rinsing, spraying or swabbing - *Temperature*: at least 75° F (24° C) but not above 120° F (49° C) - *pH*: must be below 10 - *Corrosiveness*: may attack some metals, especially at higher water temperatures - inactivated quickly by organic materials in water (rapid dissipation means frequent testing and replenishing of the active ingredient) - possible skin irritation if gloves not worn - inexpensive in cost.

* IODINE - *Concentration* (from iodophor complex): 12.5 ppm for immersion of at least 1 minute; 25 ppm for rinsing, spraying or swabbing - *Temperature*: same as for chlorine - *pH*: must be below 5.5 - *Corrosiveness*: noncorrosive - organic materials in water make them less effective - has a brown or amber color, so concentration can be measured visually - nonirritating to skin - are expensive.

* QUATS - *Concentration*: 200 ppm for immersion (at least 1 minute) and for rinsing, spraying or swabbing - *Temperature*: same as for chlorine - *pH*: most effective around 7 but varies with compound - *Corrosiveness*: noncorrosive - generally not affected by organic materials in water but varies with formulation; read label - excellent in eliminating and preventing odors - nonirritating to skin - are expensive.

Packaged and/or label instructions for using the above chemicals should be followed; they should not be short-circuited no matter what method of application is used.

Use of Wiping Cloths. Cloths used for wiping food-contact surfaces of equipment shall be cleaned and rinsed frequently in one of the above sanitizing solutions and used for no other purpose; between uses cloths shall be stored in the sanitizing solution. Sponges should be prohibited from use in the kitchen area (they were recently prohibited in Massachusetts).

Proper concentrations of sanitizers is a critical factor. Usage below the minimum results in a failure to sanitize. Concentrations higher than necessary can cause taste and odor problems and are a waste of money. Test papers and kits are available and are the only way to check the concentration of a chemical; they should be used often.

After a cleaning and sanitization procedure is completed, all equipment, utensils, and dishware shall be *air dried.*

Reasoning for the Sanitization Process: Any food protection and sanitation effort is easily nullified if food-contact surfaces, equipment, and utensils coming in contact with foods are not effectively cleaned and sanitized; they can become vehicles for transmitting disease organisms to foods and/or to the consumer.

If sanitizing facilities are not available (inadequate), only single service disposable ware and utensils should be used; they shall be disposed of properly.

Finally, **never use cleaning and sanitizing chemicals in excess**; they are poisonous or toxic materials; follow the manufacturer's directions; many dollars can be wasted if the chemicals are not applied in proper concentrations.

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Survival of Lactic Acid Bacteria in Cheese and Butter in the Presence of ^{131}I

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Abstract

The effect of artificially added ^{131}I on lactic acid bacteria (LAB) in cheese and butter and their by-products cheese-whey and buttermilk was studied. The radioisotope was introduced directly to cow's milk and cream in doses equivalent to 10,000 Bq/kg. After homogenization and cooling, milk and cream were inoculated with 1.5% mixed activated cultures (*Streptococcus thermophilus - Lactobacillus bulgaricus* and *Streptococcus lactis - Streptococcus diacetylactis*, 1:1 in ratio).

The results demonstrate that the radioisotope ^{131}I decreased the LAB counts by 29.5% and 25.8% in cheese and butter and by 33.3% and 29.0% in cheese-whey and buttermilk.

The presence of ^{131}I had minimal or no effect on the gross composition and percent yield of both products but *L. bulgaricus* is more sensitive to ^{131}I than *S. thermophilus*.

Introduction

The contamination with radioactive isotopes of milk and milk products was the result of the Chernobyl nuclear accident on April 26, 1986. The distribution and the effects of radioactive materials on milk and milk products have not been studied, extensively so far (Vosniakos et al., 1989).

It is known that lactic acid cultures are commonly used to improve the shelf life of various food products because of the metabolic products such as lactic acid, propionic acid, diacetyl and antibiotic - like substances produced by these organisms. These end products have a profound inhibitory effect on gram-negative food spoilage bacteria (Gilliland and Speck, 1979; Pulusani et al., 1979 and Rao et al., 1981).

The effects of radioactive materials on milk and their distribution in feta cheese have been studied quite extensively (Vosniakos et al., 1989). However there is no available information in the literature with respect to cheese, and butter and to their by-products cheese-whey and buttermilk, prepared from radioactively contaminated milk. Therefore the objective of this study was to determine the behavior of lactic acid bacteria in butter or cheese and their by-products, prepared from cow's milk contaminated with ^{131}I.

Materials and Methods

The determination of ^{131}I was done by gamma-spectroscopy system, consisting of a high purity coacial Germanium detector p-type (CP 2100 Tennelec). The sample chamber was a cylinder 12 cm in diameter and 25 cm in height and was shielded by 5.0 cm of lead and 0.5 cm of copper. The full width at half maximum (FWHM) of the system was found 1.95 KeV at 1332 KeV of ^{60}Co. The linearity of the detector was checked with a ^{152}Eu source and a simple regression analysis gave a straight line with a correlation coefficient of 0.999. The liquid samples were measured in to 50 ml cups with 5.5 cm in diameter. The radionuclides used were supplied by "The Nucleus", Oak Ridge, USA.

Fresh, chilled cow milk was supplied by the Experimental Farm of our Institution. The isotope was introduced directly to milk and cream in doses amounting to 10,000 Bq/Kg. After homogenization and cooling, milk and cream were inoculated with 1.5% mixed activated cultures (*S. thermophilus - L. bulgaricus* and *S. lactis - S. diacetylactis* 1.1 in ratio). The inoculum supplied by Christian Hansen's Laboratory, Denmark and it was CH1 Culture. All samples were analyzed according to Standard Methods for the Examination of Dairy Products for lactic acid bacterial (LAB) counts (Marth, 1978). The production method used for feta cheese was according to the Kosikowski procedure (Kosikowski, 1982). Butter was made from pasteurized cream (96 $\pm$ 1°C x 30 min) in which most of the spoilage organisms have been destroyed. The cream was pasteurized at a somewhat higher temperature from the pasteurizing milk since the high fat content had a slight protective effect on bacteria. The fat content of the cream used was 49 + 1%. After inoculation the cream was incubated for 20 hours at 21°C. The mass of butter fat was obtained by using a wooden churn which was operated at about 10°C. After 40 min of batch churning, the butterfat was separated from buttermilk.

Results and Discussion

It is quite clear from the tables 1 and 2, that the isotope ^{131}I inactivates a great percentage of lactic acid bacteria. This

Table 1: Viable cell counts of LAB in cheese curd and cheese whey from cow's milk.

Product	*L. bulgaricus* cfu * 10^4/ml sample			*S. thermophilus* cfu * 10^6/ml sample		
	Control	Radioactive product	% inactivation	Control	Radioactive product	% inactivation
Cheese curd	16[1]	11	31.2	28	20	28.6
Cheese whey	8	5	37.5	19	13	31.6

[1]Each value is a mean of ten replicate determinations.

Table 2: Viable cell counts of LAB in butter and buttermilk from cow's milk.

Product	*S. Lactis* *S. diacetylactis* cfu * 10^5/ml sample		
	Control	Radioactive product	% inactivation
Butter	31[1]	23	25.8
Buttermilk	62	44	29

[1]Each value is a mean of ten replicate determinations.

is more obvious in the case of cheese-whey, where there is more time and quantity of ^{131}I available to react with the bacteria. Based on these results we concluded that *L. bulgaricus* is more sensitive to ^{131}I than *S. thermophilus*. This difference in sensitivity to ^{131}I between the two organisms may cause problems in structure, taste and shelf life of cheese due to proteolysis which is faster in the presence of *L. bulgaricus* (Vosniakos et al., 1991). It might affect also the synergistic effect existed between the two organisms. The symbiosis existing between *S. thermophilus* and *L. bulgaricus*, is the result of stimulatory factors of bacillus produced by coccus (formate, pyruvate, CO_2) and coccus stimulators produced by bacillus (amino acids, peptides) (Larsen and Anon., 1989).

This decrease of LAB counts is due to the direct action of radiation upon the cell eytoplasm causing various types of growth inhibition and indirect action of radiation causing ionization of the surrounding water molecules, with the formation of highly reactive hydrogen and hydroxy radicals. The lower survival of lactic acid microflora in cheese-whey and buttermilk is due to the fact that ^{131}I follow the water phase, during processing of contaminated milk and cream. (Vosniakos et al., 1989).

The results demonstrate that the radioisotope ^{131}I decreased the viability of LAB in cheese and butter prepared from artificially contaminated cow's milk. The presence of ^{131}I had minimal or no effect on the gross composition and percent yield of the products prepared from cow's milk.

This study provides evidence that the nutritional implications to humans of the use of such product certainly deserves consideration. Biological testing to traditional and manufactured milk products is required to help to elucidate the possible nutritional differences that exist in radioactively contaminated products.

Acknowledgment

The authors wish to express their appreciation to Mrs. H. Diomou and to the following students for their cooperation in preparing the present work: C. Takalou, G. Ioannidis, S. Iakovoglou, Ch. Tsilepidis, S. Theoxaris and J. Ioannidis.

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News

Unique Aseptic Contract Packer Offers Clients Greater Flexibility and Superior Quality

White Knight Packaging Corporation announces the opening of their new 45,000 square foot contract packing facility in Wyoming, Michigan. This unique, high tech plant provides clients optimum processing flexibility and meets the rigorous quality control standards required for low acid aseptic milk products.

Prevalent in Europe since 1963, low acid aseptics like milk, dietetic and health products are still relatively rare in this country. However, acceptance of aseptics by retailers and consumers is starting to grow. According to *Beverage Marketing* (February, 1991), the consumption of aseptic juices and drinks, the largest aseptic segment in the U.S., has grown 83% from 1985 to 1990. But, according to Marc Fry, President of White Knight Packaging Corporation, U.S. manufacturers are still reluctant to exploit this aseptic opportunity, particularly in lower acid products like milk and milk based beverages. Fry reasons that in today's economy, many companies are reticent to make the necessary investment in capital and technical expertise required to set up and operate an aseptic line. "That's where we can help," continues Fry, "because we are committed to the more stringent quality control standards necessary for low acid aseptic products, we can readily handle higher acid juices and juice drinks as well as milk beverages." "There's simply no better or easier way to tap into the sales potential represented by aseptic products than to use White Knight as a contract packer," concludes Fry.

IN THE MARKET FOR A WHITE NIGHT?

Companies looking for a "white knight" to come riding in with a cost efficient means to pack innovative low acid products need look no further than Michigan. In fact, Grand Rapids boasts three "white knights": Marc Fry, John Bridgeforth and John Parsons. All three entrepreneurs are partners in White Knight Packaging Corporation — a contract packer dedicated to low acid, aseptic products.

"For those wanting to test the 'water' prior to the full scale commitment necessary to launch a new aseptic product, we offer a low cost, low risk alternative," states Marc Fry, President. "In these economic times, it just makes sense for companies to delay large financial commitments until they're sure of an acceptable return," continues Fry. "You might say we're in the risk management business. A company can come to us and for a relatively small commitment can test the viability of a new aseptic product and assess the likelihood of its success prior to spending really large sums of money on new equipment, packaging and technical support."

Fry's easy going manner belies the $10 million investment in state of the art plant and equipment.

At their 45,000 square foot facility, White Knight has the capacity to blend a total of 9,500 gallons at temperatures ranging from 5° C to 90° C. Clients can choose APV indirect plate heat exchange or an Alpha-Laval VTS direct steam injection system to process their products. Once processed, the client can elect to add a sterile dose of heat sensitive flavorings, essences, oils, vitamins or minerals.

For more information contact John Bridgforth, White Knight Packaging Corporation, (616)538-3822.

Archer Gives Frazier Memorial Lecture

Dr. Douglas L. Archer gave the first W.C. Frazier Memorial Lecture in Food Microbiology at the University of Wisconsin-Madison on May 4, 1992. Dr. Archer is Assistant Surgeon General and Deputy Director of the Center for Food Safety and Applied Nutrition, Food and Drug Administration, Washington, D.C. The topic of Archer's lecture was "Food Microbiology of the Future: From What We Have Learned in the Past."

The W.C. Frazier Memorial Lecture in Food Microbiology was created with funds contributed by former students, colleagues and friends of the late Professor William C. Frazier, a pioneer in food and dairy microbiology at the University of Wisconsin-Madison. The Memorial Lecture is intended to annually bring an outstanding food microbiologist to the campus of the University of Wisconsin while perpetuating the memory of Professor Frazier and his outstanding career as a researcher, educator, and administrator. The lectureship is being administered jointly by the Departments of Food Microbiology and Toxicology, Food Science, and Bacteriology.

Contributions to support the lectureship are still welcome, should be designated for the Frazier Fund, and should be sent to the University of Wisconsin Foundation, 150 East Gilman Street, P.O. Box 8860, Madison, WI 53791-9944.

DNA Fingerprinting Gives Consumers Safer, Less Costly Foods

Whodunit? In the case of food poisoning, that's the million-dollar question. Until public health detectives identify and destroy the culprit, no one is safe. Tracking suspects often requires sleuthing skills rivaling those of Sherlock Holmes.

The challenge is particularly acute when the villain is *Listeria monocytogenes*. Found mainly in meat and dairy products, this bacterium kills some 400 people annually in the United States. It's an especially slippery suspect because it is found just about everywhere, and not every "strain"—genetically similar group—causes illness.

Lacking the ability to distinguish between deadly and innocuous strains, health workers find tracking *L. monocytogenes*-induced illness akin to searching for the proverbial needle in a haystack. And because they haven't been able to tell for sure if the strains that occasionally show up in food samples are dangerous, the food industry has had to recall millions of dollars of products containing only harmless relatives of the true killers. This loss is, in turn, passed on to consumers in the form of higher food prices.

Thanks to University of Minnesota food scientists Susan Harlander and Andrea Baloga, who conduct research for the university's Agricultural Experiment Station, food safety sleuths now have a tool for distinguishing deadly strains from those that are just part of the harmless micro-world that inhabits virtually everything we eat.

"Not every strain of *L. monocytogenes* will make people ill," explains Harlander. "The question we faced was, how do you pick out one strain of *L. monocytogenes* from among the rest when they share almost all the same characteristics?"

Baloga and Harlander applied a biochemical procedure called "DNA fingerprinting" to the task. The technique chemically breaks a cell's genetic material into tiny pieces, then electrically siphons the pieces through a gel-filled bed. Depending on their chemical traits, the fragments fall out along a bed into a striped pattern—a DNA fingerprint—that is unique for each kind of living thing.

With the support of the Minnesota-South Dakota Dairy Foods Research Center, the two researchers adapted DNA fingerprinting for use with *L. monocytogenes* identification. Their procedure can be used to quash food poisoning outbreaks more quickly and accurately than ever.

"The process can be used for forensic purposes—to track if it's the same organism in an infected person and a particular food," Harlander explains, who adds that the technique is already being used commercially. "We've trained a number of people in the food industry to start doing this themselves. They can follow a particular strain through the processing plant and find out where the problem was introduced so they then can work to change it."

Because DNA fingerprinting is simple and accurate, Harlander expects it to be used increasingly in the battle against *L. monocytogenes*-induced illness, which is a global problem. She predicts that someday DNA fingerprinting, in combination with other techniques being developed in her lab, will allow food safety workers to selectively identify and eliminate virulent *L. monocytogenes* strains before illness occurs.

For more information contact Susan Harlander at (612)624-5335.

1992 BISSC Directory of Registered Companies — Now Available

The 1992 Baking Industry Sanitation Standards Committee (BISSC) Directory of Registered Companies is now available. It features an alphabetical listing of 119 BISSC-registered companies whose equipment is certified under BISSC Sanitation Standards. The directory also offers a listing of registered companies by Standard authorization. A complete list of the 42 BISSC Standards is provided.

Published annually in June, the directory is available upon request at no charge from BISSC headquarters.

The BISSC Office of Certification was established in 1966 to promote greater recognition and use of bakery equipment conforming to the criteria of BISSC Standards. Under this program, individual bakery equipment manufacturers may apply for BISSC registration and certify equipment which meets the requirements of the particular Standard(s) for which they are seeking authorization.

Once certification is approved, the equipment manufacturer may then display the BISSC Symbol on the equipment certified within the program.

The BISSC registration period runs from January 1 through December 31 each year. Registration and authorization must be renewed annually if the manufacturer wishes to continue to display the BISSC Symbol on the certified equipment.

Requests for application forms to register and certify bakery equipment with the BISSC Office of Certification should be directed to Bonnie Sweetman, secretary-treasurer, BISSC, 401 N. Michigan Ave., Chicago, IL 60611 or call 312/644-6610.

Federal Register

Food Safety and Inspection Service

Codex Alimentarius: Public Forum Solicitation of Participants

Agency: Food Safety and Inspection Service, USDA.

Action: Notice of public forum.

Summary: The Food Safety and Inspection Service (FSIS), U.S. Department of Agriculture (USDA); the Food and Drug Administration (FDA), Health and Human Services; and the Environmental Protection Agency (EPA) are sponsoring a forum to solicit public comments and suggestions on U.S. participation in activities of the Codex Alimentarius Commission and the direction of future activities of such participation. The cosponsors of this public forum recognize the importance of providing interested parties the opportunity to obtain background information on the Codex Alimentarius, to discuss current Codex issues, and to address U.S. participation in the Codex process.

Dates: The public forum is scheduled for July 8, 1992, from 9 a.m. to 4 p.m. Written notice to participate in the forum should be filed by July 6, 1992. Written comments regarding the forum will be received until August 8, 1992.

Addresses: The public forum will be held at the following location: Hyatt Regency Crystal City, 2799 Jefferson Davis Highway, Arlington, VA 22202.

The transcript of the public forum and copies of the data and information submitted during the forum will be available for review at the Office of the FSIS Hearing Clerk, Room 3171 South Building, U.S. Department of Agriculture, Washington, DC., under Docket Number 92-016N.

For Further Information Contact: Ms. Rhonda S. Nally, Executive Officer for Codex Alimentarius, Contact Point for the United States, U.S. Department of Agriculture, Food Safety and Inspection Service, Room 3175-South Building, 14th and Independence Avenue, SW, Washington, DC., Telephone: (202)720-9150; FAX No: (202)720-5124.

Supplementary Information:
Background

The Codex Alimentarius Commission was established in 1962 by two United Nation's organizations, the Food and Agriculture Organization (FAO) and the World Health Organization (WHO), as a mechanism for encouraging fair international trade in food while promoting the health and economic interests of consumers. Today, both groups continue to support Codex, with each contributing a portion of the Codex budget.

Codex provides a forum for the world's leading experts to discuss, debate, and reach scientific consensus on the food safety issues that affect trade. There are currently 141 member nations of Codex that work to develop "standards" and "codes" dealing with basic principles, technical specifications for products, and good manufacturing practices.

Within the United States, Codex activities are coordinated by officials from USDA, FDA, and EPA. Dr. Alejandro B. Thiermann, Deputy Administrator, International Services, Animal and Plant Health Inspection Service, USDA, serves as the U.S. Coordinator for Codex Alimentarius. Dr. Fred R. Shank, Director, Center for Food Safety and Applied Nutrition, FDA, and Ms. Linda Fisher, Assistant Administrator for Pesticides and Toxic Substances, EPA, are the Assistant U. S. Coordinators for Codex Alimentarius.

Issues to be Discussed at the Forum

The following specific issues will be discussed during the public forum:

1. Introduction to Codex.
2. GATT Sanitary and Phytosanitary Measures and the relationship to Codex.
3. Codex Alimentarius in Transition.
4. The Role of the Expert Bodies.

In addition, in order to develop strategy and direction for future Codex activities, we will open the forum for public comment in the following areas:

1. What specific changes should be made in the purpose, activities, and philosophy of Codex?
2. What do you hope to see in the next 5 years in terms of:
   —What Codex accomplishes, and
   —how Codes operates?

Participants are also free to identify other related issues concerning Codex and to provide comments.

The public forum will be open to all interested parties. Representatives from the following categories are encouraged to participate in this public forum:

1. Consumer groups.
2. Industry groups.
3. Trade associations and recognized professional groups.
4. Other interested departments or agencies (including State offices.)
5. Academia.
6. General public.

All persons wishing to participate in the public forum should submit a written request to Ms. Rhonda S. Nally, Executive Officer for Codex Alimentarius. (See "Addresses").

The written request should contain the following: (1) participant's name, address, and phone number; and (2) name of company, corporation, organization, or group being represented.

FSIS will prepare a forum schedule showing the persons slated to participate. A schedule of participants will be available before the forum and will also be filed with the FSIS Hearing Clerk. (See Addresses).

The agencies are holding this forum to gather information and general comments on Codex Alimentarius. All information and comments presented, along with written comments, will be carefully reviewed and considered.

Done at Washington, DC., on June 26, 1992.

H. Russel Cross,

Administrator Food Safety and Inspection Service.

(FR Doc. 92-15505 Filed 7-1-92; 8:45 am)

Federal Register/Vol. 57, No. 128/Thursday, July 2, 1992/Notices.

Updates . . .

Corrections to Volume 12, No. 7 (June 1992) *Dairy, Food and Environmental Sanitation*

The article, "The 3-A Sanitary Standards and Accepted Practices Program: A Brief Overview" contained the following errors in the side-bar:

Page 407, paragraph two - Walter Laun was referred to as "Secretary-Treasurer" of the 3-A Symbol Council. His correct title is Administrative Officer.

Page 408, paragraph one - Reference was inadvertantly made to "Robert Wolf, Secretary-Treasurer of the 3-A Symbol Council." Mr. Wolf is no longer associated with the Symbol Council. The reference should read, "...Walter Laun, Administrative Officer of the 3-A Symbol Council."

The 3-A Accepted Practice for The Sanitary Construction, Installation, Testing and Operation of High-Temperature Short-Time and Higher-Heat Shorter-Time Pasteurizer Systems, Revised, Number 603-06 ommitted the following from the "Glossary—Abbreviations and Symbols section , page 458, number 17, column two. This information should follow the second line ("Other time delay relays may be used to (a) permit a..."):

...homogenizer used as a timing pump to run for 1 sec during the FDD transit time and (b) prevent the FDD from assuming the forward-flow position until the timing pump and all other flow promoting devices have stopped or been by-passed.

18. Safety Thermal Limit Recorder ...the adjustable, sealable instrument which senses the temperature at the end of the holding tube and controls the FDD position.
19. Cold Milk Recorder (CMR) ...a recording thermometer with the sensing bulb located in the discharge line from the final cooler.
20. Inlet Tee ... a fitting at the beginning of the holding tube which permits installation of the required components for accomplishing the salt conductivity timing test.
21. Cross Assembly ... a fitting at the end of the holding tube in the connecting line to the FDD which provides means for installing the STLR sensing bulb and an indicating thermometer.
22. Flow Diversion Valve ... with micro switches. A dual-stem FDD is shown.

Items 23-27 apply only to systems with vacuum treatment equipment downstream of the FDD.

23. Vacuum Breaker.
24. Temperature Controller (TC) and Culinary Steam Supply Valve ... for additional heating via direct steam injection.
25. Back Pressure Control Device ... to regulate flow into vacuum chamber.
26. Vacuum Chamber and Product Removal Pump.
27. Ratio Controller and Vacuum Regulating Valve ... to assure no product dilution via steam injection heating, via regulation of chamber pressure.
28. Positive Shut-Off Valves ... one is required between the vacuum breaker and the inlet to the vacuum chamber and a second is required down stream of the product removal pump. Both must be properly inter-wired with the FDD to close in diverted-flow, thereby preventing occurrence of negative pressure on flow diversion valve or pasteurized regenerator.
29. Homogenizer... this is the typical location for the homogenizer in a system with vacuum treatment equipment. A recirculation line with a check valve is necessary for proper operation.
30. Temperature Control By-Pass Valve ... a manually or automatically controlled valve in a regenerator by-pass line used on some cheese milk pasteurizing systems to adjust setting temperature by regulating amount of regeneration provided (may be installed around raw or pasteurized regenerators).
31. Regenerator Differential Pressure Switch (RDPS) ... an adjustable sealable instrument which continuously compares the pressure at the inlet of the raw regenerator and controls booster pump operation.
32. Back Pressure Valve and Controller (BPC) ... an instrument and flow control valve installed downstream of the vacuum breaker at the discharge of the final cooler to automatically regulate pasteurized regenerator back-pressure. This function may be accomplished with a "...manually adjustable compression valve such as (7) or (30), or with an orifice in some installations."

Basic Considerations In Environment, Facilities, and Equipment Control

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St.Paul, MN 55114

Package and Pasteurize vs. Pasteurize and Package

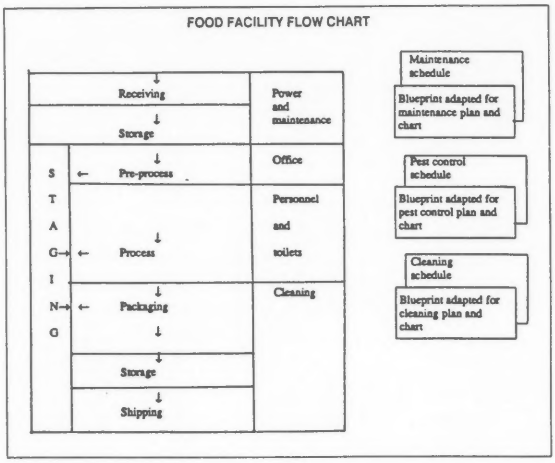
If food is assembled, packaged, and then pasteurized (cook-in-package), there is only a package failure risk following pasteurization. The food will be free of vegetative pathogens as long as the package seals are sound. Under these circumstances, the packaged pasteurized food does not have to be handled in an immaculate environment because there is no chance of cross-contamination. It should be stored at less than 38°F to control non-proteolytic *Clostridium botulinum*. If stored at 28°F to 30°F, it will achieve its maximum shelf life. If food is cooked and then packaged, the process must be carefully hazard controlled. If the food, after cooking is put immediately into containers above 160°F and sealed, the food and the insides of the containers will be effectively pasteurized. If the food is cooled, then manipulated and packaged, it must either be done in a manner that will keep pathogens out of the food, or controlled so that the pathogen level will not be a hazard. If the food is to be used in less than 5 days and stored below 38°F, the risk is the same as for any existing foodservice. The food contact surfaces after pasteurization must be kept clean so that there would be less than 1 *Listeria monocytogenes* per square cm and APC less than 100 microorganisms per square cm. If the food is to be stored for more than 5 days, it should be stored at 28°F to 30°F. In this case, the food contact surfaces should be pathogen free, as determined by swabs of 40 square inches. APC should be kept below 100 per square cm.

KITCHEN DESIGN AND FOOD HANDLING PROCESSES

Katsuyama and Strachan (1980) and Shapton and Shapton (1991) provide many useful ideas on kitchen/processing plant design. The figure, **Food Facility Flow Chart,** shows a conventional, large food operation kitchen design.

It is assumed that the receiving, raw food storage, and pre-preparation areas are contaminated. There are, for example, low levels of *Salmonella* spp. and *Campylobacter jejuni* from poultry found on many surfaces, especially refrigerator door handles. *Listeria monocytogenes* is in all floor drains.

If a facility uses a cook-and-package method, whereby food is manipulated after pasteurization, access to the packaging area must be restricted to people who have properly sanitized their hands and garments, and have full hair restraints, before going into the clean area. There can be no backflow of food from shipping into the process, and no dirty equipment or food can be allowed in the packaging or storage area.



In order to control maintenance, pest control, and cleaning, there should be three separate blueprints on the wall in the operations manager's office. The blueprint for maintenance shows every item and location that needs maintenance. This is cross-referenced to a maintenance schedule. There should be a blueprint showing all pest control locations, including traps. It should be cross-referenced to a pest control schedule. Finally, there should be a color-coded blueprint of levels of contamination. Green indicates areas that are clean, with no vegetative pathogens on food or food contact surfaces, and are pathogen controlled (e.g., packaging, finished product storage). Yellow represents areas of moderate or mixed contamination, such as production. Red indicates highly contaminated areas such as receiving and raw food storage. There should be a cleaning schedule that provides complete guidance as to how to maintain specific level of microbiological cleanliness in the different areas of the facility.

EQUIPMENT HACCP — QUALITY ASSURANCE DESIGN FOR PERFORMANCE

Refrigerators and Blast Chillers

Refrigerators and blast chillers must have:

1. Air velocity of 20 to 40 feet per minute (1.09 to 2.2 meters per second) for holding refrigeration units, and more than 1,000 feet per minute (54.7 meters per second) for rapid chilling of foods 2 inches or less in thickness, to 40°F within 4 hours. Temperature uniformity with the unit must be +/-2°F (+/-1°C).
2. Food Btu removal capacity of the refrigerator per hour: 0.25 compressor horsepower and 2,000 Btu evaporator coil capacity per 20 pounds (9.1 kilograms) of food cooled per hour. Refrigerant temperature drop in the coils must be no more than 8°F. There should be an electric coil defrost system so that with a periodic 10-minute defrost, the coils can be kept free of frost build-up.
3. Temperature settings:
   28°F to 30°F (-2.2°C to -1.1°C) — Meat, fish, poultry, and chilled food.
   35°F (1.7°C) — Less perishable items (e.g., vegetables).
4. Temperature uniformity of +/-2°F (+/-1°C).
5. Humidity control of either dry (70%) or moist (90 to 95%).
6. Reach-in refrigerators — compressors which are on less than 80% of the time at 100°F (37.8°C), 95% relative humidity ambient conditions, when the door is opened up to 20 times per hour for 10 seconds each time.
7. Walk-in refrigerators — ceilings higher than 9 feet to accommodate sufficient air exchange to maintain uniform unit temperatures. The floors should be tile and on a level with the kitchen floor.

Low Temperature Ovens

Low temperature ovens, which cook at 250°F (121.1°C) or less, must have:

1. Humidity control that permits 30 minutes of moist heat (95% relative humidity) at the beginning of the heating period in order to destroy *Salmonella* spp. on the surface.
2. Heat transfer rate that is capable of heating all items from 40°F to 130°F (4.4°C to 54.4°C) in less than 6 hours.
3. Temperature uniformity of +/-5°F (+/-2.8°C).
4. When door is opened for 3 minutes, time for temperature recovery at 250°F (121.1°C) of less than 2 minutes.

Food Contact Surface Sanitizing

The system used to sanitized food contact surfaces must have:

1. A detergent cleaner in a dispenser that is capable of dissolving grease.
2. Scrub brushes and plastic scrubbies that are replaced or cleaned and sanitized at least daily. Each area should have its own cleaning utensils in order to avoid cross-contamination.
3. In order to melt grease and remove soil, a hot water supply [above 120°F to 140°F (48.9°C to 60.0°C)] for washing and rinsing surfaces.
4. A four-compartment sink to be used for pre-rinsing food scraps from equipment, washing, rinsing, and sanitizing equipment.
5. A hot water supply of 170°F (76.7°C) or more to be used for sanitizing surfaces.

Food Sinks

Food sinks must:

1. Have two compartments.
2. Be cleaned and sanitized before each use, to include drains.

Salad Preparation Tables

Kitchen cold preparation tables must have sufficient food surface cooling capacity to keep the surface temperature of the food on the table, in a 100°F (37. 8°C) and 95% relative humidity environment, below 40°F (4.4°C). This will require air at 35°F (1.7°C), 95% relative humidity, blowing across the food surface at 20 feet per minute (1.09 meters per second), and a shield to prevent hot air and radiation from interfering with cooling.

OTHER QUALITY ASSURANCE KITCHEN DESIGN CHARACTERISTICS

Raw Food Area

The raw food area must be kept totally separate from the prepared food area. There must be no crossover in halls or dock areas.

Pest and Insect Control

For pest and insect control, the building is sealed. Traps and fly control are approximately 50 feet away from the building. There can be no blue/fluorescent insect-attracting lights by the door leading into the facility or immediately inside the doors.

Walls

The walls are made of light-colored tile, either block or ceramic, which goes up to the ceiling.

Ceiling

There are no false ceilings. The ceiling is the underside of the roof, which is usually sealed concrete beams. There are no overhead pipes. Pipes come from the wall or up through the floor. The floor is raised, and there is an under-floor area for maintenance of pipes and plumbing.

Access

Access to the normal food preparation area is designed so that no one can enter the area without first putting on a protective coat and hair cover, and washing the pathogens from their fingertips. The feces-wash-off hand station is by the entryway. No one with a respiratory illness is admitted.

Sloping Surfaces

There should be no flat surfaces on tops of equipment or window sills. Surfaces should slope at 30° to 45°. Windows should be flat to the inside walls. Sloping sills should be on the outside wall.

Floors

Floors should be brick or quarry tile. They should be slip resistant in walkways. Floors should be sloped 1 to 40 or 1 to 60 to drains. At least 6-inch risers are used for the walls.

Air

The air systems should filter for 95 percent removal of all particulates. Air ducts and filters should be easily cleanable. UV can be added if desirable. All processing rooms should be under positive pressure. Room temperature should be kept at about 70°F (21.1°C) in order to better control the low-temperature pathogens. Refrigerating a room to below 50°F (10.0°C) is unnecessary unless it is used constantly for processing chilled pre-pasteurized food. Humidity must be controlled to prevent "sweating" of walls or food. Water cooling towers must be checked for presence of *Legionella pneumophila* and other agents. Air inlets should be fashioned so that birds, which carry high levels of pathogens, cannot nest in or near them.

Water

The municipal water source should be checked regularly. One can filter one's own water and use UV or ozone to ensure safety. Water should be tested quarterly. The pH should be 7.5 or less.

Piping

Copper tubing (piping) should be checked for properly soldered connections. Only silver non-lead solder should be used. It is important to check backflow valves on vending machines to make sure that they prevent CO_2 leaking back into copper pipes.

Sewage

Greywater (food waste and wash water) and sewage are kept separate. Personnel sewage systems must be checked regularly. No sanitary sewer lines should go through the floor or overhead in the processing and packaging area.

Light Intensity

Lighting in storage areas should be a minimum of 30 to 40 footcandles. Prolonged close work should have 60 to 90 footcandles of light. In potentially dangerous areas and for use during cleaning, lighting above 100 footcandles should be used.

High-Pressure Cleaning and Sanitizing

The facility should be cleaned and sanitized each night from ceiling to drains with high-pressure detergent followed by sanitizer. Food contact surfaces should be cleaned every 4 hours during operations. The area is sanitized in the morning before start-up, if it has been closed for the night. Mops should not be used. If floors are mopped, they must be mopped first with a detergent solution, rinsed with clean water using a second mop, and then mopped with sanitizer solution using a third mop.

Sinks

Sinks must be large enough for submerging all equipment to be washed. Pot and pan sinks should have four compartments. The first compartment is for removing gross soil. It should have a spray and disposal. The second sink is for washing at 120°F (48.9°C); the third, rinsing at 120°F (48.9°C); the fourth, sanitizing. There must be enough space to air dry the pots and pans.

Hand Washing

For hand washing, water must flow in a shower at 2 gallons per minute. Water temperature must be controlled at 110°F to 120°F (43.3°C to 48.9°C). The water outlet is 6 inches above the sink to enable people to wash their arms. Soap is not antibacterial, but is sufficient for soil removal. The on/off value should be infrared/proximity from the Sloan Valve Company, Illinois, or equivalent.

Temperature

A temperature of less than 95°F (35°C) and 70% relative humidity must be maintained in the kitchen for the health of food preparation personnel.

People

People must be prevented from moving from the raw food area to the aseptic area. Maintenance personnel are followed by a supervisor when they are in the area, and must be approved before they enter or change anything.

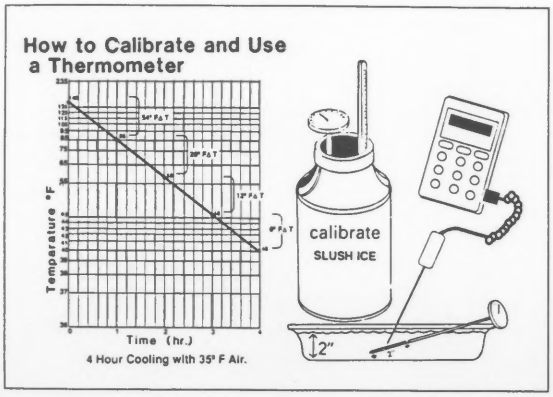
TEMPERATURE MEASUREMENT AND CALIBRATION

Temperature is probably the most critical of all controls in chilled food systems. One or two degrees Fahrenheit at 30°F can freeze some food or cause a doubling in the growth rate of some spoilage microorganisms.

At pasteurization temperatures of 158°F to 160°F, the D value for *Salmonella* spp. changes from 0.02740 second at 158°F to 0.01729 second at 160°F, an increase in the destruction rate of 58 percent. Precision is critical.

Stem Thermometers

It is normal for the retail food industry to use bimetallic stem thermometers, as shown in the figure, **How to Calibrate and Use a Thermometer**, to measure food temperature. **Bimetallic stem thermometers are unreliable devices**, having only an accuracy of+/-2°F. This is unsatisfac-



tory. They can be used by line employees for general product monitoring. However, they cannot be used to record critical process temperatures such as pasteurization and cold holding. **A calibrated, grounded junction thermocouple probe with a diameter of less than 1/16 inch must be used** to measure temperature.

Glass Precision Thermometers

Because of the precision needed, thermocouples must be calibrated against precision glass thermometers certified traceable to National Institute of Standards and Technology reference thermometers. Brooklyn Thermometer Company Inc. supplies precision glass thermometers.

Calibration for Pasteurization

To calibrate a thermocouple to pasteurization temperatures, a 1/10°F calibrate standard thermometer is placed in a capped thermos filled with water at 150°F, +/-10°F. The thermocouple is inserted next to the thermometer in the thermos and allowed to stabilize.

Thermocouple Meters and Probes

A thermocouple meter such as the Barnant model 115 can be field calibrated to 0.1°F. A wide variety of thermocouple probes can be selected from OMEGA Engineering, Inc. With the help of the precision glass thermometer and thermos, the probe and meter can be calibrated to be accurate to under +/-1°F. A simple, less versatile but highly accurate thermocouple meter and probe is Atkins Technical model 330. A useful, compact multi-channel thermocouple printing recorder is manufactured by ECD.

Flex Package Feedthrough

One of the challenges in process temperature measurement is to get a probe into a flexible food package which is then cooked and cooled in water. A male connector to "O" ring straight thread fitting ZHBA5 (Parker Hannifin Corporation) works well with a 1/16-inch or 1/8-inch thermocouple probe to provide a vacuum-water tight feedthrough.

Measuring Cooling

The process of cooling is not a linear loss of heat from the food, as shown in the graph in the figure, **How to Calibrate and Use a Thermometer**. Temperatures must be measured accurately to make sure that the center of the food will cool at a rapid enough rate. In cooling from 140°F to 40°F, the center must cool 54°F in the first hour. Otherwise, the center will not reach 40°F in 4 hours. For viscous food to cool in 4 hours, it must be no more than 2 inches thick.

The only way to verify that a thin food package such as a *sous vide* product or a pan of food is cooled correctly is to use a small diameter thermocouple probe.

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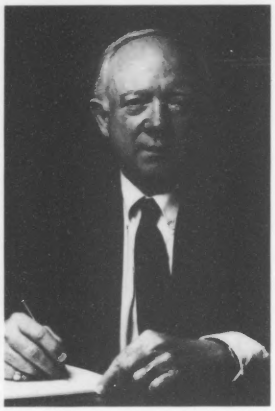
Sanitary Design



A Mind Set (Part XIV)

Donald J. Graham
Senior Food Technologist
Sverdrup Corporation
St. Louis, MO

Sanitation means different things to different people. Variations of the word have been used to describe numerous functions, jobs and processes. We have all heard about the "sanitary engineer" aka the garbage man. "Sanitary waste" means human waste in many cases. "Sanitary operations" can have diverse meanings ranging from rather unsophisticated raw material processing to highly sophisticated clean room Class 1 operations.

Used as an adjective, the word sanitary has to be considered in light of what is being processed. It fits into a range of requirements. For example, sanitary design concepts at Sverdrup fit into three categories: good, better and best.

Good sanitary design is the minimum level for a food processing plant. This level of design satisfies regulatory requirements. It takes into account the shalls and shoulds in Part 110 of Title 21 Code of Federal Regulations. (21 CFR). It also takes into account, if applicable, these requirements of the USDA's Handbook 570 for meat, poultry, and egg plants. This design level accommodates design that does no incorporate these regulations is, aside from being contrary to law, not good sanitary design and can make the processor subject to regulatory action by the FDA or prevented by USDA from operating a meat, poultry, or egg plant.

The next level of sanitary design is designated as "better." At this level all the requirements of the good level PLUS recommended design feature from organizations such as 3-A, BISSC (Baking Industry Sanitation Standards Committee), A.I.B. (American Institute of Baking), N.F.P.A. (National Food Processors Association), and from the client's own sanitation and sanitary design criteria are taken into account. HACCP (Hazard Analysis Critical Control Points) analysis is of prime consideration as it related to facilities and equipment.

The third level of sanitary design is "BEST." The Sverdrup design criteria for plant/warehouse/process sanitation incorporates both items listed in levels "good" and "better" with additional sanitary design features tailored to the project, state of the art and, if applicable, leading edge upgrading of materials and construction methods.

In applying the good, better, best criteria to a project, it is imperative to remember that an entire facility will not necessarily be designed at one specific level. All three levels should be present in the same facility. The higher levels of design are to be applied in the more sensitive areas of the processing sequences and locales. For a process that is completely enclosed, the equipment's sanitary design should follow the "best" sanitation level criteria, while the structure enclosing the equipment probably only has to follow the minimum, or good, criteria.

The engineers that design areas, processes and equipment at the three criteria levels must have the mind set of sanitary design. These levels require training and experience in food/beverage processing as related to sanitation. It is important to know why sanitation is important in a processing facility to effectively plan the best sanitary design for the facility and situation.

As an example of how sanitary design training assists this type of thinking, one of Sverdrup's newer engineers, who had not yet taken the company's Sanitary Design and Construction course, was asked to design an equipment platform for a food processing facility project underway. The engineer designed a textbook platform. It was structurally sound with I Beams, cross braces, and easily met all the stress and load requirements necessary for a good structural design. However, it was a sanitation disaster. The 3' x 6' x 4' platform had 36 sq. ft. of flat area that had to be cleaned daily. In addition, 18 sq. ft. of area under the platform was not accessible for sweeping because of the cross braces.

The new, untrained engineer's supervisor/group leader who had been trained in sanitary design concepts, quickly recognized the problem. He assigned the person to work with another trained member of the project team and together they came up with a revised design. The new designed utilized tubular sections, plate gussets in place of cross braces, and concealed bolts in the floor to secure the tubular legs. This platform had the same dimensions as before, but now had only 15 sq. ft. of flat area to be cleaned daily and the entire floor underneath was accessible. In addition, the redesigned platform was less expensive to construct and much less expensive to maintain and clean.

There are many examples of how sanitary design concepts have been developed with some creative thinking. Sanitary design is not a fixed science but continues to evolve and develop by those cognizant of its need in food and pharmaceutical facilities and processes.

A Glance at the Past

A column of IAMFES happenings from bygone days. Written and presented by IAMFES Past Presidents'. This column will present some of the interesting highlights and accomplishments of IAMFES over its past years.

This month's column - October **1937** By Henry Atherton

Special Convention Issue

The IAMFES Officers for this year were:

President:	John G. Hardenbergh, Plainsboro, NJ
1st Vice President:	Alexander R. Tolland, Boston, MA
Secretary-Treasurer:	C. Sidney Leete, Albany, NY
2nd Vice President:	Paul B. Brooks, Albany, NY
3rd Vice President:	Victor M. Ehlers, Austin, TX

Dues: Active member $5.00/yr

Annual Meeting: 26th Annual Meeting

In: Louisville, KY

October 11-13, 1937

The highlights for this year included:

- *Journal of Milk Technology*, Vol. 1, No. 1. Special Convention Number October, 1937. Suggested first at 20th Annual Meeting in Montreal, 1931. 1936 Annual Meeting (Atlantic City) referred to Executive Board with power to act. *Journal of Milk Technology* inaugurated as bi-monthly publication with January 1938 issue. Only published Convention Proceedings prior to this issue. (Every year for 25 years).

- Organization (International Association of Milk Sanitarians) came in to being in October 1911. Constitution adopted 10/16/11 - was know as International Association of Dairy and Milk Inspectors until 1935 when the name was changed to International Association of Milk Sanitarians.

- **Editorial Comment in First Issue:**
  - Members can no longer wait six months for information presented at annual conference.
  - Milk inspection was organized entirely on a local basis.
  - Milk inspector effectiveness varied greatly, depending on his personal knowledge of subject.
  - Public becoming more insistent on effective inspection.
  - Noted the change from local producer-dealer to collection of milk from scores of farms.

  "This journal is to serve that field of milk technology not now covered by publications of the purely research type on the one hand, nor of the trade journal type on the other."

- **Among "Personal Items."**
  - Mr. C. K. Johns, former President of IAMS (1934-35) was on leave from official duties as Asst. Agricultural Bacteriologist at the Central Experimental Farm, Ottawa, Canada to carry on post-graduate study during the second semester at the University of Wisconsin.

  - Milk Control and Sanitation Exhibit planned for New York World's Fair of 1939. Dr. Milton J. Rosenau, M.D., will chair committee.

  - 42 outbreaks of diseases in 1936 attributed to milk-borne infections as reported by health authorities throughout the country. Raw milk was responsible for all of them. 1892 cases and 27 deaths (typhoid fever, 5 deaths; scarlet fever, 15 deaths; septic sore throat, 7 deaths). 2,044 cases of undulant fever in 1936 but number of milk-borne cases was not determined.

- **Articles appearing in the first issue -**
  - Report of Special Committee on Association Publication
  - Current Technological Problems in Dairy and Ice Cream Industries - A. C. Fay
  - Engineering of Pasteurization - C. A. Holmquist and W. D. Tiedeman
  - Report of the Committee on the Food Value of Milk and Milk Products
  - The Resazurin Test - Preliminary Studies on its Practicalities and Possibilities - J. A. Keenan, W. D. Bartlett, and H. Rutan
  - Undulant Fever in Man, and its Relation to Bang's Disease in Livestock - Dr. Gaylord W. Anderson
  - Which Test Gives the Most Accurate Fat Determination for Ice Cream? - Forrest C. Button
  - Raising Calves on Wire Floors

  plus the Program for the Fall Conference.

Food and Environmental Hazards to Health

Botulism in the Entire United States

Home-canned and home-preserved foods are the most common cause of botulism in the United States. The problem of botulism in commercial canning in the early 20th century was virtually eliminated after a series of studies defined the habitat of the *Clostridium botulinum* bacteria responsible for the disease, the foods incriminated, and the conditions that would destroy *C. botulinum* spores.

The largest outbreaks ever reported in the United States were in Pontiac, Mich., in 1977, when 59 people developed the illness after eating home-canned peppers in a restaurant, and another in Clovis, N.M., in 1978, when 32 people became ill with botulism after eating potato salad at a country club.

There are seven strains of *C. botulinum*, designated A though G. Types A, B, E, and F are responsible for most cases of botulism in humans. The bacteria can also be grouped into proteolytic and non-proteolytic categories. The proteolytic types have enzymes that break down proteins in food, releasing compounds such as putrescine and cadaverine that produce offensive odors, providing a warning that something is wrong. Non-proteolytic types, on the other hand, don't have these enzymes. They can grow in a food and make it toxic with no signs of spoilage, either in appearance or taste.

Although botulism is not a common food-borne disease in the United States apart from Alaska, still roughly 5 to 10 outbreaks occur each year, says Jeffery Rhodehamel, research microbiologist with FDA's Center for Food Safety and Applied Nutrition.

"Most outbreaks are from improperly home-processed foods—either home canning or other home processing," he says. "Commercial outbreaks occur less often, but when they do, they usually involve a number of people and are more spectacular."

C. botulinum bacteria grow under anaerobic conditions—that is, in an environment without oxygen, such as in canned food or other vacuum-packed products. Though a relatively anaerobic environment and temperatures above 30 degrees Celsius (86 degrees Fahrenheit) are optimal for production of botulinum toxin, strict anaerobic conditions are not necessary, and toxin production by some type E strains has occurred at temperatures as low as 3.3° C (38° F).

Low-acid canned foods are historically associated with botulism. Recent outbreaks, however, have involved foods not usually associated with botulism, such as improperly prepared sauteed onions, potato salad, and commercial garlic-in-oil.

"These outbreaks emphasize the need for continued vigilance both by consumers and by regulatory agencies," Rhodehamel says. He advises consumers to be aware that swollen or badly dented cans have a greater potential for contamination. A severe dent may stress the metal and make a pinhole through which the bacteria may enter.

Regarding home-processing, Rhodehamel says that freezing inhibits the growth of *C. botulinum*. "If you vacuum-pack a product and spores are present, they may be able to grow, but if you freeze it, they won't grow, and if you thaw the product under refrigeration and cook it, there's no danger. Boiling the product for 10 minutes or other equivalent cooking will destroy any toxin that may have formed," he says.

FDA Consumer/January-February 1992.

Children's Chicken Meal Recalled

Consumers were asked to return containers of a chicken meal for children to the place of purchase because some of the packages contained lumps of chicken that are difficult to swallow.

Last October, the U.S. Department of Agriculture announced the voluntary recall of "Table Time Chicken & Stars Microwave Meal for Children" by the product's manufacturer, Beech-Nut Nutrition Corporation of St. Louis.

The problem was discovered when the company began receiving reports of children choking, gagging, and spitting out lumps of chicken from the product, according to William J. Hudnall, a deputy administrator of USDA's Food Safety and Inspection Service. Because of the potential choking hazard, the agency urged consumers not to eat the product or feed it to children and to return unopened packages to the place of purchase.

The product was distributed to wholesalers and retailers in at least 21 states and possibly more. The suspect product can be identified by "EST P-6817" inside the USDA inspection seal on the label and by a two-line production code stamped on the bottom of the container. The first line of the production code is "FEB93" preceded by the numbers "08," "09," "14," "15," or "19." The second line is "18G0885" followed by one of the letters A through H. Only containers with these production codes were included in the recall.

Consumers with questions may phone a toll-free USDA hot line at (1-800) 535-4555 from 10 a.m. to 4 p.m. EST Monday through Friday. At other times, callers can hear a recorded message. In the Washington, D.C., metropolitan area the number is (202) 447-3333.

FDA Consumer/January-February, 1992.

Industry Products

Portable Pilot Plant Evaporator Fabricated by Walker Stainless Equipment Co., Inc.

A small natural circulation evaporator was fabricated and assembled by Walker Stainless Equipment Company to the design of Marriott Walker Corporation for pilot plant operation. It has the capability to concentrate product down to a one gallon batch at selected temperatures, both on steam and product sides. The evaporator components are fabricated to 3-A Standards from type 304 stainless steel and is rigidly supported on a mobile steel framework, with separable flexible connections for electricity, water and steam.

Walker Stainless Equipment Company fabricates multiple effect evaporators and spray driers for Marriott Walker Corporation.

Walker Stainless Equipment Co., Inc. - New Lisbon, WI

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TransVair® Mechanical Conveyor

The Young Industries' TransVair Mechanical Conveyor features dust-free handling for friable, abrasive, corrosive, or sticky powders, granules, prills, pellets and fibers. The TMC is manufactured either as a straight line or right angle unit, (both with transfer rates up to 1,200 cu. ft./hr.) The TMC is also available in stationary or portable designs. The Young Industries' test lab facilities are equipped for conveying sample runs. The Young Industries has a number of TMC rental units in stock

The Young Industries, Inc. - Muncy, PA

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Nitrogen/Sulfur Analyzers with Autosamplers

Model 7000V Nitrogen/Sulfur Analyzers from ANTEK Instruments, Inc. can be configured for nitrogen analyses only, sulfur analyses only, or simultaneous nitrogen and sulfur analyses.

The unique vertical orientation of the furnace requires less bench space and allows the use of new, sophisticated autosamplers. The 7000V LA comes equipped with a robotics liquid autosampler with space for up to 200 vials. The 7000V SA has a 20 position solids autosampler which accepts samples up to 500 mg. Both are microprocessor controlled to provide trouble-free, unattended operation. Results are printed as samples are run to provide documentation and keep the operator informed of the progress of analyses.

ANTEK Instruments, Inc. - Houston, TX

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Pesticide Screening is now Easy Using New On-Site Testing Kits

A new addition has been made to the line of QuickKit® testing kits and is now available. Spectrochrom, Ltd., an Ames, Iowa-based chemical testing and research laboratory, introduces the new Pesticide Detection QuickKits®.

Pesticides in water and soil have become a topic for concern because any residues left behind in these mediums could be potentially harmful to animals and humans. Using a thin layer chromatography procedure, recognized as one of the most reliable methods for pesticide detection in field testing kits, soil and water samples can quickly and effectively be screened for pesticide residues. These kits are fully self-equipped and ready to perform an entire screen; from sample preparation to residue detection. All material used are also readily available from Spectrochrom, Ltd. to restock each kit.

The procedures used in the QuickKits® are easy to understand and to apply In fact, no special training is required to perform these screens. When quick and easy screens need to be performed without the cost and time consumption of extensive laboratory analyses, QuickKits® will be beneficial with their easy, on-site applications.

Spectrochrom, Ltd. - Ames, IA

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Microscopy Immersion Oils

Consistent quality and precise specifications make Cargille Immersion Oils the most trusted immersion oils. Six types of Immersion Oil with various viscosities and fluorescence levels are available:

Types A & B	150 & 1250 cSt: respectively, for normal light microscopy
Type 300	300 cSt: Appropriate viscosity for AUTOMATED HEMATOLOGY, optimum refractive index, & controlled color absorption
Type NVH	21,000 cSt: for horizontal, inverted and inclined instruments
Type DF	VERY, VERY LOW FLUORESCENCE: highest resolution of any fluorescence microscopy immersion oil
Type FF	FLUORESCENCE-FREE: for observing very low levels of fluorescence; highly stable; water-white

Detailed literature describing the optical and physical properties and free samples of each immersion oil are available upon request.

R. P. Cargille Laboratories, Inc. - Cedar Grove, NJ

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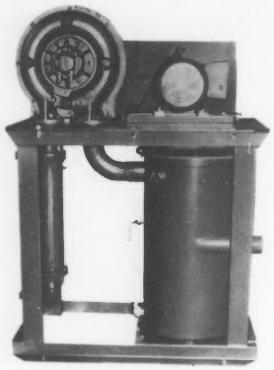

Lamson Corporation Develops Vacuum for Dairy Industry

Lamson Corporation, a leading manufacturer of industrial blowers, vacuum pumps, and vacuum systems announces the development of a new energy efficient milking/vacuum package for the dairy industry.

The Lamson DAIRYPAK system, designed for operations with 100 or more cows, is comprised of a very quiet Turbotron vacuum producer, cyclonic moisture separator and cast iron heat exchanger. The heat exchanger utilizes water heat from the pump discharge to produce hot water.

Depending on the size of the unit, 20 to 75 gallons of 180 degree water is produced per hour. Excess heat can be used to supplement the heating system in the barn or milking parlor. If additional hot water is required, a second heat exchanger can be utilized.

The resulting reduction in hot water/heating expense pays for the operation of the system; return on investment is less than two years.

In addition to energy savings, Lamson's DAIRYPAK system minimizes maintenance time and expense. The Vacuum producer is a state-of-the-art, patent pending centrifugal pump with only one moving part (the impeller) to provide quiet, dependable source of pulse-free vacuum. Externally mounted grease lubricated bearings produce dry, oil free discharge air.

Lamson Corporation - Syracuse, NY

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New Two-Side Sealable Film Offers Broad Seal Range

STC Films has introduced a two-side sealable, biaxially oriented polypropylene film (BOPP) that provides excellent seal strength on both surfaces.

Called SB, the new film is designed for use as an unsupported web on high-speed, horizontal form fill and seal machines. Its low seal-initiation temperature, good hot tack and seal strength combine to maximize packaging speeds. SB is ideal for packaging bakery products, but it can also be used as an unprinted overwrap applications where shrink is not required. Its good optical properties of low haze and high clarity enhance product visibility and provide cost-effective protection from outside contaminants and moisture.

The new film provides excellent machinability and is available in thicknesses ranging from 18 micron (71 gauge) to 25 micron (98 gauge).

STC has been a leading producer of films and a pioneer in the flexible packaging industry since 1971. Utilizing advanced manufacturing technology, STC produces a broad spectrum of high quality packaging and industrial films, including BOPP, cast polypropylene (CPP) and polyester (PET).

STC of America - North Bergen, NJ

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Tri-Clover, Inc. Introduces the Vacuum Breaker — A New Source of Protection Against Silo Collapse

Tri-Clover, Inc. introduces the new Vacuum Breaker (patent pending), a low cost, easy to install system to help protect silo tanks from collapsing due to over-filling. The unit can be installed on new tanks, or easily retrofitted to existing tanks in the field.

Vacuum buildup is a common and costly occurrence. Typically, a silo can collapse due to a mechanical or electrical failure of the level sensing device, operator errors or some other cause. When this failure happens, liquid is pumped beyond the established shut-off point until it reaches the overflow port. As the pump continues to run, the product is pumped into the silo faster than it can be discharged into the overflow tube. When the overflow is discovered, the pump is immediately shut off; however, the excess liquid transferred to the silo continues to funnel off through the overflow. As the excess liquid is discharged into the overflow tube, sufficient vacuum may be created to collapse the tank.

For the cost of one tank repair or less, this lost cost, one time investment can save time, worry, and money.

The Vacuum Breaker fitting from Tri-Clover is designed to stop this pressure build-up by actually "breaking" the vacuum pressure. This fitting is essentially a cone with a four-inch diameter bottom and two three-inch diameter tubes formed into the top in the shape of a vee. The four-inch bottom is welded into the vertical discharge tubes. One of the top tubes is welded to the silo overflow fitting, and the other tube is welded to the air inlet pipe. Both the vertical fluid discharge tube and the air inlet tube terminate in screened fittings at the silo vestibule, also available from Tri-Clover.

The unit is made of sanitary 316L stainless steel, with 4" x 3" tube OD butt-weld permanent connections, and features full CIP capability, utilizing existing silo tank CIP lines. Since the Vacuum Breaker has no internal moving parts, it is virtually maintenance free. The fitting is designed to handle an overflow rate to up to 550 gallons per minute, and meets USDA and 3A Standards. The Vacuum Breaker is intended for use with low viscosity products such as milk, juice, bottled water, whey, condensed products and cream up to 50%.

Headquartered in Kenosha, Wisconsin, Tri-Clover, Inc. is a leading manufacturer of sanitary stainless steel valves, pumps and fittings, as well as flow control, batch/weigh and Clean-In-Place (CIP) systems. Founded in 1919, Tri-Clover, Inc. is now a member of the Alfa-Laval Group, a $3 billion multi-national organization headquartered in Sweden that operates more than 160 companies in 130 countries around the world.

Tri-Clover, Inc. - Kenosha, WI

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Filtration Engineering Manufactures Largest Ultra-Osmosis® Membrane System in the World

Filtration Engineering Co., Inc. based in New Hope, MN recently delivered the Largest Ultra-Osmosis® membrane system manufactured in the world. The system is designed to partially demineralize and concentrate 45,500 liters or 100,100 lbs/hour of HCL Casein Whey. The system includes nine (9) internal recirculating loops, with 450 spiral wound elements, totaling 34,250 square feet of active membrane area. The process and CIP procedures are controlled by an Alllen Bradley 5/30 PLC with a Panelview Monitor for ease of operation. In addition, the system uses a remote IBM compatible PC, that will be located in a control center area.

Demineralizing HCL Casein Whey with the Ultra-Osmosis® membrane process was developed by Filtration Engineering for preparation of the whey prior to further processing into a valuable food ingredient.

Filtration Engineering Co., Inc. - New Hope, MN

Please circle No. 249
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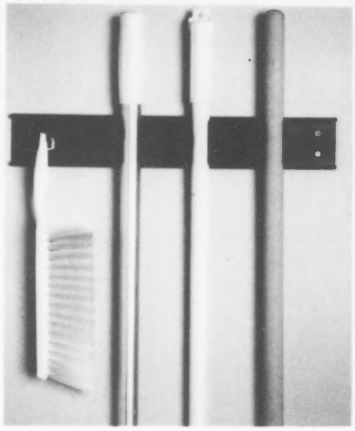

Broom & Brush Holder System Available From Sparta

Sparta Brush Company has introduced a systematic approach to organizaing brooms and brushes with the new Broom & Brush Holder.

The Broom & Brush Holder System is molded nylon with no springs that can break and no rubber fingers that wear out. Brooms or brushes can be individually hung or used with the mounting bar which is designed with anchor holes 16" on center for convenient attachment of the mounting bars to studs, drywall or other surfaces. A hook is also available for individual use or it can be used with the system. This systematic approach to hanging brooms & brushes is important for proper storage and proper air drying.

Sparta Brush Company is a leading manufacturer of high quality specialized brushes for the food service and food processing indsutry.

Sparta Brush Company - Sparta, WI

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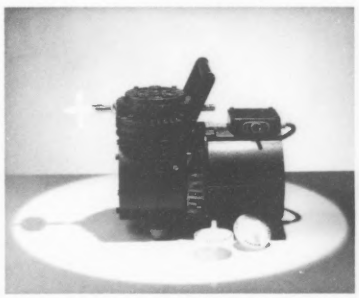

Safety Alert — Vacu-Guard™ Helps Laboratories Comply with New OSHA Regulations for Eliminating Exposure to Bloodborne Pathogens

Using the readily available and easy to use Vacu-Guard™ protective filter device from Whatman, laboratories can easily comply with the new OSHA regulations for eliminating or minimizing exposure to bloodborne pathogens from any vacuum, suction and aspiration equipment handling contaminated body fluids.

These regulations, issued on Friday, December 6, 1991, and which take effect on March 6, 1992, require the use of engineering controls as the primary means of preventing contamination of vaccum, suction and aspiration systems by hepatitis B virus, human immunodeficiency virus (HIV) and other bloodborne pathogens from blood, body fluids and tissue samples.

The Vacu-Guard™ protective filter device from Whatman is such an engineering control. Its retention efficiency is rated at 99.99% for 0.1 m particles or aqueous fluids up to 14 psi (0.9 bar); sufficient to prevent aerosols and fluids containing these infectious agents from contaminating equipment and being exhausted into the room.

Vacu-Guard™ is constructed from hydrophobic PTFE filter media housed in a polypropylene housing. Two styles of stepped hose barbs allow it to be easily installed on-line with 1/4", 3/8" or 1/2" tubing immediately before the vacuum source. Vacu-Guard™ is readily available in packages of 10.

Contact Whatman for details of an information packet that explains the new regulations, and a free maintenance log to document the use and replacment of Vacu-Guard™.

Whatman Inc. - Clifton, NJ

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Metro HD Super™ Clean Tables Provide Clean, Stable Work Area

InterMetro Industries' HD Super® Clean Tables are designed and built for cleanliness and stability. The work surface is made of seamless, 14-gauge steel with a support structure that virtually eliminates "drumming." HD Super® posts, tapered sleeves and Metro's Super Erecta Shelf® corners assure a rigid, wobble-free table.

With almost 90 models available, there's an HD Super® Clean Table to meet virtually any application need. All models feature stainless steel tops with your choice of chrome-plated or stainless steel posts and either a shelf, three-sided frame, or "H" frame, which can be placed at the desired level below the top. Additional shelves can be ordered from HD Super® stock.

Metro also offers HD Super® Clean Table models with overhead structures to help organize work areas. Cantilever shelves and hooks attach to back posts providing convenient storage for materials, tools and paper work. A special neoprene seal round posts creates a watertight seal between the posts and table, ensuring the highest standards of cleanliness.

Intermetro Industries Corp. - Wilkes Barre, PA

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Survey Says World Dryers Built to Last

The results of a survey from more than 7,000 restaurants conducted by World Dryer in February and March, 1992, demonstrated that World's Model A warm air hand dryers remain operational after more than nine (9) years of heavy usage.

The telephone survey was directed at managers of high traffic restaurants. Targeted restaurants ranged in age from 7-22 years old. Each had a World Dryer Model A unit installed at the time of construction.

89% of those surveyed stated that the original dryers are still operational and adequately fulfilled the hand drying needs of their customers. Less than 6% rated old dryers as less than fully operational but still adequate. 5% felt their units need to be replaced. A fully 95% of those surveyed would not replace their existing dryer unless it was part of a complete washroom renovation. The average age of the dryers in the surveyed restaurants was 9.2 years.

World Dryer, founded more than 40 years ago, built its reputation by manufacturing quality products which meet its customer's needs for reduced operating expenses, improved sanitation and environmental impact.

WORLD DRYER CORP. - Berkeley, IL

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Book Review

4th Ed. Educational Foundation of the National Restaurant Association's Applied Foodservice Sanitation Certification Coursebook

The Fourth Edition of the Educational Foundation of the National Restaurant Association's Applied Foodservice Sanitation Certification coursebook is notably reorganized as well as updated, incorporates HACCP methods, and is prefaced by Dr. Frank L. Bryan.

The book conveys both the HACCP system and NRA's Sanitary Assessment of the Food Environment (S.A.F.E.) program. As one of the first foodservice manager coursebooks to introduce HACCP, the book flows well and places a greater emphasis on the food itself and proper handling techniques. Management's responsibilities and outlines for planning HACCP programs are noted throughout the book, instead of being addressed in separate chapters.

Part I discusses foodborne illnesses and the hazards responsible for outbreaks. The information is easier for the non-scientific food service manager to understand. It is updated to include emerging pathogens such as *Campylobacter jejuni*, *E. coli* and Norwalk virus, and has given greater attention to parasitic diseases and fish toxins. Personal hygiene standards, employee habits, methods to establish a food service safety system, and the issue of AIDS are also updated and now located in the beginning of the book.

The practical aspects of storing and handling food safely and identifying critical control points are covered in Part II. Part III addresses clean and sanitary facilities and equipment, updates chemical safety handling and Material Safety Data Sheet requirements, and expands the section on pest control to include Integrated Pest Management systems. Parts IV and V deal with accident prevention, crisis management and employee sanitation training which are critical to establishing a total sanitation program. Appendixes have been created at the end of the book for food quality and storage charts. An updated Instructor's Guide is also available.

A. Kelly DeMauro, R.S.
General Mills Restaurants, Inc.
Orlando, Florida

Affiliate News

Minutes of the Tennessee Association of Milk, Water and Food Protection's Annual Meeting

The Thirteenth annual meeting of the Tennessee Association of Milk, Water and Food Protection was held June 5, 1992 at the Ramada Airport, Nashville, TN with President Ed Miller presiding. 45 members and guests were in attendance.

Hugh Wilson served as Morning Session Chairman. Dr. Monty Montgomery of the University of Tennessee, Knoxville gave a talk on the recent survey of manure disposal systems on Tennessee dairy farms.

Bob Bowen of Consolidated Flavor Corp. spoke on cocoa processing.

After a milk break, Maureen Gallagher of Charm Sciences, Malden, MA gave a talk on present and future tests for residues.

John Sanford of the TN Dept. of Ag. updated the group on changes in the IMS Single Service Container regulations.

After the Invocation by Earl Morgan of TDA, a buffet luncheon was served.

Patty Musgrave served as afternoon chairperson.

President Ed Miller conducted the business session.

Audit Committee report given by Cecil White. Membership report given by Mary Lou Hopper. Financial report given by Dennis Lampley. International Association report given by Ruth Fuqua. Nominating Committee report given by Sid Matthews. New officers were elected by acclamation.

President ..... Dr. Ann Draughon, Knoxville
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Vice President ..... Wayne Crabtree, Athens
Sec-Treasurer ..... Dennis Lampley, Bon Aqua
Archivist ..... Ruth Fuqua, Mt. Juliet
Brd Member at Large .. Ernie Yates, Cross Plains
Past President ..... Ed Miller, Lewisburg

Jack Grubb of Mayfield Dairy, Athens, TN was presented a plaque for outstanding service to the Association.

Ed Miller was presented a plaque for outstanding leadership as president.

Jerry Baggett served as door prize chairman and each person in attendance received a prize.

Upcoming IAMFES Affiliate Meetings

SEPTEMBER

•**17-18, Minnesota Sanitarians Association, Inc.'s Annual Meeting** will be held at the Earl Brown Center, St. Paul, MN. For more information, please contact Paul Nierman (612)785-0484.

•**18, Georgia Association of Food and Environmental Sanitarians and Georgia Environmental Health Association's Fall Education Symposium, Entitled "Seafood Safety and Quality"** will be held at the Skidaway Institute of Oceanography, Skidaway Island, GA. For more information call Larry Beuchat at the University of Georgia, (404)228-7284.

•**21-23, Indiana Environmental Health Association, Inc. 's Annual Meeting** will be held at the Abe Martin Lodge, Brawn County State Park, Nashville, IN. For more information call Tammi Barrett at (317)633-0168.

•**22-24, New York State Association of Milk & Food Sanitarians Annual Meeting** will be held in Saratoga Springs, NY. For more information contact Janene Gargiulo, Cornell University, 11 Stocking Hall, Ithaca, NY 14853, (607)255-8892.

•**23-24, Wisconsin Association of Milk & Food Sanitarians, Wisconsin Environmental Health Association and Wisconsin Dairy Plant Fieldmen's Association Joint Educational Conference** will be held at the Holiday Inn-Downtown, Eau Claire, WI. For more information contact Neil M. Vassau, P.O. Box 7883, Madison, WI 53707; (608)267-3504.

•**23-24, Joint Annual Convention of the South Dakota State Dairy Association and Dairy Fieldmen's Association** will be held at Howard Johnsons, Sioux Falls, SD. For more information call John Parsons at (605)688-4116.

•**29-Oct. 1, Wyoming Environmental Health Association Annual Meeting** will be held at the Holiday Inn in Cody, WY. For more information call Terry Carlile at (307)876-2483.

OCTOBER

•**5-7, California Association of Dairy and Milk Sanitarians in cooperation with the California Dairy Industries Association is hosting the Fall Dairy Industry Conference** to be held at the Red Lion Inn, Modesto, CA. For more information contact John Bruhn at (916)752-2191.

•**7-9, Kansas Association of Sanitarians Annual Meeting** will be held at the Holidome, Great Bend, KS. For more information contact John Davis, Wichita - Sedgewick Co., 1900 E. 9th, Wichita, KS 67214; (316)268-8351.

•**8-9, Washington Milk Sanitarians Association's Annual Meeting** will be held in Yakama, WA. For more information contact Lloyd Luedecke at (509)335-4016.

•**15-16, Iowa Association of Milk, Food and Environmental Sanitarians Annual Meeting** will be held at the Ramada Inn, Waterloo, IA. For more information contact Dale Cooper (319)927-3212.

•**15-16, Michigan Environmental Health Association's Fall Food Conference** will be held at the Holiday Inn South, Lansing, MI. For more information contact Bob Taylor, Michigan Department of Agriculture, (517)373-1060.

•**20, Associated Illinois Milk, Food and Environmental Sanitarians Annual Meeting and Fall Conference** will be held at the Carlisle in Lombard, IL. For further information contact Bob Crombie, Sec., AIMFES, 521 Cowles, Joliet, IL 60435, (815)726-1683 (Voice & FAX).

•**21-23, Mississippi Association of Sanitarians** will hold their Annual Meeting in Biloxi at the Mississippi Beach Hotel Resort. For further information contact Jerry Hill, P. O. Box 1487, Starkville, MS 39750 or call (601)323-7313.

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3-A SANITARY STANDARDS FOR SILO-TYPE STORAGE TANKS FOR MILK AND MILK PRODUCTS, NUMBER 22-05

Formulated by
International Association of Milk, Food and Environmental Sanitarians
United States Public Health Service
The Dairy Industry Committee

It is the purpose of the IAMFES, USPHS, and DIC in connection with the development of the 3-A Sanitary Standards Program to allow and encourage full freedom for inventive genius or new developments. Silo-type tank specifications heretofore and hereafter developed which so differ in design, material, fabrication, or otherwise as not to conform with the following standards, but which, in the fabricator's opinion are equivalent or better, may be submitted for the joint consideration of the IAMFES, USPHS, and DIC at any time.

A

SCOPE

A.1

These standards cover the sanitary aspects of silo-type storage tanks for milk and milk products used at dairy processing plants. These standards are not intended to cover silo-type tanks used on dairy farms.

A.2

In order to conform with these 3-A Sanitary Standards, silo-type storage tanks shall comply with the following design, material, fabrication, and refrigeration criteria.

B

DEFINITIONS

B.1

Product: Shall mean milk and milk products.

B.2

Silo-Type Tank: Shall mean any vertical tank in excess of 10 ft (3.05 m) inside height for the storage or storage and cooling of product.

B.3

Control Area(s): Shall mean the area(s) in which all appurtenances for the operation of the silo tank are located and vent lines terminate, except as provided in Section D.17 and shall be a part of one or more of the following:

B.3.1

A processing area.

B.3.2

An area in the plant at least the equivalent of a processing area.

B.4

Alcove(s): Shall mean an extension of the control area(s) in which appurtenances and vent lines terminate.

B.5

Silo Rupture Disc: Shall mean a membrane type differential pressure and/or vacuum device for venting a silo under emergency conditions (pressure and/or vacuum beyond design).

B.6

Silo Vacuum/Pressure Break: Shall mean a mechanical differential pressure and/or vacuum device for venting a silo under emergency conditions (pressure and/or vacuum beyond design, see Appendix, Section I).

B.7

Silo Emergency Venting Sensor: Shall mean a device to remotely indicate the actuation of the emergency venting device(s) (i.e., rupture disc or silo vacuum/pressure break).

B.8

Mechanical Cleaning or Mechanically Cleaned: Shall denote cleaning, solely by circulation and/or flowing chemical detergent solutions and water rinses onto and over the surfaces to be cleaned, by mechanical means.

B.9

Surfaces

B.9.1

Product Contact Surfaces: Shall mean all surfaces which are exposed to the product and surfaces from which liquids may drain, drop, or be drawn into the product.

B.9.2

Lining: Shall mean all surfaces used to contain the product, including the sides, bottom, and top.

B.9.3

Shell: Shall mean the material covering the exterior of the insulation and/or heat exchange jacket.

B.9.4

Non-Product Contact Surfaces: Shall mean all other exposed surfaces.

C

MATERIALS

C.1

Product contact surfaces shall be of stainless steel of the

AISI 300 Series*[1] or corresponding ACI*[2] types (See Appendix, Section F.), or metal which under conditions of intended use is at least as corrosion-resistant as stainless steel of the foregoing types and is non-toxic and non-absorbent except that:

C.1.1

Rubber and rubber-like materials may be used for umbrellas, slingers and drip shields for vertical agitator assemblies, agitator seals, gaskets, seals, caps, rupture discs and parts having the same functional purposes.

C.1.2

Rubber and rubber-like materials when used for the above specified applications shall comply with the applicable provisions of the 3-A Sanitary Standards for Multiple-Use Rubber and Rubber-Like Materials Used as Product Contact Surfaces in Dairy Equipment, Number 18-00.

C.1.3

Plastic materials may be used in sight and/or light openings and for umbrellas, slingers and drip shields for vertical agitator assemblies, bearings, gaskets, seals, caps, rupture discs and parts having the same functional purposes.

C.1.4

Plastic materials when used for the above specified applications shall comply with the applicable provisions of the 3-A Sanitary Standards for Multiple-Use Plastic Materials Used as Product Contact Surfaces for Dairy Equipment, Number 20-14 as amended.

C.1.5

Rubber and rubber-like materials and plastic materials having product contact surfaces shall be of such composition as to retain their surface and conformation characteristics when exposed to the conditions encountered in the environment of intended use and in cleaning and bactericidal treatment or sterilization.

C.1.6

The final bond and residual adhesive, if used, of bonded rubber and rubber-like materials and bonded plastic materials shall be non-toxic.*[3]

C.1.7

Where materials having certain inherent functional properties are required for specific applications, such as bearing surfaces and rotary seals, carbon and/or ceramic materials may be used. Carbon and/or ceramic materials shall be inert, non-porous, non-toxic, non-absorbent, insoluble, resistant to scratching, scoring and distortion when exposed to the conditions encountered in the environment of intended use and in cleaning and bactericidal treatment or sterilization.

C.2

In a silo-type tank to be sterilized by heat or operated at a temperature of 250 degrees F (121 degrees C) or higher, all materials having a product contact surface(s) used in the construction of fittings, valves, tubing, gaskets, and non-metallic component parts shall be such that they can be (1) sterilized by saturated steam or water under pressure (at least 15.3 psig or 106 kPa) at a temperature of at least 250 degrees F (121 degrees C) and (2) operated at the temperature required for product storage.

C.3

Non-product contact surfaces shall be of corrosion-resistant material or material that is rendered corrosion-resistant. If coated, the coating used shall adhere. Non-product contact surfaces shall be relatively non-absorbent, durable and cleanable. Parts removable for cleaning having both product contact and non-product contact surfaces shall not be painted.

D

FABRICATION

D.1

All product contact surfaces shall have a finish at least as smooth as a No. 4 ground finish on stainless steel sheets and be free of imperfections such as pits, folds, and crevices in the final fabricated form. (See Appendix, Section G.)

D.2

Permanent joints in metallic product contact surfaces shall be continuously welded. Welded areas on product contact surfaces shall be at least as smooth as a No. 4 ground finish on stainless steel sheets free of imperfections such as pits, folds, and crevices. (See Appendix, Section G.)

D.3

Silo-type tanks shall be provided with means for mechanical cleaning. The top head shall be dished or otherwise shaped so that it readily facilitates mechanical cleaning.

D.4

Silo-type tanks shall be designed so that the product contact surfaces of the tank, including the product contact surfaces of the opening for a vertical mechanical agitator, silo rupture discs, silo vacuum/pressure breaks, and all non-removable appurtenances thereto can be mechanically cleaned and are accessible for inspection.

D.5

All product contact surfaces shall be self-draining. The bottom of the lining, if flat, shall have a minimum slope of 3/4 in. per ft (60 mm per m) toward the outlet or if the bottom of the lining is of the reverse dish-type the portion of the bottom adjacent to the side wall shall have

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*[1] *The data for this series are contained in the AISI Steel Products Manual, Stainless & Heat Resisting Steels, December 1974, Table 2-1, pp. 18-20. Available from the Iron and Steel Society, 410 Commonwealth Drive, Warrendale, PA 15086 (412-776-9460).*

*[2] *Alloy Casting Institute Division, Steel Founders Society of America, Cast Metal Fabrication Bldg., 455 State St., Des Plaines, IL 60016 (708-299-9160).*

*[3] *Adhesives shall comply with 21 CFR Part 175 - Indirect food additives. Adhesives and components of coatings. Document for sale by the Superintendent of Documents, U.S. Government Office, Washington, DC 20402 (202-783-3238).*

a minimum slope of 3/4 in. per ft (60 mm per m) toward the outlet. Silo-type tank bottoms shall be so constructed that they will not sag, buckle or prevent complete drainage.

D.6

Gaskets

D.6.1

Gaskets having a product contact surface(s) shall be removable or be bonded.

D.6.2

Bonded rubber and rubber-like gaskets and bonded plastic gaskets shall be bonded in such a manner that the bond is continuous and mechanically sound and when exposed to the conditions encountered in the environment of intended use and in cleaning and bactericidal treatment, or sterilization, the rubber and rubber-like material or the plastic material does not separate from the base material to which it is bonded.

D.6.3

Grooves in gaskets shall be no deeper than their width, unless the gasket is readily removable and reversible for cleaning.

D.6.4

Gasket grooves or gasket retaining grooves in product contact surfaces for removable gaskets shall not exceed 1/4 in. (6 mm) in depth or be less than 1/4 in. (6 mm) wide except those for standard O-Rings smaller than 1/4 in. (6 mm).

D.7

Radii

D.7.1

All internal angles of 135 degrees or less on product contact surfaces shall have radii of not less than 1/4 in. (6 mm) except that:

D.7.1.1

Smaller radii may be used when they are required for essential functional reasons, such as those in flat sealing surfaces. In no case shall such radii be less than 1/32 in. (1 mm).

D.7.1.2

The radii in gasket grooves' gasket retaining grooves, or grooves in gaskets, except for those for standard 1/4 in. (6 mm) and smaller O-Rings, shall be not less than 1/8 in. (3 mm).

D.7.1.3

The radii in grooves for standard 1/4 in. (6 mm) O-Rings shall not be less than 3/32 in. (2 mm) and for standard 1/8 in. (3 mm) O-Rings shall be not less than 1/32 in. (1 mm).

D.7.1.4

The minimum radii for fillets of welds in product contact surfaces shall be not less than 1/4 in. (6 mm) except that the minimum radii for such welds may be 1/8 in. (3 mm) when the thickness of one or both parts joined is less than 3/16 in. (5 mm).

D.7.1.5

The minimum radii where head(s) and the side wall(s) join shall not be less than 1/2 in. (13 mm).

D.8

There shall be no threads in product contact surfaces.

D.9

SILO RUPTURE DISCS AND SILO VACUUM/ PRESSURE BREAKS

D.9.1

Silo rupture discs and silo vacuum/pressure breaks, if used, shall be installed as close as practical to the highest elevation of the silo-type tank top head. The interior of the fittings as well as the interior of the venting device shall be designed to be mechanically cleaned and are to be considered product contact surfaces. The cleaning system design shall insure that the venting device will not be damaged by cleaning media impact.

D.9.2

The silo emergency venting device shall be vented to a control area. (See Appendix, Section I.)

D.9.3

A silo emergency venting sensor shall be installed on each venting device to indicate failure or activation. Means shall be provided to test proper functioning of the sensor.

D.9.4

The silo emergency venting device and associated line(s) shall be independent of CIP or vent lines.

D.10

Rupture discs, if used, shall conform to applicable provision of the 3-A Sanitary Standards for Fittings Used on Milk and Milk Products Equipment and Used on Sanitary Lines Conducting Milk and Milk Products, as amended, Parts I and II, Number 08-17G, (Rupture Discs).

D.11

All sanitary fittings and connections shall conform to the applicable provisions of the 3-A Sanitary Standards for Fittings Used on Milk and Milk Products Equipment and Used on Sanitary Lines Conducting Milk and Milk Products, Numbers 08-17, Parts I and II, 08-17A, 08-17B, 08-17C as amended, 08-17E and 08-17F.

D.11.1

Sanitary fittings made of optional metal alloy shall not be used.

D.12

All tubing shall conform with the 3-A Sanitary Standards for Polished Metal Tubing for Dairy Products, Number 33-00.

D.13

An exception to D.11 and D.12 is made in that materials conforming to C.1.2 or C.1.4 may be used for caps of sanitary design for the protection of terminal ends of sanitary tubes, fittings, or vents.

D.14

All instrument connections having product contact surfaces shall conform to the 3-A Sanitary Standards for Instrument Fittings and Connections used on Milk and

Milk Products Equipment, Parts I and II, Number 09-08.

D.15

Two or more fittings to accommodate indicating thermometer and recording thermometer sensing devices shall be provided. The thermometer connections and/or openings shall be located so that the thermometers are not influenced by heating or cooling medium.

D.15.1

These fittings shall conform to one of the following types:

D.15.1.1

Fittings conforming to thermometer-well specifications in the 3-A Sanitary Standards for Instrument Fittings Used on Milk and Milk Products Equipment, Parts I and II, Number 09-08.

D.15.1.2

Fittings for temperature sensors which do not pierce the tank lining, but which have either temperature sensor receptacles securely attached to exterior of the lining, or means to attach temperature sensing elements securely to the exterior of the lining shall be provided.

D.15.2

The fittings for temperature sensors shall be located not more than 24 in. (610 mm) above the bottom of the lining. The indicating and/or recording thermometer shall be located so that it is easily readable.

D.16

A silo-type tank used in a processing system to be sterilized with heat or operated at a temperature of 250 degrees F (121 degrees C) or higher shall comply with the following additional criteria:

D.16.1

The construction shall be such that all product contact surfaces of the silo-type tank can be: (1) sterilized by saturated steam or water under pressure (at least 15.3 psi or 106 kPa) at a temperature of at least 250 degrees F (121 degrees C) and, (2) operated at the temperature required for product storage.

D.16.2

The silo-type tank shall have steam or other sterilizing medium chamber(s) surrounding the agitator shaft seal, manhole seal, silo rupture disc fitting seal, silo vacuum/pressure break fitting seal, and other fitting seals.

D.16.3

The connection(s) on the steam or other sterilizing medium chamber(s) for the steam or other sterilizing medium lines shall be such that the lines can be securely fastened to the connection(s). The lines shall be connected in a manner that they may be disconnected to allow the sterilizing medium chamber to be inspected and cleaned if necessary.

D.16.4

The agitator seal(s) shall be between the product contact surface and the steam or other sterilizing medium chamber.

D.17

All openings in the tank lining shall be within a control area, except openings for vertical mechanical agitators, openings for cleaning and/or vent line(s), including rupture discs and silo vacuum/pressure break emergency line(s) and vent openings. Cleaning, vent and silo emergency device venting lines shall terminate in a control area. The terminal ends of these lines in the control area shall be arranged, or means provided, to prevent liquids or objects from being drawn into the lines.

D.18

Agitation

D.18.1

Unless otherwise specified, means for mechanical and/or air agitation of product shall be provided that when operated intermittently or continuously shall be sufficient to maintain the butterfat content of whole milk throughout the tank within a variation of plus or minus 0.1% as determined by an official AOAC Milk Fat Test.[*4] The agitator, if not designed for mechanical cleaning, shall be located in such a manner that it shall be readily accessible and removable for manual cleaning. Mechanical agitators may be of a vertical or horizontal type. They shall comply with the applicable provisions of D.18.2, D.18.3 and D.18.4.

D.18.2

For tanks equipped with vertical mechanical agitators, the opening for a vertical agitator shall have a minimum diameter of 1 in. (25 mm) on tanks which require removal of the agitator shaft for cleaning or be of a diameter that will provide a 1 in. (25 mm) minimum annular space between the agitator shaft and the inside surface of the opening on tanks which do not require removal of the agitator for cleaning. An umbrella or drip shield of sanitary design that can be raised or dismantled, to permit cleaning of all of its surfaces, shall be provided to protect against the entrance of dust, oil, insects and other contaminants into the tank through the annular space around the agitator shaft. The agitator shaft, if removable, shall be provided with an easily accessible, readily demountable coupling of either a sanitary type located within the lining or a coupling located outside the lining provided that it is above the umbrella provided to protect the annular space around the shaft.

D.18.3

A seal shall be provided for a vertical agitator when it is specified that the tank is to be located so that the portion of the shaft outside the tank is not in a processing area. The seal for the vertical agitator shaft, if provided, shall be of a packless type, sanitary in design and durable. When a seal is provided for vertical agitators the design

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[*4] *The method of making this test will be found in the following reference: Official Methods of Analysis. Available from the Association of Official Analytical Chemists, 1111 N 19th St., Suite 210, Arlington, VA 22209 (703-522-3038).*

shall be such that (1) all product contact surfaces can be mechanically cleaned, and (2) the seal assembly is easily accessible and readily demountable for inspection.

D.18.4

The agitator driving mechanism shall be securely mounted in a position that will provide a minimum distance of 4 in. (100 mm) measured from the driving mechanism housing, excluding bearing bosses and mounting bosses, to the nearest surface of the silo-type tank; and in such a manner that all surfaces of the silo-type tank under or adjacent to the driving mechanism shall be readily accessible for cleaning and inspection.

D.18.5

A bottom support or guide, if used, shall be welded to the lining or be otherwise rigidly supported and shall not interfere with drainage of the tank and the inside angles shall have minimum radii of 1/8 in. (3 mm). When the agitator shaft has a bearing cavity, the diameter of the cavity shall be greater than the depth. When a bottom support or guide is designed for mechanical cleaning, provision must be made to permit separating the mating guide/bearing surfaces to permit inspection of such surface.

D.19

A seal for a horizontal agitator shall be provided. The seal for the horizontal agitator shall be of a packless type, sanitary in design and durable.

D.19.1

The seal shall be designed so that (1) all product contact surfaces can be mechanically cleaned and (2) the seal assembly is easily accessible and readily demountable for inspection, or (3) be such that the seal may be readily disassembled for manual cleaning and inspection.

D.20

Any coil spring having product contact surfaces shall have at least 3/32 in. (2 mm) openings between coils, including the ends, when the spring is in the free position.

D.21

Equipment for applying air under pressure shall conform to the applicable provisions of the 3-A Accepted Practices for Supplying Air Under Pressure in Contact with Milk, Milk Products and Product Contact Surfaces, Number 604-03, except that clamp-type fittings shall not be used in the product zone. Tubing and related fittings within the tank shall be readily and easily removable for cleaning outside the tank or be designed for mechanical cleaning. If designed for mechanical cleaning, the tubing and all related fittings shall be self-draining. Permanently mounted air tubing shall be constructed and installed so that it will not sag, buckle, vibrate or prevent complete drainage of the tank or tubing and shall be located so that the distance from the outside of the tubing to the lining shall be at least 2 in., (50 mm) except at point of entrance.

D.22

A sanitary connection(s) of sufficient diameter to prevent back pressure during normal filling and to prevent vacuum during emptying shall be provided in or near the top of the tank as a vent connection. The vent line(s) from the connection(s) shall terminate in a control area and shall be provided with a perforated cover(s) having openings not greater than 1/16 in. (2 mm) diameter, or slots not more than 1/32 in. (1 mm) wide. This cover(s) shall be so designed that parts are readily accessible and easily removable for cleaning. Woven wire mesh shall not be used for this purpose. (See Appendix, Section I.)

D.23

The outlet and inlet shall be located where they are readily accessible. The outlet shall be in a position that will provide complete drainage of the tank. The top of the terminal end of the outlet passage shall be lower than the low point of the bottom of the lining at the outlet. When tanks are located in the processing area or an area in the plant at least the equivalent of a processing area, inlets and outlets may be in the side or bottom of the tank. Means shall be provided for easy access to the valve(s) for cleaning and inspection purposes.

D.24

Inlet and outlet connections shall be provided with welded stub ends, or bolted or clamp-type flanges. The face of a bolted or clamp-type flange shall be as close as practical to the outer shell of the tank. (See Appendix, Section L.)

D.25

The distance between the nearest point on the outer shell of the tank to the face of a bolted or clamp-type flange on an inlet or outlet valve connection shall not exceed the smaller of (a) twice the nominal diameter of the connection or (b) 5 in. (130 mm).

D.26

The control area and alcove, or if there is more than one, the lowest, shall be at an elevation that will include the lowest vertical portion of the tank.

D.27

A pressure or level sensor, if provided, shall comply with applicable provisions of the 3-A Sanitary Standard for Pressure and Level Sensing Devices, Number 37-01. The product surface of the device shall be relatively flush with the inner surface of the tank.

D.28

A manhole(s) shall be provided and, if there is more than one control area, there shall be a manhole accessible from the lowest control area. The inside dimensions of the manhole opening shall not be less than 15 in. (380 mm) by 20 in. (510 mm) if oval, or 18 in. (460 mm) in diameter if round. The upper edge of a top entering manhole opening shall not be less than 3/8 in. (10 mm) higher than the surrounding area and, if any exterior flange is incorporated, it shall slope and drain away from the opening. The sleeve or collar of a manhole opening for an inside swing-type manhole cover shall

be pitched so that liquids cannot accumulate.

D.28.1

A hand grip shall be mounted externally on the silo-type tank near the manhole in order to afford easy access to the silo-type tank's interior.

D.29

The manhole cover shall be the inside or outside swing type. If the cover swings inside, it shall also swing outside away from the opening for disassembly and cleaning. No threads or ball joints shall be employed within the product zone to attach the manhole cover and its appendages. The manhole cover and its appendages shall be removable without tools. The manhole cover for a top entering manhole opening shall be of the outside swing type.

D.30

Sight and light openings, when provided, shall be of such design and construction that the inner surfaces drain inwardly, and the inner surface of the plastic shall be relatively flush with the inner surface of the silo-type tank. The exterior flare shall be pitched so that liquids cannot accumulate. The plastic shall be readily removable. The inside diameter of the opening shall be at least 3 3/4 in. (95 mm).

D.31

A sample cock shall be provided. It shall be of a type that has its sealing surface relatively flush with the product contact surface of the tank and have an inside diameter no less than that of 1 in. (25 mm) 3-A sanitary tubing.

D.32

Insulation

D.32.1

The silo-type tank shall be insulated with insulating material of a nature and amount sufficient to prevent freezing, or in 18 hours, an average temperature change of greater than 3 degrees F (1.7 degree C) in the storage tank full of water when the average difference between the temperature of the atmosphere surrounding the storage tank is 30 degrees F (17 degrees C) above or below that of the water in the storage tank. The insulating value of the insulation over non—refrigerated areas of the storage tank shall be equivalent to not less than:

D.32.1.1

An R-value of at least 8 for

(a) A storage tank designed to be installed wholly within a building or

b) That portion of the storage tank within a building on tanks designed to be installed partially outside a building.

D.32.1.2

An R-value of at least 12 for that portion of the storage tank outside of a building on storage tanks designed to be installed partially outside of a building.

D.32.2

Insulation material shall be installed in such a manner as to prevent shifting or settling.

D.33

Silo-Type Tank Supports

D.33.1

When the silo-type tank is installed in a processing area or an area in the plant at least the equivalent to a processing area, means of support shall be one of the following:

D.33.2

If legs are used, they shall be smooth with rounded ends and have no exposed threads. Legs made of hollow stock shall be sealed. Legs shall provide a minimum clearance between the lowest part of base and the floor of not less than 8 in. (200 mm). The legs shall be of sufficient size and spacing to support the tank when full.

D.33.3

When silo-type tanks are mounted on a slab or island, that portion of the base within the processing area shall be designed for sealing to the slab or island surface. (See Appendix, Section O.)

D.34

The outer shell shall be smooth and effectively sealed except for vent or weep hole(s) in the outer shell of the tank. The vent or weep hole(s) shall be located in a position that will provide drainage from the area between the lining and the outer shell and shall be vermin proof. Outside welds need not be ground.

D.35

Guards required by a safety standard that will not permit accessibility for cleaning and inspection shall be designed so that they can be removed without the use of tools.

D.36

Non-product contact surfaces shall be smooth, free of pockets and crevices and be readily cleanable. Surfaces to be coated shall be effectively prepared for coating.

D.37

Silo-type tanks with a mechanical agitator shall have an information plate in juxtaposition to the name plate giving the following information or the information shall appear on the name plate: "The agitator of this tank is designed so that the portion of agitator shaft outside of the tank * in a processing area."

*Insert one of the following:

(a) does not have to be

(b) shall be

D.37.1

"This tank * designed for steam sterilization."

*Insert one of the following:

(a) is

(b) is not

D.37.2

All identification or information plate(s) affixed to silo-type tanks shall be attached to the outside lining in such a way as to be effectively sealed.

E

REFRIGERATION

Refrigerated tanks shall be capable of maintaining milk

temperature at 40 degrees F (4.4 degrees C) or lower when the tank is full.

APPENDIX

F

STAINLESS STEEL MATERIALS

Stainless steel conforming to the applicable composition ranges established by AISI[*1] for wrought products, or by ACI[*2] for cast products, should be considered in compliance with the requirements of Section C.1 herein. Where welding is involved the carbon content of the stainless steel should not exceed 0.08%. The first reference cited in C.1 sets forth the chemical ranges and limits of stainless steels of the 300 Series. Cast grades of stainless steel corresponding to types 303, 304, and 316 are designated CF-16F, CF-8, and CF-8M, respectively. These cast grades are covered by ASTM[*5] specifications A351/A351M, A743/A743M, and A744/A744M.

G

PRODUCT CONTACT SURFACE FINISH

Surface finish equivalent to 150 grit or better as obtained with silicon carbide properly applied on stainless steel sheets is considered in compliance with the requirements of Section D.1 herein.

H

SUGGESTED CLEANING PROCEDURES

One cleaning method found to be satisfactory is to pump the cleaning solution to the dome of the tank through stainless steel welded lines and distribute it in such a manner as to provide flooding over all product contact surfaces of the silo-type tank, including the product contact surfaces of the opening for a vertical mechanical agitator, silo rupture discs, silo vacuum/pressure breaks, and all non-removable appurtenances thereto. Another cleaning method is to jet spray by pumping the cleaning solution to the dome of the tank through a stainless steel nozzle located near the bottom of the tank. The jet spray cleaning solution should cover all product contact surfaces of the silo-type tank including the product contact surfaces of the opening for a vertical mechanical agitator, silo rupture discs, silo vacuum/pressure breaks, and all non-removable appurtenance thereto.

H.2

The spray device should be removable or accessible for inspection. Means should be provided for manual cleaning of all surfaces not cleaned satisfactorily by mechanical cleaning procedures.

H.3

Successful mechanical cleaning of silo-type tanks depends on properly designed tanks and properly located spray devices. The following illustrates one method of mechanically cleaning silo-type tanks. The vertical silo-type tank may be cleaned satisfactorily at flow rates of 2.5 to 3 gpm per linear ft (0.52 to 0.62 Lps per linear meter) of tank circumference. Pre-rinsing using spray devices may be accomplished by three or more bursts of 15 to 20 sec duration, and the tank effectively drained between successive bursts. For lightly soiled surfaces, satisfactory cleaning results can usually be achieved by: (1) applying a three-burst pre-rinse using tempered water; (2) recirculating a chlorinated alkaline detergent solution for 5 to 7 minutes at temperatures not to exceed 135 degrees F (58 degrees C); (3) applying a post-water rinse sufficient to remove all residual alkaline detergent solution; and (4) recirculating an acidified final rinse for 1.5 to 2 minutes at tap water temperature. If the silo-type tank is used for storing cream, condensed products, ice cream mix or similar viscous products with higher fat and/or higher total solids content, the concentration, recirculating time and temperatures should be increased proportionately. Silo-type tanks used for products comparable to milk and milk by-products can be effectively cleaned at concentrations of 1500 to 2000 ppm of alkaline detergent with available chlorine at 30 to 50 ppm. If these tanks are used for more viscous and/or higher total solids products, alkaline detergent concentration should be increased to 2400 to 3000 ppm. Even though mechanical cleaning is the norm for silo-type tanks, it is important that periodic inspection of product contact surfaces be done to insure that adequate cleaning is being achieved with the mechanical cleaning regimen being used.

NOTE: Do not allow halogen based sanitizing solutions (chlorine, iodine and bromine) to effect bactericidal action longer than necessary or to dry upon the tank surfaces.

I

AIR VENTING (Operational and Emergency)

To insure adequate venting of the tank which will protect it from internal pressure or vacuum damage during normal operation, the critical relationship between minimum vent size and maximum filling or emptying rates should be observed. The size of the free vent opening of a tank should be at least as large as those shown in the Table A-1 below:

TABLE A-1

Minimum Free Vent Opening Size				Maximum Filling Emptying Rate	
sq. in.	(sq. cm)	I.D. in.	(I.D. mm)	gpm	Lpm
2.5	(16)	1 3/4	(44.5)	175	(662)
4.0	(26)	2 1/4	(57.2)	300	(1136)
6.0	(39)	2 3/4	(69.9)	400	(1514)
11.0	(71)	3 3/4	(95.2)	700	(2650)

The above sizes are based on normal operation and are sized to accommodate air only and not liquid. The diameter of the connecting vent pipe line between the

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*[*5] Available from ASTM, :916 Race St., Philadelphia, PA 19103-1187 (215-299-5400). The spray device should be removable or accessible for inspection. Means should be provided for manual cleaning of all surfaces not cleaned satisfactorily by mechanical cleaning procedures.*

vent opening in the tank and the control area should be no smaller than the inside diameter of the vent opening in the tank. The perforated vent cover should have a free area equal to at least 1 1/2 times the area of the vent opening in the tank. Means should be provided to prevent siphonage, such as a re-vent line, or anti-siphon device. (See illustrative sketch in Appendix Section I, Pages 597 and 598.) The vent piping as well as the emergency rupture disc installation of a tank outside of a building should be protected against freezing. The venting system covered in the preceding paragraphs is intended to provide the venting during filling and emptying; however, it is not adequate during cleaning. During the cleaning cycle, tanks when cleaned mechanically should be vented adequately by opening the manhole door to prevent vacuum or pressure build-up due to sudden changes in temperature of very large volumes of air.*6 Means should be provided to prevent excess loss of cleaning solution through the manhole opening. The use of tempered water of about 95 degrees F (35 degrees C) for both pre-rinsing and post-rinsing is recommended to reduce the effect of flash heating and cooling. Provisions should be made to prevent overfilling with resultant vacuum or pressure damage to the tank. When double-tube inside overflow and vent system is provided, the preceding table for vent overflow vent tube area sizes should also apply. During the cleaning cycle there should be a continuous flow of cleaning solution through the inner tube and the annular space of the double-tube inside overflow and vent system.

J

TEMPERATURE RECORDER

A temperature recorder should be provided on all tanks to record temperatures during the filling, storage, emptying, and cleaning periods. This temperature recorder should be accurate to plus or minus 1 degree F (0.6 degree C) within the temperature range for milk storage. The recorded elapsed time, as indicated by the chart, should be the true recorded elapsed time over at least a seven day period.

K

PLACEMENT

If the tank is not in a processing area or an area in the plant at least the equivalent of a processing area or adjacent to the outside wall of one of these areas, a hallway should be constructed at least 7 ft (2.13m) high and 5 ft (1.52 m) wide to provide easy access to the control area. Extension of the tank through the roof of the building

L

VALVES

Valves on inlet and outlet connections on the tank should be of the close coupled plug-type or of the close coupled compression-type.

M

INSULATING VALUES

Table A-2 lists the thickness requirements equivalent to R=4.0 for some common insulating materials.

TABLE A-2. Inches Thickness of Insulation Material Equivalent to R=4.0 at 75 Degrees F (24 Degrees C)

Material Type	in.	mm
High Density Fiberglass Sheets	0.88	22.3
Soft Fiberglass Rolls	1.12	28.4
Polystyrene Foam Sheets	1.02	25.9
Corkboard Sheets	1.04	26.4
Polyurethane Sheets	0.66	16.8

N

SLAB OR ISLANDS

When the silo tank is designed to be installed on a slab or an island, the slab or island should be of sufficient height that the bottom of all product connections are not less than 24 in. (600 mm) above the floor. The surface of the slab or island should be coated with a thick layer of water-proof mastic material, which will harden without cracking. The junction of the silo-type tank base and the slab or island should be effectively sealed.

**6 For example, when a 6,000 gal tank (with 800 cu ft of 135 degrees F hot air after cleaning) is suddenly flash cooled by 50 degrees F water sprayed at 100 gpm the following takes place: Within one second, the 800 cu ft of hot air shrinks approximately 51 cu ft in volume. This is the equivalent in occupied space of approximately 382 gallons of product. The shrinkage creates a vacuum sufficient to collapse the tank unless the vent, manhole, or other openings allow the air to enter the tank at approximately the same rate as it shrinks. It is obvious, therefore, that a very large air vent such as the manhole opening is required to accommodate this air flow.*

These revised standards are effective September 28, 1992 at which time the 3-A Sanitary Standards for Silo-Type Storage Tanks for Milk and Milk Products, Number 22-04 as amended are rescinded and become null and void.

To receive information on membership with IAMFES Circle 360 on this card

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103	116	129	142	155	168	181	194	207	220	233	246	259	272	285	298	311	324	337	350
104	117	130	143	156	169	182	195	208	221	234	247	260	273	286	299	312	325	338	351
105	118	131	144	157	170	183	196	209	222	235	248	261	274	287	300	313	326	339	352
106	119	132	145	158	171	184	197	210	223	236	249	262	275	288	301	314	327	340	353
107	120	133	146	159	172	185	198	211	224	237	250	263	276	289	302	315	328	341	354
108	121	134	147	160	173	186	199	212	225	238	251	264	277	290	303	316	329	342	355
109	122	135	148	161	174	187	200	213	226	239	252	265	278	291	304	317	330	343	356
110	123	136	149	162	175	188	201	214	227	240	253	266	279	292	305	318	331	344	357
111	124	137	150	163	176	189	202	215	228	241	254	267	280	293	306	319	332	345	358
112	125	138	151	164	177	190	203	216	229	242	255	268	281	294	307	320	333	346	359
113	126	139	152	165	178	191	204	217	230	243	256	269	282	295	308	321	334	347	360

This second Reader Service Card is provided to allow co-workers to also respond to companies of interest.

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102	115	128	141	154	167	180	193	206	219	232	245	258	271	284	297	310	323	336	349
103	116	129	142	155	168	181	194	207	220	233	246	259	272	285	298	311	324	337	350
104	117	130	143	156	169	182	195	208	221	234	247	260	273	286	299	312	325	338	351
105	118	131	144	157	170	183	196	209	222	235	248	261	274	287	300	313	326	339	352
106	119	132	145	158	171	184	197	210	223	236	249	262	275	288	301	314	327	340	353
107	120	133	146	159	172	185	198	211	224	237	250	263	276	289	302	315	328	341	354
108	121	134	147	160	173	186	199	212	225	238	251	264	277	290	303	316	329	342	355
109	122	135	148	161	174	187	200	213	226	239	252	265	278	291	304	317	330	343	356
110	123	136	149	162	175	188	201	214	227	240	253	266	279	292	305	318	331	344	357
111	124	137	150	163	176	189	202	215	228	241	254	267	280	293	306	319	332	345	358
112	125	138	151	164	177	190	203	216	229	242	255	268	281	294	307	320	333	346	359
113	126	139	152	165	178	191	204	217	230	243	256	269	282	295	308	321	334	347	360

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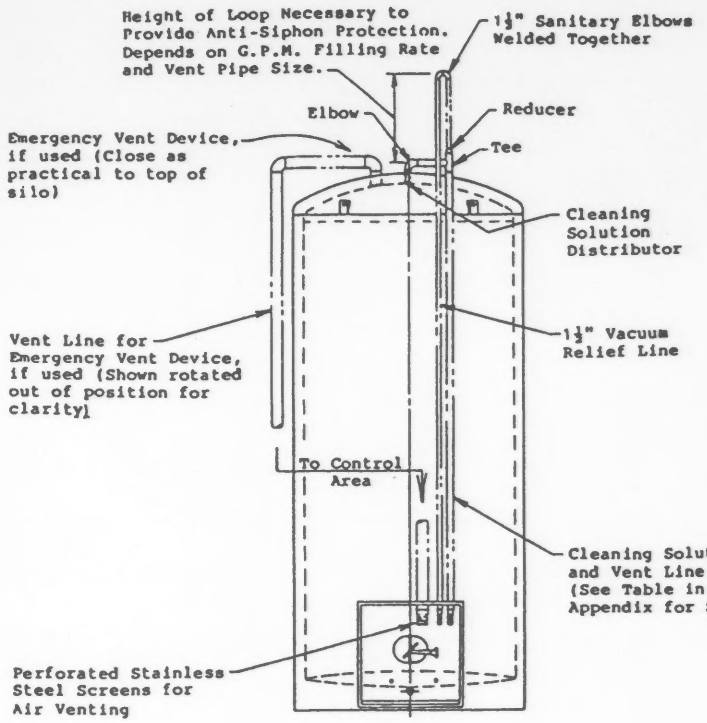
APPENDIX - SECTION I CONTINUED
PIPING FOR AIR VENTING

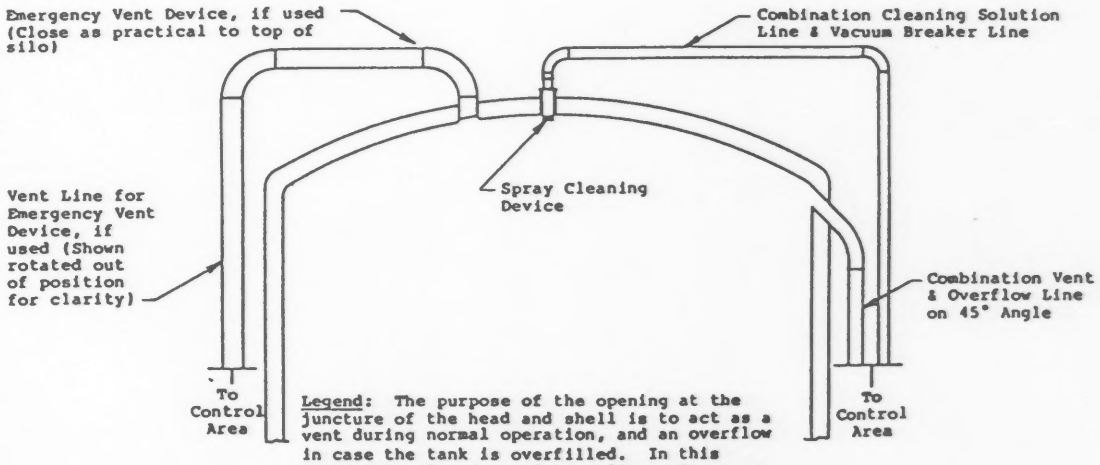
Example #1, a suggested method for venting



This design shows a loop-type syphon breaker. The loop is made so that its height above the vent line is sufficient to prevent milk rising in the vacuum relief line to the top of the loop when the tank is being filled at the maximum rate recommended by the manufacturer.

Legend: In event of overfilling, milk enters the vent line through the opening in the top of the tank. The area of this opening is such that when the tank is being filled at the maximum rate recommended by the manufacturer, pressure in the tank will not exceed that for which the tank is designed. The vacuum relief line will prevent any siphoning action in the overflow line.

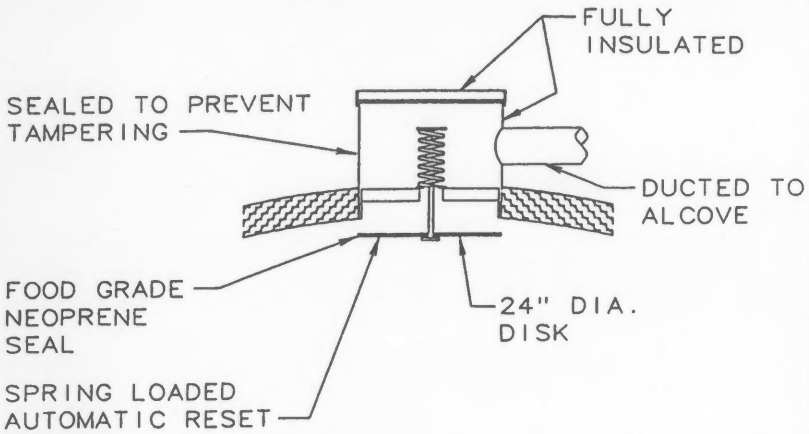
Example #2, a suggested method for venting



Legend: The purpose of the opening at the juncture of the head and shell is to act as a vent during normal operation, and an overflow in case the tank is overfilled. In this event, the cleaning solution line acts as an auxillary vent to break any siphoning action in the overflow line.

APPENDIX - SECTION I CONTINUED

EXAMPLE OF SILO EMERGENCY VACUUM/PRESSURE BREAKER

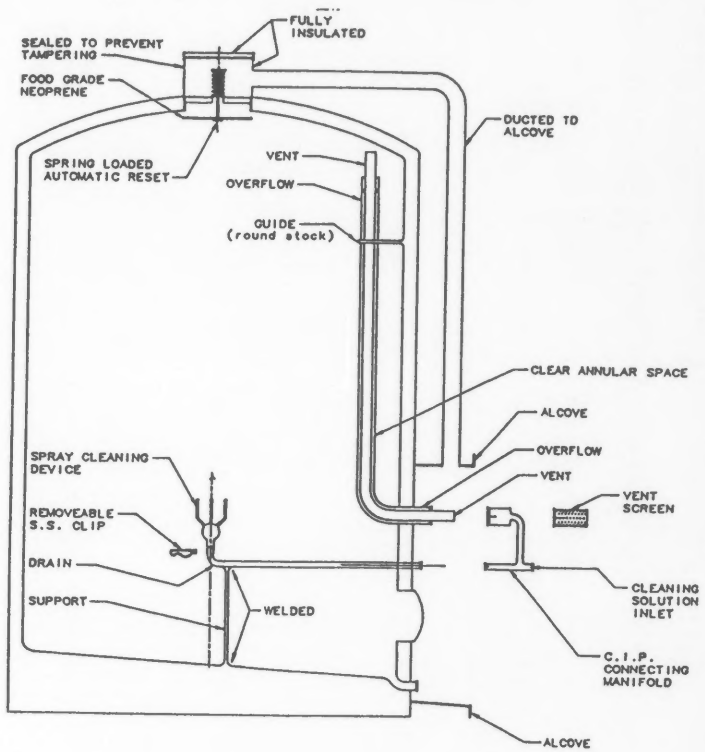


1/16" OPENING EQUALS A 2" TUBE VENT
1/8" OPENING EQUALS A 3" TUBE VENT
1/2" OPENING EQUALS A 6" TUBE VENT

An example of a silo rupture disc may be found in the 3-A Sanitary Standards for Fittings used on Milk and Milk Products Equipment and Used on Sanitary Lines Conducting Milk and Milk Products, Number 08-17, as amended, Parts I and II. Standards for Fittings

EXAMPLE 3

APPENDIX - SECTION I CONTINUED



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Office location is Jefferson City, Missouri.
Request application forms and requirements for job from:

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- 1 - 1,000 Gal. Dome Top Pressure Wall Processor w/ Agit.
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Coming Events

1992

September

•**1-4, Diagnostic Virology**, sponsored by the American Type Culture Collection, will be held in Rockville, MD. For more information contact ATCC/Workshops, 12301 Parklawn Drive, Rockville, MD 20852; (301)231-5566; FAX (301)770-1805.

•**14, Radiation Safety Seminar**, sponsored by the American Type Culture Collection, will be held in Rockville, MD. For more information contact ATCC/Workshops, 12301 Parklawn Drive, Rockville, MD 20852; (301)231-5566; FAX (301)770-1805.

•**14-15, Food Safety for Zero Defects**, sponsored by ASI Food Safety Consultants', will be held in St. Louis, MO. For more information call Christine VerPlank or Nancy Sullivan toll-free at (800)477-0778 or, in MO, (314)725-2555, or write, ASI, P.O. Box 24198, St. Louis, MO 63130.

•**16, Reclamation and Environmental Concerns in the Food Industry**, sponsored by ASI Food Safety Consultants', will be held in St. Louis, MO. For more information call Christine VerPlank or Nancy Sullivan toll-free at (800)477-0778 or, in MO, (314)725-2555, or write, ASI, P.O. Box 24198, St. Louis, MO 63130.

•**17, Employee Health, Hygiene and Practices in the Food Industry**, sponsored by ASI Food Safety Consultants', will be held in St. Louis, MO. For more information call Christine VerPlank or Nancy Sullivan toll-free at (800)477-0778 or, in MO, (314)725-2555, or write, ASI, P.O. Box 24198, St. Louis, MO 63130.

•**17-18, Minnesota Sanitarians Association, Inc. Annual Meeting** will be held at the Earl Brown Center, St. Paul, MN. For more information, please contact Paul Nierman (612)785-0484.

•**18, Georgia Association of Food and Environmental Sanitarians and Georgia Environmental Health Association's Fall Education Symposium, Entitled "Seafood Safety and Quality"** will be held at the Skidaway Institute of Oceanography, Skidaway Island, GA. For more information call Larry Beuchat at the University of Georgia, (404)228-7284.

•**21-25, Wisconsin Cheese Technology Short Course** will be held at the University of Wisconsin, Madison, WI. For more information, contact Bill Wendorff, Dept. of Food Science, (608)263-2015.

•**22-24, New York State Association of Milk & Food Sanitarians Annual Meeting** will be held in Saratoga Springs, NY. For more information contact Janene Gargiulo, Cornell University, 11 Stocking Hall, Ithaca, NY 14853, (607)255-8892.

•**23-24, Wisconsin Association of Milk & Food Sanitarians, Wisconsin Environmental Health Association and Wisconsin Dairy Plant Fieldmen's Association Joint Educational Conference** will be held at the Holiday Inn-Downtown, Eau Claire, WI. For more information contact Neil M. Vassau, P. O. Box 7883, Madison, WI 53707; (608)267-3504.

•**23-24, Joint Annual Convention of the South Dakota State Dairy Association and Dairy Fieldmen's Association** will be held at Howard Johnsons, Sioux Falls, SD. For more information call John Parsons at (605)688-4116.

•**23-25, Freezing & Freeze-Drying of Microorganisms**, sponsored by the American Type Culture Collection, will be held in Rockville, MD. For more information contact ATCC/Workshops, 12301 Parklawn Drive, Rockville, MD 20852; (301)231-5566; FAX (301)770-1805.

•**24, Consumer Food Trends**, sponsored by the American Association of Cereal Chemists, will be held at AACC, 3340 Pilot Knob Road, St. Paul, MN. For more information, contact Marie McHenry, AACC Short Course Coordinator, (612)454-7250; FAX (612)454-0766.

•**29-Oct. 1, Wyoming Environmental Health Association Annual Meeting** will be held at the Holiday Inn in Cody, WY. For more information call Terry Carlile at (307)876-2483.

•**30, October 1-2, Statistics and Measurement in Sensory Evaluation** will be held at Tragon Corporation, 365 Convention Way, Redwood City, CA 94063, (415)365-1833; FAX (415)365-3737.

October

•**5-6, The Eleventh Annual Midwest Food Processing Conference "Consumers: Driving Force For Our Future"** sponsored by the Chicago, Iowa, Minnesota and Wisconsin IFT sections, will be held at the Radisson Hotel in LaCrosse, Wisconsin. For more information, contact Ellen Bragg, MFPC Publicity Chairperson, Cargill, Inc., Salt Division, P.O. Box 5621, Minneapolis, MN 55440; phone: (612)475-6929.

•**5-7, California Association of Dairy and Milk Sanitarians in cooperation with the California Dairy Industries Association is hosting a Fall Dairy Industry Conference** to be held at the Red Lion Inn, Modesto, CA. For more information contact John Bruhn at (916)752-2191.

•**7-9, Kansas Association of Sanitarians Annual Meeting** will be held at the Holidome, Great Bend, KS. For more information contact John Davis, Wichita-Sedgewick Co., 1900 E. 9th Wichita, KS 67214; (316)268-8351.

•**8-9, Washington Milk Sanitarians Association's Annual Meeting** will be held in Yakama, WA. For more information contact Lloyd Luedecke at (509)335-4016.

•**11-14, National Fisheries Institute (NFI) 47th Annual Convention** will be held at the Marriott Desert Springs Hotel in Palm Desert, CA. For more information contact the NFI Communications Department, 1525 Wilson Blvd., Suite 500, Arlington, VA 22209 or call (703)524-8881.

•**12-15, UC Davis/Purdue Aseptic Processing and Packaging Workshop** to be held at the University of California-Davis, Davis, CA. For more information or to enroll, call (800)752-0881. From outside California, call (916)757-8777.

•**14-15, Annual Conference of the North Central Cheese Industries Association** will be held at the Holiday Inn,

Brookings, SD. For further information, contact E. A. Zottola, Executive Secretary, NCCIA, P. O. Box 8113, St. Paul, MN 55108.

•**15-16, Iowa Association of Milk, Food and Environmental Sanitarians Annual Meeting** will be held at the Ramada Inn, Waterloo, IA. For more information contact Dale Cooper (319)927-3212.

•**15-16, Michigan Environmental Health Association's Fall Food Conference** will be held at the Holiday Inn South, Lansing, MI. For more information contact Bob Taylor, Michigan Department of Agriculture, (517)373-1060.

•**20, Associated Illinois Milk, Food and Environmental Sanitarians Annual Meeting and Fall Conference** will be held at the Carlisle in Lombard. For further information contact Bob Crombie, Sec., AIMFES, 521 Cowles, Joliet, IL 60435, (815)726-1683 (Voice & FAX).

•**20-22, Basic Pasteurization Course**, sponsored by the Texas Association of Milk, Food and Environmental Sanitarians, will be held at the Le Baron Hotel, 1055 Regal Row, Dallas, TX. For registration information contact Ms. Janie F. Park, TAMFES, P.O. Box 2363, Cedar Park, TX 78613-2363, (512)458-7281.

•**21-23, Mississippi Association of Sanitarians** will hold their Annual Meeting in Biloxi at the Mississippi Beach Hotel Resort. For further information contact Jerry Hill, P. O. Box 1487, Starkville, MS 39750 or call (601)323-7313.

•**26, GMPs for the Food Industry**, sponsored by ASI Food Safety Consultants', will be held in Chicago, IL. For more information call Christine VerPlank or Nancy Sullivan toll-free at (800)477-0778 or, in MO, (314)725-2555, or write, ASI, P.O. Box 24198, St. Louis, MO 63130.

•**26-29, The Science of Ice Cream Manufacturing** to be held at the University of California-Davis, Davis, CA. For more information or to enroll, call (800)752-0881. From outside California, call (916)757-8777.

November

•**5, Food Industry Sanitation and Food Safety Workshop**, presented by the University of California Cooperative Extension, will be held at the Anaheim Plaza Resort Hotel, 1700 S. Harbor Blvd., Anaheim, CA. For more information contact Heidi Fisher, Food Science and Technology, University of California, Davis, CA 95616; (916)752-1478.

•**8-12, PACK EXPO 92, The World of Packaging Technology**, sponsored by Packaging Machinery Manufacturers Institute (PMMI), will be held at the McCormick Place, Chicago, IL. For more information contact Bonnie E. Kilduff, Exposition Manager, PMMI at (202)347-3838 or FAX (202)628-2471.

•**9-11, Quality Control and Stability Testing** will be held at Tragon Corporation, 365 Convention Way, Redwood City, CA 94063, (415)365-1833; FAX (415)365-3737.

•**10-13, Industrial Refrigeration Workshop** to be held at the University of California-Davis, Davis, CA. For more information or to enroll, call (800)752-0881. From outside California, call (916)757-8777.

December

•**7-9, Introduction to Food Processing Systems** to be held at the University of California-Davis, Davis, CA. For more information or to enroll, call (800)752-0881. From outside California, call (916)757-8777.

•**7-10, Better Process Control School** to be held at the University of California-Davis, Davis, CA. For more information or to enroll, call (800)752-0881. From outside California, call (916)757-8777.

1993

May

•**6-12, INTERPACK 93, 13th International Trade Fair for Packaging Machinery, Packaging Materials and Confectionery Machinery**, will be held at the fairgrounds in Dusseldorf, Germany. For further information on exhibiting at or attending INTERPACK 93, contact Dusseldorf Trade Shows, Inc., 150 North Michigan Avenue, Suite 2920, Chicago, IL 60601,(312)781-5180; FAX (312)781-5188.

August

•**1-4, 80th Annual Meeting of the International Association of Milk, Food and Environmental Sanitarians, Inc.** to be held at the Waverly Stouffer Hotel, Atlanta, GA. For more information please contact Julie Heim at (800)369-6337 (US) or (800)284-6336 (Canada).

To insure that your meeting time is published, send announcements at least 90 days in advance to: IAMFES, 502 E. Lincoln Way, Ames, IA 50010-6666.

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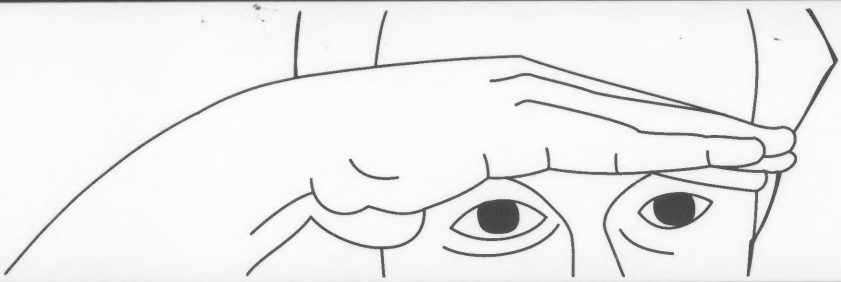

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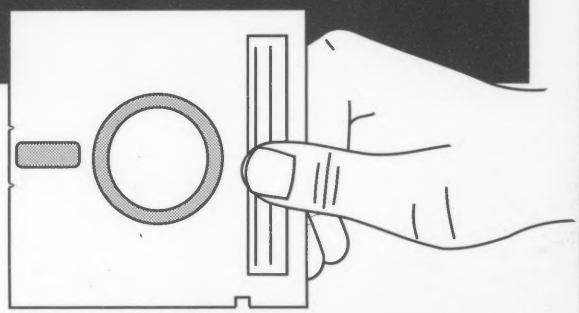

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