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A Publication for Sanitarians and Fieldmen

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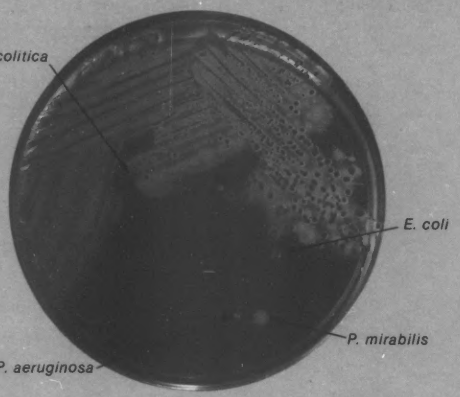

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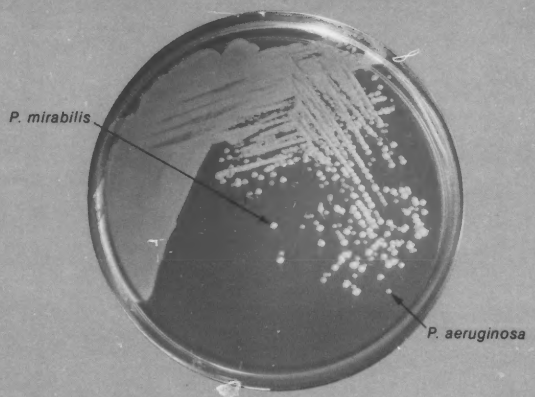

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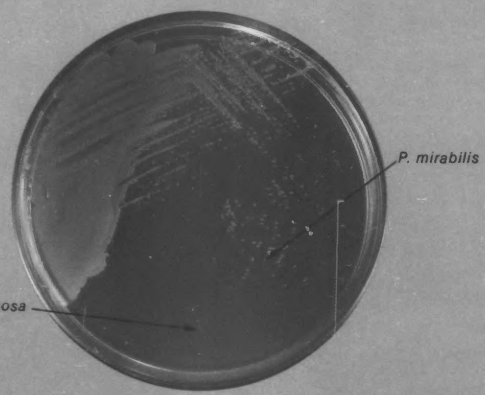

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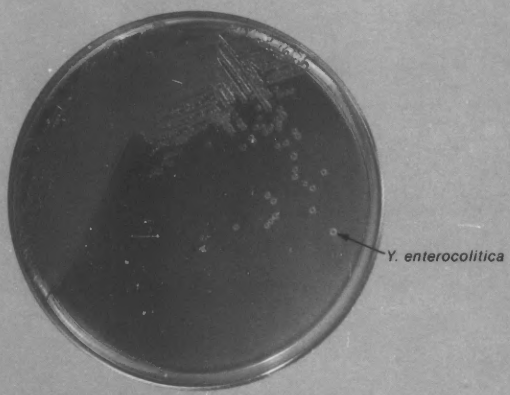

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Understanding Botulism

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Botulism is a relatively rare type of poisoning caused by the microorganism Clostridium botulinum (C. botulinum). This organism is distributed in land and water environments throughout the world. Consequently, many foods are naturally contaminated with C. botulinum spores.

The major cause of botulism is improperly processed home canned food products. *C. botulinum* produces heat resistant spores that are difficult to destroy during canning. Spores in themselves are not dangerous. However, if not destroyed, they may germinate, grow and produce a deadly toxin.

There are several types of botulism, although *foodborne botulism* is the most commonly reported. It is caused by ingestion of preformed botulinal toxin in contaminated food.

Infant botulism, first recognized in 1976, is caused by absorption of botulinal toxin produced within the intestinal tract of an infant after growth of ingested *C. botulinum* spores. As of December 1978, 21 states have reported a total of 98 cases. Honey has been implicated as a source of *C. botulinum* in several cases of infant botulism. Thus, it is recommended that honey not be fed to infants less than one year of age.

Wound botulism, the rarest form of botulism, results from production of botulinal toxin after growth of *C. botulinum* in an infected wound. The first reported case of wound botulism occurred in 1943. Since this time a total of 18 cases have been reported in the United States.

The toxins produced by *C. botulinum* are the most deadly known to man. Scientists estimate that one cupful (8 ounces) of this purified poison would kill all the people on earth. Although the occurrence of the disease is rare, large numbers of people have been poisoned in a single outbreak, such as a 1933 incident in the Soviet Union in which stuffed egg plant relish caused 230 cases of Type A botulism. Yet botulism occurs rarely. The total number of botulism deaths that occur annually in *all countries* is less than the deaths from auto accidents on any holiday weekend in *this country*.

History and Occurrence

Botulism probably accounted for the deaths of many of our ancestors, but it was not until 1793 that a well-recorded outbreak of "sausage poisoning" occurred in Wildbad, Wurttemburg (Germany).

Thirteen people were involved in the Wildbad outbreak; six of them died. It was widely accepted at the time that the poisonings were caused by Blunzen, or Schweinmagen, a type of blood sausage which was locally popular. Blunzen were made by filling pigs' stomachs with blood and other ingredients. Ends of the stomach were tied and the product preserved by boiling and exposing to wood smoke. After this treatment, the Blunzen were stored at room temperature for weeks.

We now know that *C. botulinum* can grow in a product such as Blunzen. Unfortunately, the discovery that bacteria cause botulism did not occur until 1896, more than 100 years after that outbreak of sausage poisoning.

After the outbreak in Wildbad, the number of reported sausage poisonings increased rapidly. During the early 1800's, a German physician-poet, Justinus Kerner, carefully studied the disease and published several monographs about it. As a result of his study, sausage poisoning was brought to the attention of the German medical profession. Kerner became so well known for his work that botulism is sometimes referred to as "Kerner's disease." The more common term, "botulism," comes from the Latin for sausage, botulus, and was coined in 1870 by Muller.

In recent times U.S. meat products, such as sausages, have rarely been associated with outbreaks of botulism. In fact, only about 5 percent of the recorded outbreaks in the U.S. have been associated with meat.

Before the cause of botulism was clearly understood, many substances were suggested as being responsible for the disease. For example, Kerner thought it was caused by a fatty acid which he termed "corpse acid." Other suggestions included prussic acid, pyroligneous acid from wood

smoke, choline, copper, lead, creosote, various fatty acids, vegetable alkaloids, various molds, *Trichinella spiralis*, neuridine and most fantastic of all, *Aqua toffana*. The Romans supposed *Aqua toffana* to be a toxic substance secreted in the saliva of slaves tortured to death in the arena. Because the method of killing hogs in Wurttemburg was slow, it was suggested that *Aqua toffana* was produced in the hog's saliva and ultimately contaminated the animal's flesh.

The discovery that botulism is actually caused by a toxin-producing bacterium was made by Emile Pierre Marie van Ermengem in 1896. An outbreak in the Belgian village of Ellezells was brought to the attention of van Ermengem, then a professor of bacteriology at the University of Ghent. His ensuing study provided the data on which the modern understanding of botulism is based.

van Ermengem determined that ham was the source of the poison in the outbreak. He isolated an organism from this ham and from the spleen of one of the men who had died. Subcultures of this organism produced toxin that was lethal to several animal species. Consequently, van Ermengem named the bacterium *Bacillus botulinus* (now called *C. botulinum*) because he believed that organism had caused the poisoning at Ellezells and that this disease was identical to "sausage poisoning." Succeeding studies confirmed the observations of van Ermengem.

Botulism was first recognized in the United States in 1899. In the 79 years from 1899 to 1978, there were 778 outbreaks of botulism in the U.S. involving 2,019 individuals of whom 1,002 died, for a 50 percent mortality rate. The fatility rate has declined significantly in recent years. The case-fatality rate in 1978 of 5.2 percent was a modern low.

The decline in the case-fatality ratio of foodborne botulism from the 50 percent figure seen in the first 79 years of this century is due mainly to improved detection methods, more readily available antitoxin and, especially, mechanized ventilatory assistance.

Only in seven nations — the U.S., Poland, Germany, Union of Soviet Socialist Republics, Japan, France, and Canada — do faulty methods of preserving food in the home coincide with the presence of *C. botulinum*. Poland has more botulism than any other nation. Most of the outbreaks result from eating improperly homecanned meat.

Foodborne botulism outbreaks have been reported from 45 states since 1899. Five western states (California, Washington, Colorado, Oregon, and New Mexico) have accounted for more than half of all reported outbreaks.

Since 1899, there have been 10 outbreaks, 28 cases and 21 fatalities in Nebraska. The latest outbreak, the first since 1931, occurred in 1979; the incriminated food was home-canned tomatoes.

However, botulism remains a modern day problem. In 1978, twelve outbreaks of foodborne botulism, involving 58 cases, occurred in the United States. This compares with 80 cases in 1977 and an average of 7.9 outbreaks, with 18.7 cases per year, from 1970 through 1976.

History of Scientific Methods for Home Canning

The first instructions for home canning were printed in the United States in the nineteenth century. Most of these instructions, developed through hit or miss techniques, incorporated the procedures developed by Nicholas Appert, a French chef in Napoleon's time. Many cookbooks of the Victorian era contained home canning instructions as well as descriptions of the difficulty of preserving some foods using these methods.

During World War I, the first United States government publications on home canning were printed. These publications were part of a massive campaign to urge citizens to grow and preserve their own food. They contained directions for many extremely dangerous canning methods such as water bath and steam processing of low-acid vegetables, as well as oven canning. The net result of this campaign was that many Americans died of botulism from under-processed homecanned vegetables.

In 1943, the United States Department of Agriculture (USDA) issued a firm statement that pressure canning was the only safe way to can meat and low-acid vegetables. In 1946, the USDA published results of the extensive heat penetration and bacteriological studies on home-canned foods and established a scientific basis for home-canning instructions.

The first reexamination of USDA home-canning recommendations since 1945 was completed in 1978 at the University of Minnesota. The results of these studies have been published in the University of Minnesota Extension Bulletin 413 "Home Canning—Fruits, Vegetables, and Meats." While some of the times and temperatures in this bulletin are different from those of the USDA, the new time and temperature combinations are safe and give quite reliable results.

The Organism and its Classification

C. botulinum includes several types or strains of bacteria that produce neurotoxin differing in chemical makeup and antigenicity. However, organisms so classified are alike in that they are:

1. Rod shaped (2 to 10 μm in length and 0.5 to 2 μm in width).[a/]
2. Anaerobic (grow in the absence of oxygen).
3. Form spores (very resistant, dormant or resting form of a bacterium).
4. Produce neurotoxins (toxins that affect the nervous system) with similar pharmacological action.

[a/]One μm equals 1/25,400th of an inch.

TABLE 1. *Types of Clostridium botulinum and animals more commonly affected by the toxins produced.*[b]

Type	Species
A	*Man*
B	*Man*, horse
C alpha	Birds, turtles
C beta	Cattle, sheep, horses
D	Cattle, sheep
E	*Man*, birds
F	*Man*
G	No recognized outbreaks

[b]Types A, B, E and F cause botulism in man with Types A and B occurring most frequently in the United States. Type A is the predominant type in the western U.S., whereas Type B is the prevalent type in the eastern U.S. Type E occurs most often with seafoods, particularly ethnic seafoods of the Eskimos and Native Americans of the Northwest. It has been reported that Types C and D each have caused one or two cases of botulism in man.

RESISTANCE TO HEAT

C. botulinum has the ability to form an entity called a spore (oval in shape with a diameter of 2 μm). A spore is a dormant or inactive form of the cell and must germinate to become an actively growing cell, capable of producing toxin.

The spore is the most efficient survival mechanism in nature. Spores are very resistant to adverse conditions such as heat, chemical treatments, physical stress and other environmental changes. For example, under proper conditions, spores of *C. botulinum*, Types A and B, will survive from 5 to 6 hours at 212°F (100°C). Fortunately, at higher temperatures, much less time is required to destroy these spores. This is recognized in the canning of "commercial sterilization" of food. For example, at 250°F (121°C), low-acid food will be sterilized in only 3 minutes; in ultrahigh-temperature food processes, a heat treatment of a few seconds at 280°F (138°C) is sufficient to destroy spores of *C. botulinum*.

The heat resistance of *C. botulinum* spores is one reason why outbreaks of botulism are usually associated with homecanned, preserved, or processed foods. Spores may survive in insufficiently processed food. During subsequent food storage, these spores may germinate into actively growing bacteria and produce toxin.

A less severe heat treatment is needed to destroy the toxin than is necessary to kill the spores. Heating food to boiling for 10 minutes will destroy botulinal toxin. If contaminated food is eaten without sufficient heat treatment to destroy the toxin, severe illness and possibly death will occur.

Growth Requirements

The requirements for growth of *C. botulinum* are:

1. A food contaminated with *C. botulinum* and capable of sustaining its growth.
2. *An absence of oyxgen*. Strict anaerobic conditions; only Type E does *not* require strict anaerobic conditions for growth.
3. *Proper temperature*. A range of 50°F (10°C) to 118°F (47.7°C) for Types A and B or as low as 38°F (3.3°C) for Type E.
4. *A pH greater than 4.5*. "Low-acid" foods; i.e., vegetables and meats.
5. *A low salt concentration*. 5 to 10% brine (% brine equals % NaCl divided by % NaCl + % H_2O multiplied by 100).
6. *Water activity (Aw) greater than 0.85*. An expression of water available (Aw = vapor pressure of food divided by vapor pressure of pure water).

Improperly canned foods, primarly low-acid vegetable products, provide excellent growth conditions for *C. botulinum*. When food is canned, the air is either evacuated or driven out, thereby creating the anaerobic conditions necessary for the growth of *C. botulinum*. Further, the spores of *C. botulinum* are more heat resistant than the vegetative forms of other bacteria. Consequently, spores of *C. botulinum* may remain as the sole survivors in improperly canned food.

Both meat and vegetable items provide the nutrients needed by *C. botulinum* for growth. Most of these foods are low acid (pH greater than 4.6) and can support the growth of this organism. High-acid foods require a milder heat treatment than low-acid foods because *C. botulinum* will not grow at a pH of 4.6 or less. Nevertheless, a number of outbreaks of botulism have been caused by "high-acid" foods.

Cured meats were commonly associated with botulism in the past century. This is no longer true in the U.S. because of the sophisticated and carefully controlled processes used by the modern meat industry.

A number of factors are used to preserve cured meats. During processing, most cured meats are cooked, which eliminates vegetative bacteria but not the more resistant spores. Cured meats, unlike canned foods, usually cannot be heated to the extent necessary to destroy all spores of *C. botulinum* because product quality would be reduced. Thus, to prevent the growth of botulinal spores which may survive in cured meat, inhibitory agents, namely salt and nitrite, are added. A combination of other factors, including good sanitation (and therefore low numbers of *C. botulinum*), a relatively low pH and refrigeration of perishable products, are also used to prevent botulism in cured meats.

The combined effects of these factors are of practical importance in the preservation of food. Lowering the pH or raising the salt concentration increases the minimum temperature at which *C. botulinum* grows. Similarly, increasing the acidity of a food decreases the maximum salt concentration at which growth starts.

In general, prevention of foodborne botulism is accomplished either by using heat *to destroy C. botulinum* spores in a food ("commercial sterilization") or by using a combination of factors *to prevent growth of C. botulinum* in the food.

The Disease

Foodborne botulism is almost always caused by eating improperly preserved food in which *C. botulinum* has grown. Reports of botulism deaths from eating a single string bean or a few kernels of home-canned corn are not uncommon. In one instance, an individual died who had taken a mouthful of home-preserved peppers but spat them out.

One of the most notable outbreaks of botulism in the U.S. killed an entire family of 12. The outbreak, which occurred in Albany, Oregon in 1924, involved home-canned string beans.

Whatever food is responsible, the pattern of the disease is generally the same. After ingestion, the toxin is absorbed and carried by the blood to the nerves. Nausea and vomiting are often (56% of U.S. cases) the first symptoms to appear. These particular symptoms are probably caused by contaminants other than the botulinal toxin.

Early signs are a tired or weak feeling and dizziness. Double vision, inability to focus, and progressive difficulty in speaking and swallowing almost always occur and are due to the effect of the neurotoxin on nerve transmission.

Individual resistance to the toxin varies widely. Symptoms ordinarily appear in 18 to 36 hours, although in one instance it was as short as 2 hours. There are also cases on record in which the latent period was as long as a week. Variability in the time of onset from eating contaminated food can be accounted for by the dose and time required for absorption of the toxin.

As the disease progresses, there is increasing paralysis due to the action of the botulinal toxin in preventing the passage of stimuli from the motor nerves to the muscles. Eventually, muscles fail to respond to their specific stimuli until the muscles needed for breathing or the cardiac muscles of the heart falter and fail.

CDC - Emergency Assistance

Because botulism is a rare disease, most physicians probably do not see a case of botulism in a lifetime of practice. This often results in misdiagnosis. The Center for Disease Control (CDC), Atlanta, Georgia 30333, distributes to physicians and other interested individuals information concerning the diagnosis of botulism and the use and availability of botulinum antitoxin (at no cost) in an effort to aid in the early diagnosis and treatment of botulism. Ask for *Botulism in the United States, 1899-1977: Handbook for Epidemiologists, Clinicians and Laboratory Workers*.

Prompt diagnosis and early treatment of botulism are essential to minimize the otherwise great risk of death due to botulism. When a diagnosis of botulism is considered, the physician should contact The Center for Disease Control (Day phone) - (404) 329-3753 or (Night phone) - (404) 329-3644. Equally important is the need to identify the offending, contaminated food source and remove it so others won't partake of it and fall ill; and to test it for botulinum toxin. Epidemiologic investigation and disease control are statutorily the responsibility of the local health department, where one exists, and, where not, that of the State Department of Health. Following is a list of state personnel by office and phone numbers:

Nebraska State Department of Health

Director,
Disease Control Division
(Office 471-2937)

Director,
Housing and Environmental Health
(471-2541)

One of the above will, in turn, call on CDC for necessary epidemiologic and lab assistance and order the antitoxin.

Food Involved

Home-canned foods caused 72 percent of the outbreaks in the 79-year period from 1899 to 1978. Less than 9 percent were attributed to commercially processed or canned food and the majority of these, 41 of 66, occurred before 1930. The types of food products involved in these outbreaks are listed in Table 2. The type of food processing responsible for 17 percent of the outbreaks is unknown.

TABLE 2. *Food products causing botulism outbreaks 1899-1977.*[a]

Product	Outbreaks	
	No.	Percent
Vegetables	151	54.3
Fish and fish products	41	14.7
Fruits	29	10.4
Condiments[b]	23	8.3
Beef [c]	8	2.9
Milk and milk products	5	1.8
Pork	3	1.1
Poultry	4	1.4
Others[d]	14	5.0
	278	100.0

[a]Includes only outbreaks in which the toxin type was determined. In two-thirds of the outbreaks the toxin type was not determined.
[b]Includes outbreaks traced to tomato relish, chili peppers, chili sauce, salad and dressing.
[c]Includes 1 outbreak of type F in venison, and 1 outbreak of type A in mutton.
[d]Includes outbreaks traced to vichyssoise soup, spaghetti sauce, and to corn and chicken mash.

Vegetables are the major type of food involved in botulism outbreaks. Of the 278 outbreaks shown in Table 2, 151 (54.3%) were associated with vegetables. Fish was second with 41 outbreaks, followed by fruits, condiments, milk, pork, and poultry. In almost every instance, the foods involved had been canned or processed in some manner, stored for some time and then consumed.

Prevention

The major cause of botulism outbreaks is improperly processed home-canned food products. Prevention is simple; follow proper techniques when canning food in the home.

Listed below are U.S. Department of Agriculture publications on canning foods at home. Single copies of these publications are available free from the U.S. Department of Agriculture, Washington, D.C. 20250. Send your request on a post card. Include your zip code in your return address.

G8-Home Canning of Fruits and Vegetables
G106-Home Canning of Meat and Poultry.

Several University of Nebraska extension publications about home-canning methods are available at county extension offices:

Home Canning Meat and Poultry HEG-76-19
Home Canning Fruit and Vegetables HEG-79-108

Another good reference for the home canner is a free 100-page booklet entitled "Home Food Preservation." It is available by sending a post card to:

Consumer Protection Center,
Department 664G,
Pueblo, CO 81009.

"Home Canning" is the title of a scientific status summary prepared by the Institute of Food Technologists. Copies of this indepth review are available from the:

IFT Regional Communicator
Department of Food Science and Technology
116 Filley Hall
University of Nebraska-Lincoln
Lincoln, Nebraska 68583

A number of companies that sell home-canning supplies also have publications on home canning.

Ball Corporation
345 South High St.
Muncie, IN 47302

Bernardin Inc.
2201 W. Maryland
Evansville, IN 47705

Kerr Glass Manufacturing Corp.
Sand Springs, OK 74063

Mirro Aluminum Co.
Manitowac, WI 54220

National Presto Industries,Inc.
3924 W. Hastings Way
Eau Claire, WI 54701

More extensive advice on canning can be found in the following texts:

Farm Journal Editors. Freezing and Canning Cookbook, Rev. ed. Nichols, Nell B., ed. 1973. Doubleday.

Gaulke, Judith A. Home Canning. 1975. Lane Publishing Company.

Hold, Calvin and Caradine, Patch. A Guide to Canning and Preserving. (orig.) 1974. Pyramid Pub.

Home Canning by Better Homes and Gardens. Meredith Publishing Co., Des Moines, IA

The toxin or poison produced by *C. botulinum* is readily destroyed by heat. To inactivate toxin, bring food to a boiling temperature and hold that temperature for 10 minutes. A good rule to follow is *always boil homecanned vegetables before tasting them,* particularly if the vegetables in the container, when opened, have a bad smell, bubble or look different. "When in doubt, throw it out!"

The habit of tasting homecanned vegetables before they are cooked almost cost one woman her life in South Bend, Indiana. The woman became ill one day and became progressively sicker as the days went on. Finally, 5 days after her initial symptoms appeared, botulism was considered and antitoxin therapy started. Her condition had been diagnosed as viral encephalitis, idiosyncratic reaction to prochlorperazine and myasthenia gravis. She recovered a full 8 days after botulinum antitoxin therapy was started.

The interesting part of this outbreak was that the woman shared all her meals with two other individuals, neither of whom became ill. They quite often consumed home-canned vegetables that were fully cooked at their meals. But, the woman had the habit of tasting the home-canned vegetables prior to cooking and this probably explains why she became ill and none of the others did.

Food canned in the home under proper conditions for the type of food involved will be safe to eat. Problems only develop when improper canning techniques are used.

Commercially canned products are safe to eat if the can ends are not bulged and if the product appears normal and has a normal odor.

Bulging can ends and jar lids usually indicate spoilage. If it becomes necessary to dispose of canned foods, do it in such a way that there is no chance that they will be eaten by humans or animals.

Spoilage of commercially canned foods items should be promptly reported to the Food and Drug Administration by telephone or mail. Information in such a report should include:

1. The nature of the problem involved.
2. A detailed description of the product's label.
3. Any code marks embossed or stamped on the lid of the can.
4. The name and address of the store where the product was bought.
5. The date of purchase.

Dairy and Food Sanitation, Vol. 3, No. 1, Pages 9-12 (January 1983)

WASTEWATER MANAGEMENT: MEETING THE REQUIREMENTS

NEIL A. VAN DYKE, P.E. and PAUL E. THORMODSGARD, P.E.

The challenge of wastewater management can be met by systematically diagnosing existing operational conditions and by identifying process and wastewater treatment alternatives. Important elements in developing a management plant include: a) evaluation of user charge system (if any), b) in-plant waste survey, c) process modification/optimization, d) educational programs, and e) pretreatment or complete treatment systems.

Over the years, the dairy industry has traditionally been faced with the challenge of production, quality and cost control, and consumer acceptance of its products. The ability to successfully meet these challenges has impacted directly upon the profitability of those engaged in the dairy industry. The decades of the 70's and 80's brings a new challenge for the dairy industry - the challenge of wastewater management, and one which greatly impacts profitability.

A fundamental part of coping with these new requirements requires an intimate understanding of the terminology of wastewater management. By necessity, dairy industry management must become familiar with terms such as POTW, sewer use ordinance, user charges, BOD_5, suspended solids, pretreatment, EPA/DNR, and discharge permits. Briefly, these terms may be defined as follows:

POTW-Publicly owned treatment works.

Sewer Use Ordinance-The ordinance by which a POTW or local authority regulates the users of a wastewater collection and treatment system.

User Charges-The basis by which system users pay for costs of wastewater treatment in a POTW.

BOD_5-An accepted test procedure for measuring the organic strength of wastewater; it is normally a major factor in determination of the user charge and sizing of a treatment facility and is measured in mg/1 or lbs.

Suspended Solids-Another measure of the strength of watewater; represents solids in the waste stream which can be removed by filtration; also a factor in user charge systems and is measured in the same units as BOD_5.

EPA/DNR-Federal/State regulatory agencies which regulate the disposal of treated effluents into public waters or onto the land.

Discharge Permit-A permit required by Federal and State agencies to discharge treated wastewater into public waters or onto the land.

Pretreatment-Treatment methods which are employed for reduction of pollutant strength prior to discharge to a POTW. Pretreatment may be mandated by virtue of the sewer use ordinance or may be utilized as a cost-effective means of reducing overall treatment costs.

Wastewater Treatment Options

Two options for treatment of dairy wastewater generally exist. These include treatment of the waste effluent in a POTW or, alternatively, in a treatment facility managed by the industry. Where both options are available to the plant, the choice should be based on considerations which include:

1. Economic Analysis of Each Option
2. Public Relations Factors
3. Management Philosophy of the Company

Under the POTW alternative, the dairy industry must comply with the provisions of the sewer use ordinance and the user charge system. The sewer use ordinance will establish limita-

tions regarding discharge of wastewater into the collection and treatment system.

Typically, these limitations may include:

1. A specified pH range normally of 6.0 to 9.0 is common.
2. Limitations on slug loads.
3. Requirements for spill protection.
4. Limitations on toxic pollutants.
5. Limitations on pollutant concentrations and/or hydraulic loads.

Limitations such as those described above are required to permit the optimum operational performance of the municipal treatment works. POTW's which are still unable to comply with specified conditions of their discharge permit may even further restrict system users such as cheese plants.

For those industries which treat their own wastes without use of a POTW they will be liable directly for the requirements of their own discharge permit. That permit will establish effluent standards as well as reporting and testing requirements.

Whether treatment is provided in a POTW or in your own facility, wastewater treatment is an expensive proposition which requires considerable attention by dairy industry management. Generally, waste out the door normally means money out of your pocket, and that is usually in the form of lost product, higher expenses to treat in your own system, or higher user charges if on a municipal system.

The chief objective is therefore to *identify* and *implement* the most cost-effective alternatives available for wastewater management. In developing a wastewater management plan, consideration should be given to the following items:

1. User charge system evaluation (if connected to POTW).
2. In-Plant waste survey.
3. In-Plant modifications.
4. Educational programs.
5. Pretreatment.
6. Total treatment.

I will now address each of these items individually.

Calculation of billing components, such as those illustrated above, provides management with an insight into the relative significance of each billing parameter and permits the development of a detailed strategy for cost reduction. For example, in the illustration below, BOD_5 represents approximately 65% of the total billing and is obviously an area in which substantial cost reductions may be possible. The other areas, in decreasing order of magnitude, would be suspended solids, phosphorus, and flow.

It is important to remember that data generated from an industry's effluent monitoring system provides the basis for calculating treatment charges and also for evaluating wastewater sources. It is advantageous for a dairy to insure that flow and sampling data are truly representative of actual conditions. Procedures which can be employed to this end include:

a. Collect samples from a well mixed area of the flow stream.

User Charge System

The user charge system adopted by a municipal plant establishes the basis for assessing charges for treatment of wastewater. It is absolutely essential that the user charge system be fully understood by dairy industry management. As an example, the treatment costs assessed to industrial customers at one Wisconsin treatment plant are summarized as follows:

Flow	$650.00 per million gallons (MG) discharged
BOD	$0.25 per lb.
Suspended Solids	$0.14 per lb.
Total Phosphorus	$1.75 per lb.

For illustrative purposes, we shall consider a typical dairy wastewater with the following characteristics:

Flow	75,000 gpd	
BOD_5	2,000 mg/l	1,251 lbs/day
Suspended Solids	700 mg/l	438 lbs/day
Total phosphorus	50 mg/l	31 lbs/day

Using these parameters and the previously given user rates, the monthly treatment charges are calculated as follows:

Billing Parameter	Montly Totals	Unit Cost	Total Cost	% Total
Flow	2.25 MG	$650.00/MG	$ 1,463	10%
BOD_5	37,530 lbs.	$ 0.25/lb.	$ 9,383	65%
SS	13,136 lbs.	$ 0.14/lb.	$ 1,839	13%
T. Phos.	930 lbs.	$ 1.75/lb.	$ 1,628	12%
TOTAL MONTHLY TREATMENT COST			$14,313/Mo.	100%
			$171,756/64.	

b. Samples should be taken in proportion to the volume of flow.
c. Periodically check the calibration of flow monitoring equipment and independently verify analytical results by splitting samples for testing with more than one lab.
d. Assign, train, and hold one person responsible for the routine inspection, operation, and maintenance of monitoring equipment.

In-Plant Modifications

Another approach to managing wastewater involves in-plant modifications. Such an approach is a good one because it is directed toward the source of the problem. After each process waste stream has been characterized, a thorough evaluation should be made which addresses the following points:

1. Can the waste material be recycled or disposed of in a manner other than the process sewer?
2. Can the quantity of waste be reduced by process optimization or modification?
3. Can equipment replacement or increased automation be used to advantage?
4. Is the process prone to operator error? Can operator procedures be modified which reduce the waste discharge? Can housekeeping procedures be improved?

Published reports describe a number of possible techniques to reduce water consumption and waste generation. Several of these techniques are summarized as follows:

1. Optimize CIP systems by making provision for product recovery and for re-use of final rinse water. This area may also be instrumental in controlling pH and reducing phosphorus amounts in the wastewater.
2. Dispose of sludge material collected from automatic separators or clarifiers by means other than the process sewer.
3. Equip hose stations with automatic shutoffs to promote water conservation.
4. Install liquid level controls to prevent system overflows.
5. Thoroughly drain all lines, tanks, and processing vats before rinsing. Modify systems as required to promote proper drainage.
6. Develop alternative uses such as animal feed or waste products originating from recoverable rinses, spilled product, and spillage collected from drip shields and system leaks.
7. Utilize production scheduling techniques to minimize frequency of start-ups and shutdowns on waste generating stations and optimize the sequence of processing to avoid unnecessary clean-up between products.
8. Utilize enigeering techniques in expansion and remodeling projects which minimize waste generation.
9. Consider water usage and waste discharge criteria in the selection of equipment, processes, and systems.

Educational Programs

As a result of an in-plant survey, management may find that a substantial part of the waste load is operator related, i.e. operator action or inaction which adversely affects the discharge. Under these circumstances, an educational program directed toward waste management can be used to advantage. The employee educational program may include a number of techniques and topics as follows:

1. Explain the need for water conservation and waste prevention. De-

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In-Plant Survey

In developing a strategy for wastewater management, in-plant surveys are mandatory. It is essential that the individual waste streams which comprise the total effluent be identified and characterized. In other words, the flow and pollutant concentrations from each source must be known. Such a survey permits an identification of problem areas and reduces one complex problem into a number of more clearly defined and possibly simpler problems.

For illustrative purposes and with reference to our previous example, we shall assume that an in-plant survey was conducted to pinpoint the source of BOD loadings and that three waste streams were identified with flows and BOD_5 concentrations as follows:

	Flow (gal/day)	BOD_5 (mg/l)	(lbs/day)	% of Total BOD	% of Total Vol.
Stream 1	67,000	575	321	26%	8.3%
Stream 2	6,900	5,000	288	23%	9.2%
Stream 3	1,100	70,000	642	51%	1.5%
Plant Total	75,000	2,000	1,251	100%	100%

The significance of our illustrated example is obvious. If waste Stream 3 can be eliminated, (comprising only 1.5% of the total volume) the amount of BOD can be reduced by 51% monthly BOD charges be reduced by 51% with an annual cost savings of ($57,780/yr.) It should also be noted that if this plant were in the previous community, annual cost savings of $58,000, if not, a tremendous load on the STP could be eliminated which would have a beneficial impact as well as monetary.

scribe the importance of successfully controlling waste materials in terms of benefits to the employees and community.
2. Explain the terminology of wastewater management.
3. Cite examples of good practices for reducing water usage and waste. Utilize slides and other illustrations depicting poor practices.
4. Seek the active participation of employees in attacking water and waste problems.
5. Insure that the program is on-going and continuous. Inform employees on the results of their efforts and continue to emphasize areas where further attention is required.

Pretreatment

Pretreatment is another alternative available to the dairy industry for wastewater management. It may be employed as a sole remedy to reducing wastewater treatment costs or perhaps more cost-effectively in combination with other in-plant measures previously discussed. Assuming that pretreatment is not mandated by the sewer use ordinance, the justification for pretreatment is largely a question of economics. The cost savings in the form of reduced treatment billings must be weighed against the capital and operating expense which will result from the pretreatment facility. Alternatives which should be explored to determine the optimum pretreatment system include:

1. Should all waste streams be pretreated or is it more cost-effective to pretreat only one or two of the streams?
2. What is the optimum level of pretreatment, i.e. is the optimum concentration of effluent BOD_5 1,000, 500, or 200 mg/l?
3. What are capital expenditures and annual operation and maintenance costs vs. current user charge costs? (Note: various tax incentives should be included in analysis.)

Complete Treatment

The alternative for complete treatment requires that the wastewater be treated sufficiently well to meet the requirements of the discharge permit. Additional requirements of the permit may include a sludge management plan and periodic sampling and reporting requirements.

Several treatment processes can provide excellent effluent quality in the treatment of dairy plant wastewater. These include activated sludge, oxidation ditch, aerated lagoon, biological discs, and land application methods. The criteria for selection of an optimum system includes effluent requirements, site limitations, wastewater characteristics and variability, design life, and costs.

Summary

The wastewater management alternatives available to the dairy industry are varied and complex. The optimum solution will be dependent upon the particular requirements of each facility and may include process modifications, educational programs, and pretreatment or complete treatment of wastewater. With sufficient management attention, and employee cooperation, the challenge of wastewater management is one which can be met.

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The Great Flood of 1982- Fort Wayne, Indiana

KAREN E. YAGER, R.P.S.

It had been one of the worst winters recorded in Fort Wayne history, with a freezing January and record breaking snow fall in February. By March, flooding was expected as the weather grew warmer, but no one expected a flood with such impact.

The waters of the St. Mary, St. Joseph and Maumee Rivers had risen steadily and by Saturday, March 13th, the Emergency Operations Center in the City-County Building came to life. Despite the early precautionary measures that were taken, by Sunday evening an estimated 3,000 persons were forced to evacuate their homes.

Governor Robert Orr declared the City and surrounding Allen County a disaster area. The Army National Guard, U.S. Marines, and the U.S. Army Corps of Engineers arrived to give assistance. Volunteers worked around the clock to prevent further flood damage.

The waters, however, continued to rise and the St. Joseph and Maumee Rivers reached record breaking levels of 18.95 and 25.86 feet, respectively, by Wednesday, March 17. The threat of weakening dikes forced the evacuation of an additional 4,000 residents.

On Tuesday, March 16th, as thousands of volunteers filled sandbags, placing them along the rivers and reinforcing the dikes, President Ronald Reagan visited Fort Wayne to determine the need for Federal Flood Assistance. On Friday, March 19th, a storm threatened to dump several inches of rain in the area. Sandbag efforts were frantically stepped up, but only 3/4 of an inch of rain fell. The dikes held and by Saturday, March 20th, the rivers were declining. The estimated 9,000 evacuees began to return to the task of cleaning up and salvaging their homes by March 22, 1982.

The following is a summary of the action taken by the Fort Wayne - Allen County Board of Public Health in response to this community crisis. The Health Commissioner and the Deputy Health Commissioner, during the course of the flood emergency, coordinated their efforts with the Mayor's Office, and Board of Works, and other City and County Departments and Officials. The Administrative structure also coordinated the efforts of the different divisions within the Fort Wayne-Allen County Board of Health in the application of public health endeavors relating to the flood.

THE ENVIRONMENTAL CONTROL DIVISION

Approximately 200 flood related calls were received from the public by the Environmental Control Division during the flood emergency. These calls included inquiries on a variety of subjects, such as: What were the recommended clean-up procedures and sanitizing solutions to be used; what to do with water soaked carpeting; if home canned jars of food could be salvaged; how to clean dishes and utensils; how to disinfect colored clothes; if sand from sandbags could be used for sand boxes and gardens; if food items left in refrigerators and cupboards could be eaten; and countless other health related questions. Requests were made for dumpsters to be placed in neighborhoods for water soaked items. Requests were also made for water samples to be taken from private wells to check for possible contamination. Information provided by the Indiana State Board of Health concerning flood sanitation was made available to the public. This handout included directions for disinfecting wells and water sources, directions for treating drinking water in small quantities, directions for salvaging flood-damaged food in the home, and guidelines to be followed concerning the rehabilitation of buildings, furnaces, furniture, rugs and clothing.

The Pollution Control Section's main task during the flood was to make sure that the water supplies from private wells were not contaminated. To do this, the flooded area was surveyed and those parts of the area served by private wells were identified. Whenever possible, neighborhood associations were contacted to act as liasons with the residents to pass on information concerning clean-up and well sterilization, and to help in collecting water samples.

Volunteers were instructed in the techniques of water sampling and well sterilization. Sterilized bottles were left at each affected area for volunteers to use. Samples were brought in to the Board of Health Laboratory twice a day by section personnel.

Representatives of the Indiana State Board of Health were on hand to assist the section and to check on semi-

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public water supplies which may have been affected. The State Board of Health personnel were accompanied by the sanitarians of the Pollution Control Section.

After the flood emergency subsided, follow-up work was undertaken by personnel of the section to ascertain that all wells showing bad samples were sterilized and the water made safe.

It was the primary responsibility of the Food Section of the environmental Control Division to assure that the food supply of the community remained in sound condition during the flood emergency. The seven food inspectors accomplished this goal by:

1. Regularly checking the status of food establishments and markets affected by the flood;
2. Daily visits to evacuation sites to monitor the food preparation facilities;
3. Advising the American Red Cross and Salvation Army in regards to the preparation and transportation of food, and monitoring any food operations that were set up for feeding volunteers and flood victims.

Twenty-two licensed food establishments and markets were closed during the flood emergency, due largely to direct flooding. The other establishments were closed as a precautionary measure when orders were given by Mayor Winfield Moses, Jr. to evacuate possible flood-threatened areas.

The flooded establishments were contacted by the food inspectors on a regular basis. Water levels ranged from flooded basements to up to approximately three to four feet of water on the ground level of these establishments. When the flood water receded, inspections were conducted. Operators were instructed as to the proper sanitizing procedures to be followed during the clean-up operation. Contaminated and/or unrefrigerated food items were destroyed. Sewage and wastewater disposal facilities were checked for proper functioning. Water samples were also taken at each establishment and were checked by the Board of Health Laboratory. The flooded establishments remained closed until final approval had been given by a food inspector to reopen for business.

The evacuated establishments were also contacted by the food inspectors. Initially, the City planned to shut off the utilities in the evacuated areas. Therefore, the operators of the establishments were forced to transport their perishable items to a refrigerated storage area. Most operators returned their potentially hazardous foods to the wholesaler or stored their items at another food establishment. Others maintained their perishables in refrigerated trucks. Nonperishable items that were left in these establishments were placed on higher shelves for protection. The Administration later decided to leave the utilities on in these evacuated areas, and after a few days, when the flood threat lessened, operators resumed their normal activities.

By midweek of the flood crisis, the American Red Cross had designated eleven locations as refugee sites. These locations, which were churches and schools, were checked daily by the food inspectors. Approximately 160 people were housed at these sites, with up to an additional 300 victims being served 2-3 daily meals. Most meals were transported in approved containers to the sites from the Salvation Army's main kitchen. However, some meals were prepared directly at the sites which were equipped with approved kitchen facilities.

The food inspectors checked these evacuation sites for proper sanitizing of utensils and food contact surfaces, food protection during storage, preparation and serving, and also took water samples at each site. It was noted that most sites utilized single service utensils.

In addition to inspecting the food operations at these sites, a general sanitation check was made on restroom and sleeping accommodations. Cots, which were provided by the Red Cross, were set up in either a large room or in cases where separate rooms were available; families were sectioned. Separate quarters were provided for victims who showed any sign of illness. A problem developed as most of the sites did not have shower facilities. Those evacuees who were being temporarily housed at the sites had to either take sponge baths or be bused to the local Y.M.C.A. for showers.

At the request of the American Red Cross and the Salvation Army, hundreds of organizations and individuals donated food items for flood victims and volunteer workers. The Salvation Army estimates that they prepared over 1.5 million meals from their main kitchen facility, which was under Board of Health permit. These prepared items were covered and transported in approved containers to several locations, including evacuation sites, the Memorial Coliseum, and to the trailers that had been set up in flooded areas to feed volunteers.

The overwhelming response from the community in donating food items, however, soon led to an unforseen problem. Cases were reported of individuals trying to donate home-prepared meals, without prior notice or consent, to the Memorial Coliseum and to some evacuation sites. These locations were advised not to accept prepared food items, except those delivered from approved sources. By March 18th, the Deputy Health Commissioner found it necessary to prepare a media release in order to prevent any inadvertent food sanitation problems. This news release confirmed that only commercially prepared canned goods and other nonperishable items were to be donated by the community. Licensed food establishments were allowed to donate prepared foods as long as the food was labeled and properly transported to the sites. Individuals and organizations were limited to donating home baked items, such as cookies and cakes, to the flood victims and volunteers.

Despite the threat of food sanitation problems occurring during the flood crisis, the food section of the Board of Health did not receive any reports of flood-related food poisonings. It was noted that the temporary food operations that were functioning during this

period were managed very well. The owners of flooded food establishments and markets were also very cooperative and concerned about restoring their facilities to a sanitary condition.

In addition to the duties listed above, the food inspectors also supervised the evacuation and return of patients to a flood-threatened nursing home. Sixty-four patients were evacuated to the Crosier House, a ministry center. Twenty-eight bedridden patients were transported to the St. Joseph Hospital where they could receive proper treatment. During the evacuation period, the inspectors continued to survey the Crosier House's food facilities as well as determining the status of patient care.

The Code Enforcement, Rodent Control and Mosquito Control Sections of the Environmental Control Division became most active in the aftermath of the flood.

Complaints were received about tenants who had abandoned rental properties, leaving them unsanitized and filled with debris. Also, as a result of all the debris and rubbish left behind after the flood, it was a great concern that displaced rodents who left the riverbanks would find new homes in surrounding neighborhoods.

The Code Enforcement Section carefully supervised the removal of this debris and rubbish. The City of Fort Wayne placed dumpsters throughout the flooded areas, so the victims could place their unsalvagable items in them. This action was taken immediately after the waters had receded, and worked out well. Legal action was taken, however, against anyone who did not comply.

The Rodent Control Section received a higher number of complaints approximately two weeks after the waters had receded. In response to these complaints, the Rodent Control technicians surveyed and baited the affected properties.

Weather variability plays a constantly changing role in the life cycles and breeding potential for mosquitoes. One can never accurately predict what effect a measurable precipitation, snowmelt, or changes in temperature and daylight hours will have on mosquito production.

To assess the affect on a potential mosquito problem brought about by the 1982 flooding in the Fort Wayne area, an initial survey of riverbasin areas was made beginning in late March. There was evidence of a great deal of standing water and a number of pockets of water or pools adjacent to streams and ditches. Fortunately, low spring temperatures and a rapid drying in these areas seemingly inhibited *Culex* (vector mosquito) production, with normal sparse findings of *Aedes* (nuisance) mosquitoes found in woodland pools.

Weekly follow-up inspections indicated that drying conditions further eliminated sites believed capable of becoming active with *Culex* mosquitoes. In mid-May, marginal amounts of mosquito production were found, with egg rafts in permanent pools or streams, and early-spring nuisance mosquitoes in the wooded areas.

THE BOARD OF HEALTH LABORATORY

The Fort Wayne-Allen County Board of Public Health Laboratory was primarily concerned about the quality of the water in the flooded areas surrounding Fort Wayne and Allen County. All personnel were on twenty-four hour call, including weekends.

Water sampling bottles were made available to the population of the entire area and parts of several surrounding counties. Newspapers, television and radio spots supplied the necessary publicity. "No charge" water testing was instigated during the flood period, and during the period six weeks immediately following the recession of the flood waters. Water sampling of the entire area of the City was stepped up to a daily basis and these samples were examined by the laboratory as well as the Filtration Plant.

All drinking water samples were run on the five tube lauryl tryptose broth procedure and confirmed on brilliant green bile. All presumptive positive results were immediately called to the individual concerned. All confirmed samples were renotified that the water proved to be "Not Satisfactory" and that another sample should be submitted to the laboratory for re-examination.

All patrons having an unsatisfactory well water sample were notified not to consume the water without boiling and/or chlorinating it first. Instructions regarding these were given over the phone to the patron and literature was made available for pick-up at the laboratory office detailing the procedure. The procedure for sterilizing wells was also given over the phone when necessary, and more detailed literature made available for those desiring it.

Statistically speaking, the laboratory processed 413 private well water specimens. Ninety-eight of the 413 samples were contaminated, which meant that 23.7 percent of the samples were unsafe.

The municipal water supply of the City of Fort Wayne remained completely satisfactory throughout the entire emergency period.

Many calls regarding food in glass jars and cans were also handled by the laboratory. Callers were instructed to destroy all glass-contained food that was submerged in floodwater. Canned goods still intact in the containers were to be washed and chemically sterilized prior to being used. Patrons were advised, "when in doubt, throw it out."

PUBLIC HEALTH NURSES

The health of the victims of the flood disaster was closely monitored by the National and the local Red Cross. They in turn informed the public health nurses of the situation.

The nurses gave assistance at the evacuation sites, which in addition to treating minor cuts, rashes, and respiratory ailments, consisted of counseling, giving assurance, comfort, and showing ways to help stabilize the continued health of the patients.

A team consisting of a Red Cross worker, a social worker, and a registered nurse, visited each home affected by the flood waters, to assess the situation. Fortunately, there were

no major accidents or health problems during the crisis.

The public health nurses remained on alert in the aftermath of the flood, as a precautionary measure in case some incidences of hepatitis were reported as a result of the flood.

CONCLUSION

During the course of any natural disaster, such as the Flood of 1982, the potential for adverse effects on the health of the community is greatly magnified. It was necessary for Department personnel to act expediently and efficiently in response to this challenge. Despite the problems that a flood of this nature imposed, the Fort Wayne-Allen County Board of Public Health did not receive reports of any major incidents occurring during this period.

The preceding article was compiled and edited based on the contributions of the following Board of Health personnel:

1. Ben Hassoun, R.P.S. Director Pollution Control Section.
2. Delores Butts, R.N., Public Health Nurse.
3. Michael Holly, R.P.S., Director Code Enforcement Section.
4. Michael Beard, R.P.S., Director Mosquito Control Section.
5. Ted Katras, Director, Board of Health Laboratory.
6. Marion Battin, Administrative Secretary Environmental Control Section.

News and Events

Eliason Dies Unexpectedly

Carl Eliason, Chief Executive Officer and founder of Eliason Corporation passed away unexpectedly at his Kalamazoo, Michigan home Friday, November 5, 1982.

Mr. Eliason was born October 1, 1913 in Muskegon, Michigan. He attended Muskegon Jr. College, was a member of the Presbyterian Church, Kalamazoo Country Club and Point-o-Woods Country Club in Benton Harbor.

Mr. Eliason and his wife Edwanda founded the Eliason Refrigerator Company in 1952. The original plant was located in Coloma and later moved to Hartford. In 1969 the plant was expanded to Lawrence, Michigan where sectional Walk-In coolers and freezers are manfuactured.

In 1964 the Corporate Headquarters was established in Kalamazoo, Michigan. This plant produces ELIASON Easy-Swing patented double action doors which have become world famous and are used in many supermarkets and restaurants today.

In 1977 a West Coast division of ELIASON Corporation was opened in Woodland, California to handle export sales to Japan and other countries.

In the same year a complete ELIASON Building System was used in the construction of a manufacturing plant and hanger facility to house the corporate aircraft in Dowagiac, Michigan. This plant produces energy saving, patented ECONO-COVER night covers and ECONO-STRIPS used on open type refrigerated cases and freezers.

Carl Eliason was well known in the refrigeration industry and contributed many ideas in the early 1930's to further the development of the present day self service supermarket.

Family members include his wife Edwanda, David Eliason, Diane Burch, and five grandchildren.

Fermentec Appoints G. Clayton Cone

Fermentec Corporation has appointed G. Clayton Cone as Manager of its prototype whey conversion plant now under construction at Manteca, California.

A widely-recognized authority on yeast fermentation technology, Cone will oversee start-up of the plant when it comes on-stream in November. Thereafter, he will have full responsibility for all plant operations involving the production of fuel alcohol and food and feed products from cheese whey.

Cone comes to Fermentec with 30 years experience in the fermentation industry involving food, dairy and beverage processing. He has held the positions of Assistant Plant Manager of the Archer Daniels Midlands facility for industrial ethanol at Decatur, Illinois; Assistant Plant Manager of the Jacquin Distillery in Florida; and Technical Director of the Fleishmann Division of Standard Brands, Inc.

Fermentec Corporation is a biotechnology company which develops and markets commercial systems to recycle, by fermentation, the waste materials of food manufacturers and turn them into valuable products.

Tobin Elected Chairman by the American Frozen Food Institute

Edward J. Tobin, president of Comstock Foods, a division of Curtice-Burns, Inc., was elected Chairman of the Board of the American Frozen Food Institute on November 7 at the Institute's Annual Meeting in New Orleans, Louisiana.

Paul T. Corddry, president of Ore-Ida Foods, Inc., was elected First Vice Chairman.

Charles Rizzuto, president of Southland Frozen Foods, Inc., was elected Second Vice Chairman.

Elected to the Institute's Board of Directors, were:

•Oreste J. Boscia, senior vice president of Kitchens of Sara Lee

•Edward H. Coale, president of Readi-Bake, Inc.

•R. P. Garberg, president and manager of Shuksan Frozen Foods, Inc.

•Walter A. Hagen, vice president-marketing of the Durkee Foods Division of the SCM Corporation

•Kent C. Larson, vice president-general manager, frozen foods, of the Pillsbury Company

•Robert W. Lauffenburger, senior vice president-operations of Del Monte Frozen Foods, Inc.

•Paul K. Mead, president of Stilwell Foods, Inc.

•Michael A. Midler, president of Midler Associates

•Glen R. Mitchell, senior vice president of the Carnation Company

•Clinton E. Owens, senior vice president-marketing of the Coca Cola Company Foods Division.

New Dry Chemical Feeder

Recognizing the growing needs of the research and development function, the AccuRate Division, Moksnes Manufacturing Co., Whitewater, Wisconsin, has introduced a new dry chemical feeder specifically designed for R & D and laboratory work: the series 300.

Measuring just 14.5 inches wide by 14.5 inches long by 11.5 inches high, the series 300 with its exclusive flexing agitation hopper eliminates bridging, compacting

and rat holing while assuring metering accuracy up to plus or minus 1 to 2 percent, depending on material.

A smaller version of the popular 500 and 600 series AccuRate feeders, the 300 laboratory feeder provides extremely close tolerance feeding combined with dependability at an affordable investment.

To find out exactly how the 300 series lab feeder can meet your needs, contact James Kocher, Vice President - Marketing, AccuRate Division, Moksnes Manufacturing Co., 746 E. Milwaukee St., Whitewater, Wisconsin 53190. 800- 558-0184 (In Wisconsin call 414-473-2441).

AccuRate Feeders are used extensively in the chemical process, food processing, snaitary, and foundry markets.

New Line of Purchasing Offices

National Partitions, the nation's leading manufacturer of prefabricated, modular, in-plant offices for industry recently introduced its new line of purchasing offices.

These offices are designed to enable Purchasing Department people to meet with a vendor in a quiet, organized and efficient atmosphere. The sound and noise deadening features of the panel construction comprising these offices provide an effective environment for the purchasing agent, even if located in the midst of a busy, noisy factory.

Available for selection are three different panel constructions, ranging from STC 36 to 41, for sound reduction purposes. The structural posts which connect the panels are excellent supports for wall shelves in the office to hold extensive catalogs and reference books. Also available, if desired, are cork board panels for pinning up crucial items to remember. These special purchasing offices range from a single 8'x8' unit--up to a Purchasing Department complex which includes individual offices for buyers, connecting on to a purchasing department manager office. For large departments, a small waiting area for vendors is also provided.

For additional information contact National Partitions - 340 West 78th Road-Hialeah, FL or call free 800-327-3697.

Microbiological Safety Cabinet Containment Efficiency Test Kit

The containment efficiency of microbiological safety cabinets can be quantified quickly without the risk of bacterial or spore contamination with a British-developed test kit.

The KI-DISCUS method involves generating a fine mist of potassium iodide droplets within the cabinet by means of a spinning disc spray generator. Any droplets that escape are collected on the filter membranes of two air samplers connected to a suction fan. Deposited particles form well defined, easily counted spots when developed in a solution of palladium chloride. A comparison between the number of droplets generated and the number collected on each membrane provides a measure of the protection an operator has working in front of the cabinet as compared with working at an open bench.

To measure the degree of isolation a product in a laminar flow cabinet has from outside contamination, the air samplers are placed inside the cabinet and the spray generator outside. Cross contamination is tested with spray generator and air samplers on opposite sides of the cabinet's work surface. The equipment can also quantify the effectiveness of air-conditioning systems in industrial and medical clean areas. Five consecutive tests can be completed and evaluated in 90 minutes.

The spray generator, air samplers, suction fan and all other equipment required for the tests--including chemical solutions, a X10 microscope, forceps and tweezers, filter membranes, flexible tubing and vacuum gauge -- are contained in a cart small enough to fit in the trunk of an average car.

For all tests, 0.68 liquid oz. of potassium iodide solution in alcohol are fed from a reservoir which is part of the spray generator, through a metering needle and onto the spinning disc which is driven by a low-voltage d.c. motor. The high speed of the disc -- 28,000 rpm -- coverts the liquid into a well controlled, fine-droplet spray. Air samplers with barrel valves, centripetal cones and filter membrane holders are connected to a suction fan at the base of the cart. Once developed and examined, the filter membranes are stored in a special wallet for future reference and comparison with later tests.

The unit will test safety cabinets built to US standard NSF 49.

The cart measures 37.8" high × 22.4" wide × 13" deep and weighs 86 lb. including all test equipment.

Inquiries from US customers are welcomed by the agent. British Company: WATKINS & WATSON LTD., Westminster Road, Wareham, Dorset BH20 4SP England. Telephone: Wareham (09295) 6311. Telex: 418480. U.S. Company: Watkins and Watson (Contact: Jeff Jackson), 236 East Castle Harbour, Friendswood, TX 77546. Tel: 713-482-1966.

Poultry Products

Poultry supplies are plentiful and poultry products are moving at a good clip througout the U.S.

"Consumers currently are spending 21 percent of their

grocery dollars on meat, and 15 percent of that goes for poultry products," points out Dr. James Denton, a poultry marketing specialist with the Texas Agricultural Extension Service, Texas A&M University System.

Americans consumed 63 pounds of poultry meat last year and that figure will likely move up for 1982, says Denton. Per capita consumption has increased steadily over the years--from 49 pounds in 1971 and 37.7 pounds in 1961. Per capita consumption of all red meat in 1981 stood at 157 pounds, with beef and veal topping the list at 79 pounds. Some industry officials see poultry consumption capturing the top spot by 1990.

"With current economic conditions, poultry is a good buy for most households. Consumers are looking for value and are finding it in chicken nuggets, chicken patties, chicken weiners, chicken lunchmeat and chicken bologna," says the specialist.

"Processed chicken products are the fastest growing category in the meat case," says Denton. "And, due to their popularity, more chicken products will be coming from processed meat packers than ever before."

Packaging also has contributed to the success of poultry product sales, notes the specialist. Many broiler marketing firms now sell poultry products pre-packaged with brand-name labels. Warehouse packs, thrifty packs, family packs and bonus packs also have helped boost sales by providing consumers with a wider range of selections.

While the U.S. poultry market is strong, exports have been dampened by foreign subsidies, mainly in Europe, notes Denton. These subsidies have made it difficult for U.S. poultry products to compete abroad. If negotiations fail to reverse this policy, the Reagan administration will consider providing its own subsidies.

Dubl-Snap Bottles

Bottlers, retailers, and institutional users of premium fruit and dairy drinks can now package their products in single-serving Dubl-Snap bottles with colorful, tight-sealing, reclosable caps. The 8-oz. high-denisty polyethylene bottles are ideal for individual "convenience" servings of fresh fruit juices and ciders, dairy products, and other premium drinks. In addition, their tamper-resistant, relcosable caps make them excellent containers for concentrates and powdered drink mixes, and for non-food products ranging from shampoos and cosmetics to vegetable seeds and small hardware items. Dubl-Snap bottles and caps are manufactured by Albert Mojonnier, Inc. (AMI).

Every Dubl-Snap cap fits securely to ensure product quality. This tight fit is made possible by AMI's injection blow molding process, which produces a bottle with a strong, uniform neck finish superior to those produced by other processes. Bottle necks are molded to very close tolerances without any trim or scrap. The result is a seal that's tight and secure enough to make the Dubl-Snap bottle suitable for such demanding applications as vending machines, where bottles are typically stored on their sides and dropped several inches when they are dispensed.

For consumer appeal and brand identification, AMI Dubl-Snap caps can be manufactured in any customer-specified color. The HDPE bottles are translucent, so consumers "see what they're getting."

Handling AMI Dubl-Snap bottles is simple and economical. Capping may be done automatically or, for low-volume applications, by hand. No heat or adhesives are required. The bottoms and tops are flat and parallel to ride smoothly on conveyors and seat cleanly with capping equipment. And AMI's exclusive tray-pack cuts shipping costs. More than 215,000 bottles can be shipped in a 45-foot trailer (vs. 160,000 with conventional bulk packing), ready to be fed into fillers without sorting.

Free samples of Dubl-Snap and all AMI bottles and caps are available on request. For more information, contact: Albert Mojonnier, Inc., 1100 North & North Hartford street, P.O. Box 188, Eaton, Indiana 47338, 317-396-3351.

Food Irradiation

A new technique of preserving food by irradiation could offer substantial benefits to consumers, according to a report released today by the American Council on Science and Health (ACSH).

Irradiation involves the use of gamma rays, X-rays, or high velocity electrons to treat foods. This process does *not* make the food radioactive.

Irradiation can be used to destroy microorganisms that spoil food, providing high-quality products with an extended shelf life. The process can also be used to inhibit sprouting of potatoes and onions, delay fruit ripening, kill insects that infest grains, and produce sterile foods for special purposes.

The safety of food irradiation has been extensively tested, and no health hazards have been found. The Food and Drug Administration (FDA) recently took the first steps toward the approval of a substantial number of applications of food irradiation in the U.S.

"If irradiation comes into use in the U.S., it will benefit consumers by providing a wider choice of high-quality food products," said ACSH Executive Director Dr. Elizabeth M. Whelan. "Irradiated foods are often superior in taste and texture to conventional alternatives, and irradiation processes sometimes use less energy than other methods. Internationally, the use of irradiaiton to

destroy insects on stored food could be of tremendous value, since insects destroy a substantional portion of the world food supply."

"Some people are wary at first about the idea of irradiated food," said ACSH Associate Director Dr. Richard Greenberg."The process is unfamiliar, and anything involving radiation has negative connotations for some people. But there is no radiation hazard from irradiated food. Radiation *itself* can be harmful, but objects that have been exposed to it (such as food products) are not dangerous. Similarly, while X-rays themselves must be handled with caution, there is no radiation hazard from the X-ray *table* in a doctor's office, even though the table may have been exposed to X-rays thousands of times."

"Once information about irradiated foods is readily available," Dr. Greenberg continued, "we think that American consumers will accept food products processed in this new way."

The American Council on Science and Health is an independent, nonprofit educational association promoting scientifically balanced evaluations of food, chemicals, the environment, and human health. ACSH has offices in New York, New Jersey, and Washington, D.C.

Copies of the report *Irradiated Foods* are available from ACSH, 47 Maple St., Summitt, NJ 07901.

Dean Foods Acquires Pet Inc.'s Powdered Products Plant

Dean Foods Company announced that it has reached an agreement with Pet Incorporated to acquire its Wayland, Michigan powdered products plant along with inventories related to certain lines of business. Dean would also acquire the manufacturing rights to certain powdered products currently being manufactured and sold by Pet.

Dean is a leading manufacturer of non-dairy coffee creamers and would expect to fully utilize the production capacity of this facility as a result of sales growth achieved in 1982. An experienced work force is available and will be utilized. Dean has two other powdered products plants in Rockford and Pecatonica, Illinois, both of which are operating in excess of normal capacity.

Dean is a diversified food processor and distributor producing a full line of dairy and other food products including ice cream and frozen novelties, aged cheddar cheeses, specialty foods such as dips, pickles, relishes, salad dressings and cranberries, powdered coffee creamers and aseptic products for the institutional business.

Casein and Whey

U.S. Department of Agriculture scientists have discovered a way to ensure the nutritional integrity of ice cream, nonfat dry milk, and other dairy products.

For years, researchers have wanted to distinguish between casein and whey when added to processed dairy products. But identifying these two important protein sources in processed dairy products seemed out of reach until Research Food Technologist Frederic W. Douglas Jr. and other researchers at the USDA Eastern Regional Research Center tackled the problem at the Food and Drug Administration's request.

Casein and whey are basic constituents of milk. Casein is the part made into cheese and other products when coagulated by rennet, natural souring, or bacterial "starter" culture. Whey is the watery by-product of cheesemaking. Until researchers from ERRC and other laboratories a decade ago found methods for drying whey, billions of gallons had to be thrown away each year creating a pollution problem. Now, dried whey is an important natural food source.

That, ironically, is the hitch. whey is plentiful and inexpensive, and easily supplements milk-derived casein in frozen dairy desserts. Using *some* whey in desserts is just fine, says the FDA. But past a point, ice cream is no longer considered ice "cream." Consumers lose some of the valuable ribolfavin, calcium, and protein that milk contains. And the dairy industry suffers.

Trouble is, whey and casein proteins form an inseparable complex molecule when heated in processed dairy products. How, then, to tell them apart?

ERRC Agricultural Research Service scientist Douglas and visiting researcher Joseph Tobias of the University of Illinois recently solved this problem. After several unsuccessful attempts to break the complex, Douglas and Tobias tried a new approach. Casein, they realized, is unique among milk proteins because it contains phosphorus. If casein's phosphorus content could be measured, the amount of casein present in a frozen dessert could be calculated. Subtracting this from a sample's total protein content would reveal how much whey a dairy product contained, they concluded.

Using a variety of analytical techniques, Douglas and Tobias discovered an inexpensive and easily used method of determining whey. Reporting in the Vol. 65, No. 3 issue of the *Journal of Dairy Science,* they note that the new procedure is an extension of another standard analysis of ice cream--the "Mojonnier" test for the fat content of ice cream. The fat-free watery residue from the Mojonnier test was found to be an excellent starting sample for protein determination, said Douglas. The two tests can be combined into five basic steps of fat extraction, protein precipitation, total protein determination, phosphorus determination, and calculation of casein, he added.

Groups including the Wisconsin Department of Agriculture, Trade, and Consumer Protection are interested in the Agricultural Research Service process. The U.S. Food and Drug Administration has stated the test will make new ice cream quality standards enforceable. And Douglas believes the test can be applied to a variety of dairy products.

"Having this quality control of frozen desserts and other milk products will benefit consumers," he said. "And ice cream manufacturers need no longer worry that a few competitiors may be undercutting their prices by adulterating products."

Coca-Cola USA Named "Supplier of the Year"

The Multi Unit Food Service Operators (MUFSO) Conference recently named Coca-Cola USA as "Supplier of the Year."

Coca-Cola USA was chosen by conference delegates from a list of 62 food and drink suppliers. Voters based their decision on product quality, customer service, reliability and merchandising support.

"We are extremely honored to be acknowledged in this manner by our peers," notes Herb Arnold, senior vice president and general manager, Fountain Sales. "Coca-Cola USA is indebted to the network of bottlers and wholesalers who are so much a part of our success."

More than 500 industry representatives participated in the audience poll while attending the 23rd annual MUFSO gathering sponsored by *Nation's Restaurant News*.

MUFSO originated the "Supplier of the Year" award in 1981. Votes are tabulated in two categories, non-food and food and drink. Sharing the spotlight with Coca-Cola USA this year is Hobart, Inc., manufacturer of food preparation and storage equipment.

"A soaring economy during the '70s may have masked our mistakes," say Haas. "There is no room for error today. Food service operators need to be smarter and better than ever before. So innovative, dependable suppliers like Coca-Cola USA are truly an asset to our industry."

American Association of Cereal Chemists Meeting Highlights

The American Association of Cereal Chemists held one of its most successful annual meetings in recent years when it met October 24-28 in San Antonio, Texas.

Meeting attendance was high with 1,356 cereal science professionals participating in the 3½ day meeting. The excellent attendance is attributed to the outstanding technical program and good location--a demonstration that members of the association and other food science professionals value the informational content of this convention even in poor economic times.

The meeting began with an opening breakfast and keynote address by Dr. Sanford A. Miller, currently director of the Bureau of Foods of the Food and Drug Administration on leave from his position as professor of nutritional biochemistry at the Massachusetts Institute of Technology. He reviewed the history of food safety legislation and discussed the difficulties of administering the "Delaney Amendment" in view of the chemist's increasing ability to analyze smaller and smaller quantities.

Other meeting highlights included symposia and technical sessions, new products and services sessions, poster sessions, table top exhibits, committee meetings and social events. Three books based on symposia at the meeting will be published by AACC sometime in 1983. They include Genetic Engineering, Frontiers in Food Microstructure, and New Approaches to Insect Control. In addition to these publications, two sessions, Food Allergies and Experimental Baking, were videotaped and will be available for sale at a later date. A complete proceedings will not be published, although most presentations will appear throughout the coming year in issues of CEREAL FOODS WORLD or CEREAL CHEMISTRY®.

The 68th Annual Meeting will take place October 30-November 3, 1983 at the Hyatt Regency and Crown Center Hotels, Kansas City, Missouri.

The American Association of Cereal Chemists is a scientific society of more than 3000 members internationally. It was founded in 1915 to establish standardized methods of analysis in cereal laboratories and to encourage research within the cereal processing industries.

Aseptic Processing

A packaging procedure called "aseptic processing" now allows consumers to store perishable products for months without refrigeration, reminds Beverly A. Rhoades, consumer information specialist with the Texas Agricultural Extension Service, Texas A&M University System.

This permits families to use items such as milk, fruit juices and similar perishable liquids in throw-away cartons for lunches, camping trips and other purposes without energy-consuming refrigeration, she emphasizes.

"Aseptic packaging is not new--it's been used in more than 50 other countries for over a decade--but it's just recently been approved by the federal government for use in the United States," Rhoades says.

The process involves aseptic liquids being sterilized and stored in bacteria-free protective containers, generally made of paperboard and plastic or polyethylene. Liquids are heated to ultra-high temperatures for a short time to destroy the bacteria which normally cause milk and juices to spoil quickly.

The sterile liquid moves under non-refrigerated but bacteria-free conditions to the package and is sealed. Then it can be transported to grocery shelves for display without refrigeration.

"When you purchase these produces, you may store the liquids at home as shelf-stable foods at room temperatures," Rhoades says.

It's best to compare prices of these produces with their traditionally packaged counterparts, she suggests.

Aseptic liquids may be less expensive than similar refrigerated products in other containers because of high speed packaging and reduced energy consumption through elimination of refrigerated processing, transportation and storage. In some cases, however, aseptic products may cost more.

"When aseptic liquids are more economical, they're an excellent buy. You save both money and energy. If they cost more, you have to decide if the storage convenience and extended shelf life is worth the extra cost," Rhoades says.

Food Service Industry Hiring Practices

Hiring practices in the food service industry lag behind most of U.S. business, according to a survey by the New York executive search firm Thorndike Deland Associates. Two key findings in the survey of 20 food service companies: the majority of companies fill fewer than ten percent of their management positions through external recruitment and the method most commonly cited for such hiring was newspaper advertising, followed closely by word of mouth.

"Our survey of hiring practices in the food service industry, the first of its kind, confirms what most search and personnel professionals know -- that the industry is behind the times with respect to its recruitment policies," says Howard Bratches, a partner in the Thorndike Deland firm. "For most large American companies, for example, it is highly unusual to rely on newspaper ads to fill top management positions. In practice, it is actually a very passive way to recruit, and invariably the job is filled quite close to home, which tends to make the food service industry somewhat inbred," he explained.

Among the survey's other findings:

- -- External hiring in the industry held constant in 1981 over 1980 for three out of four of the companies polled.
- -- The last cited means of external recruitment, used by only three of the 20 companies surveyed, was executive search.
- -- Two out of three food service companies offer a 10-20 percent increase over base salary when hiring externally. Only two of the 20 companies polled offer an increase in the 20-30 percent range, which is considered a norm for most of U.S. industry. Four companies indicated they offer increases of under ten percent.
- -- Asked to indicate which management categories will be important to their organizations in the '80s, most cited operations, followed closely by both human resources and marketing.
- -- The responding companies offer the following relocation benefits: movement of household goods (100 percent); house hunting trips (90 percent); financial assistance such as bridge loans (70 percent); interim living payments (70 percent); purchase of home (20 percent).
- -- For all but one company, managers in the $40 - 55,000 salary range qualified for such benefits.
- -- Among compensation items used to supplement base salary: cash bonus based on company performance (35 percent); cash bonus based on individual performance (25 percent); cash bonus based on both company and individual performance (65 percent); stock options (40 percent); stock grants (10 percent); deferred compensation (20 percent); low interest loans (5 percent); automobiles (65 percent).

Nine of the 20 companies polled are in the fast-food segment of the industry, and their hiring policies tend to be more sophisticated than the other segments, noted Bratches. "Not only are fast-food companies more open to external recruitment," explained Bratches, "but they are also generally known to have superior management training programs." By comparison the remainder of the industry seems wary of fresh ideas and outside talent according to Bratches: "The dinnerhouse, restaurant, coffee shop, cafeteria and food service management companies prefer to hire from within, and failing that, to hire from a competitor in the same industry segment. Sometimes, but not frequently, they will bring in a manager from another segment, as in the case where a restaurant executive moves over to fast-food, or vice versa. But it's seldom that they would hire from outside food service all together.

Bratches explained that going outside the company or industry should not be an end in itself, but that the needs of the 80s should be moving food service companies in this direction: "Food service organizations could benefit enormously if they were to recruit some of the top talent in consumer marketing, people highly

trained in the disciplines of national and regional marketing. These companies should be moving fast to upgrade their financial analysis and M.I.S. capabilities, especially at a time when planning and cost containment have become so crucial."

International Food and Drink Exhibition

The International Food and Drink Exhibition (IFE) will be held at London's Olympia, February 28 to March 4, 1983. Beginning in 1979 with 487 exhibitors, IFE attracted 620 exhibitors in 1980; in 1983 more than 900 displays will occupy 126,000 square feet of space. The specialized trade show drew 23,000 visitors in 1981; 9% of these came from overseas.

The US and Canada are among the 25 countries who will show wares this year. The British presence is spearheaded by the British Farm Produce Council (with more than 17,000 square feet); it will embrace all the Milk Marketing Boards, the Meat Promotion Executive, the Eggs Authority, the English Country Cheese Council and the Central Council for Agricultural and Horticultural Cooperation.

The Delicatessen and Fine Food Association are again actively supporting the show. For the first time, the British Frozen Food Federation is sponsoring "Frozen Foods at IFE '83" which will occupy the whole National Hall Gallery. Reportedly, this will create the largest assembly of frozen foods producers, importers and wholesalers ever seen under one roof at one time.

Product categories will include: bakery, dairy and milk, delicatessen and fine foods, dehydrated foods, fats and oils, fish, flour and flour products, frozen foods, fruit and vegetables, infant and invalid foods, diabetic foods, rice, pasta, cereal and grains, spices and condiments, sugar, chocolate and confectionery, vinegar products, alcoholic and non-alcoholic beverages and pet foods, gift foods and soya bean products.

A 300-page catalog is available for visitors; a manual, sales and promotional ads and an exhibition inquiry card system will be available.

For further information contact the organizer: Interbuild Exhibitions Limited, 11 Manchester Square, London W1M 5AB England. Telephone (01) 486-1951. Telex: 24591. Cables: Montbuild London W1M 5AB.

AMHIC Meeting Highlights

The 26th annual meeting of the Automatic Merchandising Health-Industry Council, AMHIC, was held in New Orleans on October 8, 1982 in conjunction with the annual Convention/Exhibit of the National Automatic Merchandising Association.

Karl L. Jones has represented charter member IAMFES on the Council since 1960. The Council agenda dealt largely with water vending machine function and standards. Copies of the meeting minutes are available from N A M A, 7 South Dearborn, Chicago, Illinois 60603.

Beef Grade Standards

Future needs for beef grade standards will be discussed at a roundtable program hosted by the U.S. Department of Agriculture on Jan. 18 and 19 in Arlington, Va.

Vern F. Highley, administrator of USDA's Agricultural Marketing Service, said the program will bring together for informal discussion major organizations representing all segments of the beef industry and consumers. The Agricultural Marketing Service administers the beef grading program.

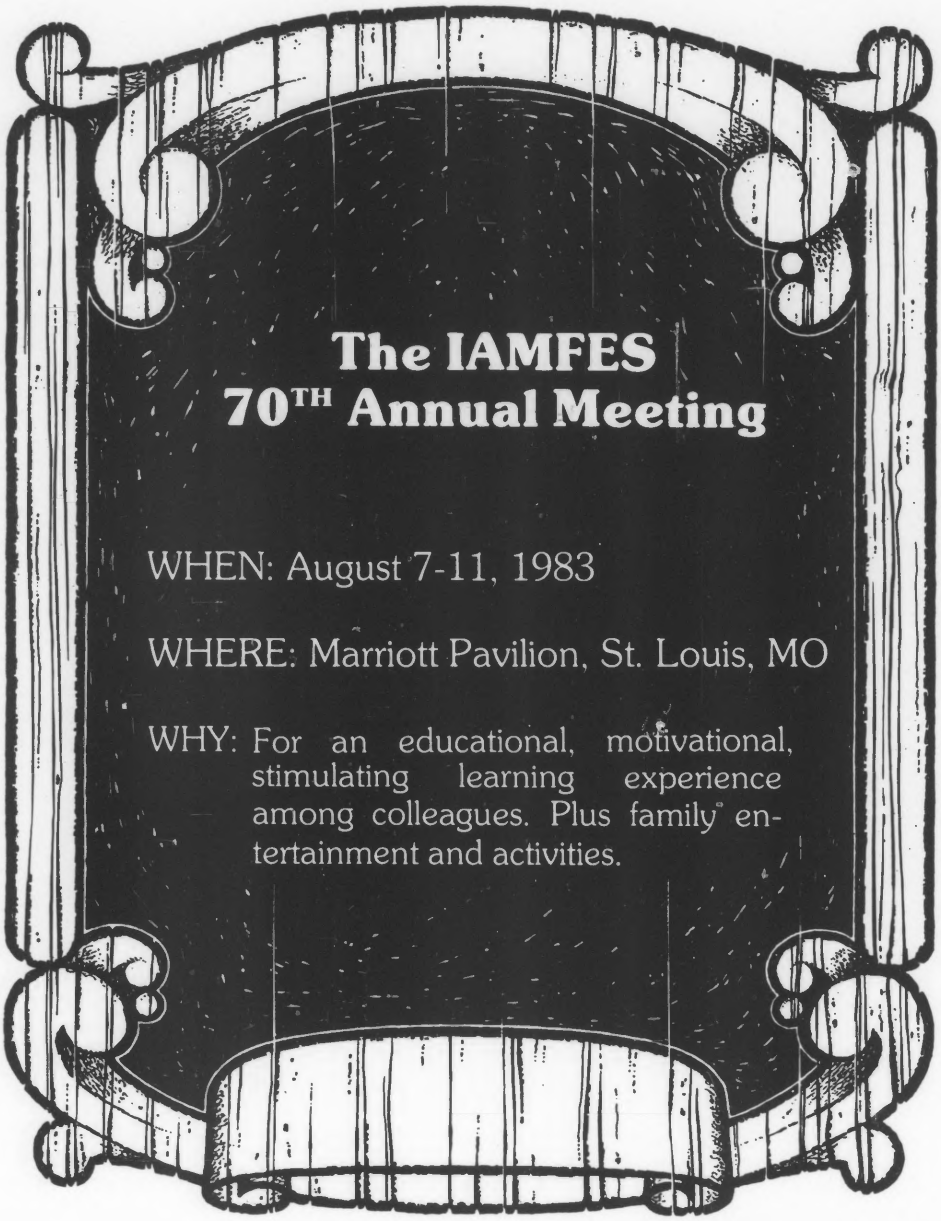
"We feel that this informal discussion is desirable," he said, "because of the wide divergence of views expressed on USDA's 1981 proposal to change official beef grade standards. An open and continuing dialogue between USDA and those public groups affected by beef grades should help us to maintain a dynamic beef grading system acceptable to all."

USDA proposed a change in official grade standards for beef in December 1981. In September, based on findings from hearings and analysis of written comments, USDA withdrew the proposal.

The beef grades roundtable will be held at the Twin Bridges Marriott, U.S.#1 and I-395, Arlington, Va. Sessions are open to the public and will begin each day at 9 a.m.

For further information, contact USDA, AMS, Room 2-M, 14th and Independence Ave. S.W., Washington, D.C. 20250; 202-447-4727.

Announcing...



Details and a registration form will appear beginning with the February journals!

Dairy Quality

Reprinted from Capsule Laboratories Newsletter, Dairy Quality Update

MONITORING POST-PASTEURIZATION CONTAMINATION

The production of high quality milk is influenced by several factors including raw milk quality, processing procedures, temperature control, post-pasteurization contamination, and other factors. The *microbiological* quality of processed milk is highly influenced by the level of post-pasteurization contamination. Contamination by psychrotrophic bacteria after pasteurization and subsequent growth of these organisms can reduce shelf-life by causing off-flavors and physical defects. The (five-day) Moseley keeping quality test has been developed to indicate the growth of psychrotrophic bacteria and estimated keeping quality. However, identification of the source of psychrotrophic bacteria cannot be done with the Moseley test alone. Therefore, Elliker et al (1) and later Sing et al (4) have introduced line sampling as a method of identifying sources of post-pasteurization contamination.

Post-pasteurization contamination can occur by several sources including ineffective cleaning and sanitizing, cracks and pinholes in storage tanks, malfunctioning valves, cracks in gaskets, cracks and scratches in tanks and pipelines, condensation from fillers, environmental contaminants, and other sources. These possible sources of contamination can be identified with properly conducted line sampling procedures that should include. . .1) aseptic sample collection, 2) proper incubation and storage of sample, 3) proper sampling locations, and 4) sufficient sample volume.

A sample device which will allow aseptic collection of a sample is necessary. Contamination of the line sample will give false data and compound the problems that the dairy is experiencing. The area around the sampling device should be sanitized with either a 200 ppm sodium hypochlorite solution, alcohol, or a 25 ppm iodophor spray. The sample must be collected with a sterile syringe or comparable device.

The following illustration can be used as a guide for proper location of sampling devices: HTST————> into storage tanks————> out of storage tanks————> line sample at the filler————> packaged products.

An increase in count greater than 10,000 (after 5 days at 45°F) would indicate post-pasteurization contamination occurring at that location. For example, if a count of 25,000 was obtained on the sample taken at the HTST, one could speculate a faulty operating HTST; possibly a crack in a plate. If counts going into the storage tanks were considerably less than 10,000 and the counts obtained from the storage tanks were continuously greater than 50,000, one might speculate that the storage tank was contributing to the post-pasteurization contamination problem. Possibly, there was a crack in the tank or the tank was not being effectively cleaned and sanitized. As another example, if the counts obtained from the HTST, into the storage tank, and out of the storage tank were continuously less than 10,000; however, the counts obtained by the line sampler at the filler were continuously greater than 50,000, one could speculate that the line and/or valves were not being effectively cleaned or that there was a malfunctioning valve (if mechanical or air valves were in line).

An equally important aspect of proper line sampling is sufficient sample volume collection. Contamination levels as low as one bacteria cell per 100 mls cause off-flavors and high counts in as little as five days. For example, consider the following illustration . . . A contaminant enters the milk at a level of one bacteria cell per 100 mls. If the contaminant doubles every 3.5 hours at 45°F (as some bacteria do) (3), the count in five days could be as high as 210,000,000. It is necessary, therefore, to obtain a large volume of sample to be able to collect the *one* organism that may be causing the problem. A volume of 50-200 mls is suggested. The importance of proper sample volume is also pointed out by Marshall and Appel (2).

A word of caution. . .when comparing line samples to packaged product samples, keep in mind that there is a volume difference. Even if volumes of line samples are 50-100 mls, it is considerably less than what is in a packaged product. Therefore, it is reasonable to expect a higher percentage of high counts from packaged products than from line samples. This phenomenon is one of the reasons that many people feel that the fillers are the main source of post-pasteurization contamination. However, post-pasteurization contamination may be occurring prior to the filler but is not being detected because of this difference in volume of samples.

In summary, the key factors influencing the development of spoilage organisms in pasteurized milk are the contamination level and the growth rate (i.e. speed of doubling). Therefore, when conducting line sampling procedures, it is necessary to collect sufficient volume and incubate the sample at times and temperatures which will stimulate consumer use (45°F for five to seven days). Equally important in proper line sampling procedures are aseptic sample collection and proper sampling location.

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THE SIGNIFICANCE OF THE STANDARD PLATE COUNT, COLIFORM COUNT, AND MOSELEY COUNT IN DETERMINING PASTEURIZED MILK MICROBIOLOGICAL QUALITY

We define milk quality as "a product with a clean, fresh taste, pleasant bouquet, free of physical defects, and with an extended shelf-life of 21 days or more". In subsequent issues we discussed some of the factors which influence production of quality Grade A pasteurized milk products. While controlling the factors that contribute to milk quality is extremely important, determining the quality of milk that is produced is equally important. One of the key factors in determining milk quality is defining the microbiological quality of the fresh product. Presently there are three standard tests used to determine the microbiological quality of fresh Grade A milk:

1. The Standard Plate count (SPC)
2. The Coliform Count (CC)
3. The Moseley Keeping Quality Test

In addition, there are several experimental tests that many dairies are using to determine the microbiological quality of the product.

Grade A pasteurized milk is unique in that it is one of the few foods having federally controlled microbiological standards. These standards (20,000 per ml for the Standard Plate Count, and limits not to exceed 10 per ml for the Coliform Count) are published in the grade "A" Pasteurized Milk Ordinance (3). However, these microbiological standards are important from a public health standpoint, but *do not* reflect the microbiological quality of freshly pasteurized milk products with respect to keeping quality. The intent of this monthly newsletter, therefore, is to point out the most effective method of determining pasteurized milk keeping quality.

In order to fully appreciate the significance of the test used to determine microbiological quality of pasteurized milk, we should first review pasteurized milk microorganisms. The microflora of pasteurized milk includes: gram positive rods (both spore formers and nonspore formers), gram positive cocci, and gram negative rods. These organisms contribute to a total bacteria count of milk products (SPC). In fresh products, the vast majority for these organisms are present because they survive pasteurization (thermoduric bacteria). For the most part, these organisms are of little significance because they do not grow at refrigeration temperatures. The bacteria that affect quality will grow at refrigeration temperatures (psychrotrophic) causing off-flavors and physical defects with time. The intent of any test designed to determine microbiological quality of pasteurized milk should be to detect the organisms that will grow at refrigeration temperatures, and; therefore, influence or affect shelf-life. As pointed out, psychrotrophic bacteria have two sources. These are: (1) post-pasteurization contamination, and (2) those capable of surviving pasteurization and growing at refrigeration temperature.

These organisms may be present in pasteurized milk at extremely low populations (e.g. one bacteria cell per 100 mls of milk). Therefore, the test to determine the microbiological quality of pasteurized milk must be able not only to determine organisms that will grow at refrigeration temperatures, but determine organisms at very low populations.

The Standard Plate count is defined by Standard Methods for the Examination of Dairy Products (Standard Methods) (1) as a test used to enumerate the viable organisms in dairy products. Therefore, this test attempts to determine the quantity of all microorganisms present in milk regardless of their minimum and optimum growth temperature. Unless the count on freshly pasteurized milk is greater than 20,000 per ml, the SPC is of little benefit in determining keeping quality.

Coliform tests were originally developed to indicate the possibility of fecal contamination of products; a test which would have great public health significance at the time it was developed. Currently, this test is routinely used to monitor the sanitation practices within a plant, particularly as they relate to post-pasteurization contamination (coliform organisms are quite heat sensitive and will *not* survive pasteurization). Recent research (2) has shown that a great deal of controversy exists over the value of this test in determining potential keeping quality of dairy products. The coliform group is quite a selective group of bacteria; consequently, it's absence from pasteurized milk does not rule out post-pasteurization contamination by spoilage organisms. Generally, if coliforms are *present*, there is a very good possibility that spoilage organisms will also be present. If coliforms are not found, however, there is still a possibility that spoilage organisms may be in the product.

According to Standard Methods, the procedure for performing the Moseley Count is "after making a Standard Plate Count, store containers of freshly processed milk or cream in a refrigerator at 7C (44.6F) for five days, then replate. Large increases in bacteria count during storage suggests that keeping quality problems can be expected during refrigerated storage".

While the Moseley Count has a disadvantage in that at least 7 days are required to obtain results, it is undoubtedly much more effective than the Standard Plate Count and the Coliform Count in determining pasteurized milk quality. There are two reasons primarily responsible for this phenomenum. These are: (1) a 45F incubation temperature is selective for organisms that will grow at refrigerator temperatures, and (2) the 5-day incubation time will allow post-pasteurization contaminants that may be present at rel-

atively low populations to increase to populations large enough to be enumerated by SPC methods.

The results of these tests must be continually reviewed to observe trends that may be developed in bacteria counts and keeping quality, and should be used to continually monitor sanitation and product keeping quality. If used properly, the Moseley tests can be a significant tool in producing high quality fluid milk products.

Capsule Laboratories is suggesting that dairies continue to do Standard Plate Counts and Coliform Counts on fresh processed products to insure that they are within the established standards. However, to determine keeping quality of processed milk, a method that will determine the number of organisms capable of growth at temperatures of less than 45F and determine low levels of post-pasteurization contamination is needed. The Moseley Keeping Quality Test or a similar test will fulfill these requirements.

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(1) American Public Health Association. 1972. Standard Methods for the Examination of Dairy Products, 13th Edition.

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THE MOSELEY KEEPING QUALITY TEST

The Moseley Keeping Quality Test was originated several years ago by W. K. Moseley of Indianapolis, Indiana. Use of the test has since been promoted by many dairy scientists, including Sing et al (5) and Elliker et al (2). According to Standard Methods (1), the procedure for performing the Moseley Count is "after making a Standard Plate count, store containers of freshly processed milk or cream in a refrigerator at 7°C (44.6°F) for five days, then replate. Large increases in bacteria count during storage suggest that keeping quality problems can be expected during refrigerated storage".

The Moseley Keeping Quality Test was a much better indicator of pasteurized milk keeping quality than the Standard Plate Count or the Coliform Count. The Moseley Keeping Quality Test, however, does not in itself determine the overall keeping quality of milk products. Overall quality is influenced by several factors including raw milk quality, processing and distribution temperatures, freedom from foreign materials, microbiological contamination, and many other factors. There is no single test which determines the overall quality of pasteurized milk; however, a combination of taste testing and microbiological tests including the Moseley Test, are good indicators of overall quality. The intent this month is to point out application and suggested guidelines of the five or seven day Moseley Keeping Quality Test, and to illustrate that this test is the only practical and reliable means to indicate microbiological quality.

The factor that has the most influence on the keeping quality of pasteurized milk is the growth of psychrotrophic bacteria (see Volume 1, Number 1). The growth of psychrotrophic bacteria can cause several off-flavors and many physical defects that have been mentioned previously (4). It is important, therefore, to determine if psychrotrophic bacteria are present in pasteurized milk and to what level they can grow in five or seven days, and what effect they might have by the end of product code. As will be pointed out later, psychrotrophic bacteria can grow to extremely high populations in as little as five or seven days at very small levels of initial post-pasteurization contamination. The intent of any microbiological test used to determine the keeping quality must be concerned with the level of post-pasteurization contamination, the rate of growth of the contaminating organism, or a combination of the two.

Of the two factors that influence the degree of microbiological breakdown of pasteurized milk products (level of contamination in growth rate or generation time of the organisms), generation time would certainly be the most important. This point is shown in Table 1:

As Table 1 points out, those organisms with a generation time of 5-8 hours (common post-pasteurization contaminants) are capable of growth to levels where off-flavors are formed even though they begin at very *low levels of contamination*. Most of these organisms are gram-negative, post-pasteurization contaminants that are very heat susceptible and usually will not survive pasteurization temperatures. Significant increases in count from fresh Standard Plate Counts to five or seven day Moseley Counts would indicate post-pasteurization and contributing to the Standard Plate count without having a significant effect on keeping quality. These generalizations can be verified by

TABLE 1. CONTAMINATION LEVEL VS. 7-DAY COUNTS AT VARIOUS DOUBLING RATES.

Contamination Level (Cells) per 100 mls	7-Day Counts/Doubling Time (Hrs.)			
	5.0 Hours	8.0 Hours	15.0 Hours	20.0 Hours
1	13,000,000	50,000	12	<1
10	1.3×10^9	500,000	120	13
100	1.3×10^{10}	5,000,000	1,200	130
1,000	1.3×10^{11}	50,000,000	12,000	1,300
10,000	1.3×10^{12}	500,000,000	120,000	13,000

(Population estimates by calculation. See Nickerson & Sinskey (3).)

microscopic examination of colonies where gram-negative organisms and gram-positive organisms can be easily differentiated.

While there are no hard and fast rules or published guidelines as to the Moseley Count and its relationship to keeping quality, Table 2 below has been used successfully as a guideline:

In summary, the five or seven day Moseley Keeping Quality Test is the most effective method of determining the microbiological quality of pasteurized milk products and monitoring on a routine basis. It cannot be over-emphasized that when quality problems arise in a plant, it is too late to begin testing of this type to pinpoint sources of contamination. Tests such as this must be conducted routinely so that developing trends and decreasing quality can be monitored. Maintaining careful records of tests of this type and comparing them with taste testing is the most effective means of successfully assuring continued keeping quality of pasteurized milk products.

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TABLE 2

5-Day Moseley Count	Level of Post-Pasteurization Contamination
Less than 2,000	Low or no post-pasteurization contamination, no significant thermoduric contaminants, and expected shelf life from a microbiological standpoint of 21 days or more under proper storage conditions.
2,000 - 10,000	Minor post-pasteurization contamination or thermoduric contamination with a shelf life expectance of 14 days.
10,000 - 50,000	Post-pasteurization contamination. Expected shelf life of 9 days or less.
Greater than 50,000	A serious post-pasteurization contamination problem with shelf life of less than 7 days.

NOTE: Keep in mind that these should only be considered as general guidelines to levels of post-pasteurization contamination.

THE MERITS OF FLAVOR ANALYSIS OF MILK IN A DAIRY QUALITY CONTROL PROGRAM

The ultimate judge of the quality of fluid milk is the consumer. The consumer's primary concern is the flavor of the product. Often times dairies place all emphasis of their quality control program on microbiological aspects of quality control. While the homemaker expects the product to be safe from a public health standpoint, she has little or no concern for the microbiological content of the product. The housewife does not have the interest or the capabilities of doing plate counts in her kitchen, however, she is continually flavoring products and makes her judgement on acceptance or nonacceptance of the product based on it's flavor. Therefore, the intent of this is to discuss objectives and procedures for taste-testing milk in a dairy's quality control program.

Capsule Laboratories would point out that the development of an effective dairy quality control program must include a series of three types of tests: (1) flavor analysis, organoleptic testing (taste-testing), (2) microbiological testing with emphasis on 5 or 7-day Moseley keeping quality tests, (3) chemical testing which may be used to a lesser extent.

The occurrence of off-flavors in milk can be caused by several factors. A review paper by Shipe, et. al (6) describes the causes of off-flavors in milk and the descriptive or associated terms connected with these causes. The most effective way of detecting these off-flavors is to conduct flavor analysis (taste-testing) on the product.

The occurrence of weed, feed, cooked, and other non-microbial induced off-flavors as well as microbial induced off-flavors can be found in products throughout the marketplace. Work conducted by Sid Barnard, Pennsylvania State University (1), Lester Hankin and co-workers from the Connecticut Agricultural Experimental Station (4,5) as well as other workers have found that between 40 and 50% of milk available at the retail level has at least some degree of flavor defects. Therefore, with the high occurrence of milk at the retail level with flavor defects, it appears that much of the dairy industry is lacking in effective flavor analysis procedures in their dairy quality control program.

Procedures for flavor analysis -- Each dairy should have two or more people that are adequately trained in flavor analysis. Several of the States' Dairy or University Exten-

sion Services offer courses in sensory evaluation of milk. A course such as this is essential for those responsible to a dairy's quality control program. If these courses are not available, procedures outlined by Shipe, et. al (6) can be used to simulate off-flavors.

Two aspects of flavor analysis should be considered: (1) sensory evaluation through noting the aroma or bouquet of milk and detection of volatiles that would be responsible for off-flavors, and (2) taste-testing of pasteurized milk.

Sensory evaluation of raw milk is essential. All farm bulk tank loads should be sensory evaluated by observing the bouquet and aromas from the headspace of the bulk tank. If there is any question with the aroma or the bouquet, the sample may be taste-tested. This can be conducted by warming of the sample to 80 or 90F, observing the bouquet, placing the sample in the mouth, and then discarding the sample.

There may be some public health concerns for taste-testing raw milk, however, many people are presently doing this with little or no health risks. However, if one does not wish to taste-test the milk, Floyd Bodyfelt from Oregon State University (2) suggests an alternative method: "Lab pasteurize the samples at 155°F for 10 minutes, then cool at 60-70°F or 80-90°F before checking the flavor".

When receiving loads at the dairy, both bouquet and flavor should be evaluated. This may be conducted in the same manner as the bulk tank load samples on the farm. If raw milk is held at the dairy for more than 24 hours, the raw product should again be sensory evaluated.

A sample of each day's production should be taste-tested on the day of production. Recommended procedures for further taste-testing of pasteurized milk also include taste-testing at 7 days and at the end of code. Taste-testing can also be a key to indicating the causes of off-flavor development. Pasteurized milk should be warmed to 80F before taste-testing.

In summary, taste-testing and/or the sensory evaluation is an essential part of a dairy's quality control program. It not only reflects the quality of the product produced, but can be a key in detecting the source of the flavor defect.

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CONTROLLING RANCID OR LIPOLYZED OFF-FLAVORS IN MILK

The occurrence of off-flavors in milk in the marketplace is quite high. Causes of off-flavors in raw milk include both microbial and non-microbial causes. These off-flavors have a definite influence on consumer attitudes; consequently, control of these off-flavors should be a primary objective of any dairy quality control program.

Rancid flavor is a term that has been used for quite some time throughout the dairy industry. Lipolyzed flavor (3) is a term gaining in popularity. Both terms are used to describe the same quality defect. Descriptive terms that have been used for this quality defect are goaty, soapy, butyric, and bitter. However, bitter flavors should not be confused with microbial induced bitter off-flavors.

Rancid or lipolyzed off-flavors are caused by enzyme (lipase) breakdown of triglycerides (milkfat). Fat occurs in milk in the form of globules which are surrounded by a membrane. The membrane protects the fat from the action of the lipase enzyme which can hydrolize (split) the triglycerides (milkfat). The short-chained free fatty acids which are formed by the breakdown of the triglycerides are the causes of rancid off-flavors. The lipase enzyme is secreted by the cow and is primarily accountable for this breakdown reaction. Although microbial lipase may also hydrolize the milk triglycerides, for the most part controlling rancid off-flavors in milk is associated with protecting the milkfat from the action of the "naturally occurring" lipase enzyme.

Rancid flavors develop quite quickly once the fat globule membrane is broken (2) allowing the enzyme to attack the milkfat triglycerides. The fat globule membrane can be broken through excess agitation in pumping, homogenizing raw milk, pipeline obstructions, and other abuse conditions.

Spontaneous rancidity or "naturally occurring" lipolyzed flavors can also be a cause of this quality defect. This normally occurs in the later stages of lactation or in milk from infected udders. Another fact influencing the degree of rancidity in milk is the length of storage before processing (2). These factors are summarized in Table 1.

From a practical standpoint, development of naturally induced rancid flavors in the milk will not occur after pasteurization. Pasteurization temperatures, for the most part, inactive the lipase enzyme controlling the rancidity problem. Although commercial pasteurization temperatures will not inactivate all lipases found in milk or all microbial lipases, it is generally accepted that these temperatures will eliminate development of rancid off-flavors due to "naturally occurring" lipases.

The Acid Degree Value (ADV) can be used to measure the extent of rancidity development in milk. A person can usually detect rancid flavors in milk at an ADV of 1.50, however, milk with an acid degree value of 1.2 or greater is usually considered rancid or in the process of becoming rancid (1).

Rancid flavor in milk can also be detected by taste-testing. For testing purposes, this flavor can be developed by mixing raw and homogenized pasteurized milk and allowing to stand for 4 hours. At that time, lab pasteurized and taste-tested.

In summary, rancid or lipolyzed off-flavors are caused by the lipase breakdown of milkfat triglycerides. Some useful hints that may help control this problem are: (1) do not homogenize raw milk, (2) do not mix homogenized pasteurized milk with raw milk, (3) avoid agitation of warm milk, (4) avoid pumping raw milk through obstructed pipelines, (5) avoid improper pasteurization, and (6) avoid milk susceptible to spontaneous rancidity -- do not extend lactation beyond normal length of time, void the use of milk from infected udders, and screen milk from cows producing milk susceptible to spontaneous rancidity.

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TABLE 1. EFFECT OF AGITATION, FOAMING, AND STAGE OF LACTATION ON THE ACTIVATION OF LIPOLYSIS IN MILK.

	Acid Degree of Butterfat from the Sources and After Treatments Indicated			
		Vigorous Agitation		
Time Sample Was Tested	Control (No Agitation or Foam Formation)	No Foam Formation	Slight Foam Formation	Extensive Foam Formation
	(Milk from cow early in lactation)			
Fresh	0.24	-	-	-
Immediately after agitation	-	0.27	0.31	0.59
After 24 hr at 35°F	0.41	0.44	0.60	3.75
	(Milk from cow late in lactation)			
Fresh	0.34	-	-	-
Immediately after agitation	-	0.36	0.41	0.78
After 24 hr at 35°F	0.42	0.51	0.72	7.39

Table taken from Henderson, James Lloyd. 1971. The Fluid Milk Industry (2).

OXIDIZED OFF-FLAVORS

Oxidized off-flavors have been described as papery, cardboard, metallic, oily, fishy, and others. Lipid oxidation (the reaction between molecular oxygen and milk lipids or milk fats) is the mechanism involved in the production of oxidized off-flavors. This reaction is catalized by several factors including copper, iron, rust, excessive chlorine, and both sunlight and artificial light. Traditionally, all oxidized off-flavors caused by the reaction of molecular oxygen and milk lipids have been classified as oxidized off-flavors. However, when off-flavors are classified according to causes (5), a distinction is made between light induced off-flavors and other oxidized off-flavors. This article will discuss oxidized off-flavors that originate from factors other than light induced oxidized off-flavors.

A number of factors are necessary for the development of oxidized off-flavors. The most important is oxygen, however, milk is normally saturated with oxygen and sufficient oxygen is available to develop oxidized off-flavors. Other important factors that must be considered in the development of oxidized off-flavors are the presence of antioxidants and/or the lack of pro-oxidants such as copper, iron, excessive chlorine that catalize an oxidation reaction. Antioxidants such as Vitamin E inhibit the oxidation reaction.

Milk varies considerably to susceptibility of oxidized off-flavor development. Jenness and Patton (4) have classified milk according to susceptibility to oxidized off-flavors as:

Spontaneous -- Those milks that will spontaneously develop off-flavors within 48 hours after milking.

Susceptible -- Those milks that will develop off-flavors within 48 hours after contamination with copper.

Resist -- Those milks which exhibit no oxidized off-flavors when contaminated with copper and stored for 48 hours.

Therefore, milk varies in it's susceptibility or resistance to oxidized off-flavors based primarily on the presence of pro-oxidants and/or the lack of antioxidants such as Vitamin E.

Henderson (3) describes a method for testing the susceptibility of milk to oxidized off-flavors.

> "Measure into 3 pt milk bottles 200-ml portions of each sample to be tested. Mark one bottle (Control), the second (0.25 ppm copper) and the third (0.50 ppm copper). Add the indicated amount of copper (cupric ion in the form of copper sulfate) to bottles 2 and 3. Pasteurize all samples at 143°F for 30 min., cool to

40°F, and store at this temperature. Score for flavor on the second and third days. If milk is susceptible to spontaneous development, the Control sample will have an oxidized flavor. If the sample with 0.5 ppm copper does not develop the flavor in 3 days, the milk is less susceptible and will probably not develop the flavor with the concentration of copper likely to be found in market milk."

This method can be used to screen milk susceptibility to oxidized off-flavors.

A number of precautions can be taken to control the incidences of oxidized off-flavors:

1. Eliminate all copper, white metal, rusty, or stainless steel equipment with iron deposits on milk contact surfaces.
2. Caution producers of the risk of feeding dry stored feeds that are low in natural antioxidants. These feeds will produce milk that is low in antioxidants and; thus, more susceptible to oxidized off-flavors.
3. Avoid the depositing of copper on stainless steel equipment. Equipment in CIP systems containing copper must be eliminated.
4. Give milk sufficient heat in processing (168-170°F).
5. Protect milk from sunlight and artificial light.

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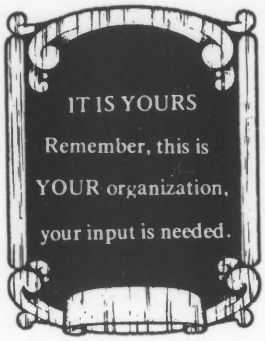
(5) Shipe, W. F. et al. 1978. Off-flavors of milk: Nomenclature, standards, and bibliography. J. Dairy Sci., 61(7):855-869.

CORRECTION:

The following is a correction to an article that ran in the October 1982 issue of Dairy and Food Sanitation - *International Dairy Federation Offers New Documents and Standards* - "Sustaining members receive these documents at no charge. Other members may subscribe for all publications at an annual charge of $75.00. Non-members may order them at the individual prices. Information pertaining to membership in USNAC and orders should be sent to Mr. Harold Wainess, Secretary, USNAC, 464 N. Central Avenue, Northfield, IL 60093."

AFFILIATE NEWSLETTER . . .



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Thanks. . .

Thanks to all book reviewers, article reviewers, authors, and affiliates who have been so helpful in '82. I look forward to your continued support and assistance in '83.

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Oregon Affiliate Meeting Highlights

President Bob Gerding called for the start of the Annual Meeting of the Oregon Association of Milk, Food, and Environmental Sanitarians at Knopp's Golden Pheasant Restaurant, Salem, Oregon on Wednesday, December 1, 1982. The special speaker was Mr. Everett Falk, Junction City, on the topic of "Some Facts About Oregon's Essential (Mint) Oil Industry".

Other news from OAMFES included:

James A. Black was recently named Assistant administrator for the Food and Dairy Division, Oregon Department of Agriculture.

Floyd W. Bodyfelt, Oregon State University Extension Dairy Processing Specialist, received the 1982 Educator Award of the IAMFES at the Annual Meeting in Louisville, Kentucky. The award included a plaque and $1000.00. He was cited for his contributions in dairy sanitation, safety, and product quality.

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Calendar

1983

Jan. 30-Feb. 2---THIRD INTERNATIONAL SWEETENER COLLOQUIUM, The Pointe, Phoenix, AZ. For more information contact: Sugar Users Group, 910 Seventeenth St. NW, Suite 1105, Washington, DC 20006. Phone: 202-296-4250.

Feb. 10-13---ALIMAC '83, Bologna. For more information contact: Senaf, 40127 Bologna Via Michelino, 69.

Feb. 15-16, 1983---FOOD PROCESSORS SANITATION WORKSHOP. Mission De Oro, Santa Nella, CA. For more information contact Paulette De Jong, Food Science and Technology, University of California, Davis, CA 95616, phone 916/752-1478.

Feb. 16-17---DAIRY AND FOOD INDUSTRY CONFERENCE, The Ohio State University. For information contact: John Lindamood, Department of Food Science and Nutrition, 2121 Fyffe Road, The Ohio State University, Columbus, OH 43210.

March 14-16, 1983---SECOND NATIONAL DAIRY HOUSING CONFERENCE, Madison, WI. For more information contact: Cathy Ziegert, Meetings Secretary, ASAE, 2950 Niles Road, St. Joseph, MI 49085, 616 429-0300.

March 20-23, 1983---AMERICAN CULTURED DAIRY PRODUCTS INSTITUTE ANNUAL MEETING AND CONFERENCE/KULTURES AND KURDS KLINIC/NATIONAL JUDGING CONTEST, International Drive Holiday Inn, Orlando, Florida. For further information: C. Bronson Lane, ACDPI, P.O. Box 7813, Orlando, Florida 32854.

March 21-25---MID-WEST WORKSHOP IN MILK AND FOOD SANITATION, The Ohio State University. For information contact: John Lindamood, Department of food Science and Nutrition, 2121 Fyffe Road, The Ohio State University, Columbus, OH 43210.

March 23-24---IOWA ASSOCIATION OF MILK, FOOD AND ENVIRONMENTAL SANITARIANS SPRING MEETING, Starlite Village, Ames, IA. For more information contact: Jack L. Schoop, 602 East 1st St., Des Moines, IA 50307.

March 24, 1983---IOWA ASSOCIATION MILK, FOOD & ENVIRONMENTAL SANITARIANS. Little Amana, Iowa. Contact Bill LaGrange, ISU, Department of Food Technology, Ames, IA 50011.

April 11-13---DAIRY AND FOOD INDUSTRIES SUPPLY ASSOCIATION, 64th ANNUAL MEETING, Boca Raton Hotel and Club, Baco Raton, FL. For more information: Dairy and Food Industries Supply Association, 6245 Executive Blvd., Rockville, MD 20852, 301-984-1444.

April 13-14, 1983---FOOD MICROBIOLOGY UPDATE. Orange County Cooperative Extension Office, Anaheim, CA. Topics covered include sampling, new trends and methods for detection, enumeration, and identification of microorganisms, microbial aspects of food processing methods, pathogens, and the significance of microorganisms in food. Contact Paulette De Jong, Food Science and Technology, University of California, Davis, CA 95616, 916 752-1478.

April 20-22---SOUTH DAKOTA ENVIRONMENTAL HEALTH ASSOC. ANNUAL MEETING. Howard Johnsons, Sioux Falls, SD. For more information contact: Morris V. Forstine, SD State Dept. Health, 1320 S. Minnesota Ave., Room 101, Sioux Falls, SD 57105.

April 20-22, 1983---FOOD MICROSTRUCTURE ANNUAL MEETING in conjunction with Scanning Electron Microscopy 1983. For more information contact: Dr. Om Johari, SEM Inc., P.O. Box 66507, AMF O'Hare (Chicago), IL 60666, 312-529-6677.

April 26---ILLINOIS ASSOCIATION OF MILK, FOOD AND ENVIRONMENTAL SANITARIANS SPRING MEETING. For more information contact: Clem J. Honer, 1 S 760 Kenilworth Ave., Glen Ellyn, IL 60137.

April 27, 1983---SOUTHERN CALIFORNIA FOOD PROCESSORS SANITATION WORKSHOP FOR THE FOOD PROCESSING AND FOOD SERVICE INDUSTRIES. Presented by the University of California Cooperative Extension with assistance from industry trade associations and food industry personnel. Inn at the Park, Anaheim, California. For more information contact: Paulette De Jong, Food Science and Technology, University of California, Davis, CA 95616, 916 752-1478.

May 16-20, 1983---INTERNATIONAL DAIRY FEDERATION SYMPOSIUM, Denmark. For more information contact: Canadian National Committee International Dairy Federation, 549 Sir John Carling Building, Ottawa K1A 0C5 Canada, 613-994-9537.

May 23-25, 1983---TRACE ANALYSIS OF FOODS: Flavor Problems and Contaminants. Univ. of MN, St. Paul, MN. For more information contact: Gary Reineccius, Department of Food Science and Nutrition, University of MN, St. Paul, MN 55108.

July 3-8, 1983---67TH ANNUAL SESSION OF THE INTERNATIONAL DAIRY FEDERATION, Oslo, Norway. For further information, contact Harold Wainess, Secretary U.S. National Committee of the IDF (USNAC), 464 Central Avenue, Northfield, IL 60093, 312-446-2402.

August 7-11, 1983---IAMFES ANNUAL MEETING, St. Louis, MO.

Aug. 7-11, 1983---23rd ANNUAL MEETING, THE HOSPITAL, INSTITUTION, AND EDUCATIONAL FOOD SERVICE SOCIETY. Fairmont Hotel, New Orleans, LA. HIEFSS Expo '83 will be open on August 9 and 10. For more information contact: Carolyn Isch, Assistant Executive Director, HIEFSS, 4410 West Roosevelt Road, Hillside, IL 60162, 312 449-2770.

Aug. 14-19, 1983---5th WORLD CONFERENCE ON ANIMAL PRODUCTION, Nihon Toshi Center, Tokyo, Japan. For more information contact: The 5th WCAP Conference Secretarial, c/o National Institute of Animal Industry, Tsukuba Norindanchi, PO Box 5, Ibaraki 305, Japan.

Sept. 7-9---SYMPOSIUM ON LACTIC ACID BACTERIA IN FOODS: GENETICS, METABOLISM AND APPLICATIONS. Wageningen, The Netherlands. Organized by The Netherlands Society for Microbiology. For more information contact: Dr. P. M. Klapwijk, Unilever Research Laboratory, P. O. Box 114 3130 AC Vlaardingen, The Netherlands.

Sept. 18-23---SIXTH WORLD CONGRESS OF FOOD SCIENCE & TECHNOLOGY, Dublin, Ireland. For more information contact: Sixth World Congress of Food Science and Technology, Congresses & Exhibition Ltd. 44, Northumberland Rd., Dublin, 4, Ireland.

Sept. 20-22---NEW YORK STATE ASSOCIATION OF MILK AND FOOD SANITATION ANNUAL MEETING. Hotel Syracuse, Syracuse, NY. For more information contact: David Bandler, Stocking Hall, Cornell University, Ithaca, NY 14853.

Oct. 22-26---FOOD AND DAIRY EXPO -83, McCormick Place, Chicago, IL. For more information contact: Dairy and Food Industries Supply Association, 6245 Executive Blvd., Rockville, MD 20852, 301-984-1444.

1984

August 3-9, 1984---IAMFES ANNUAL MEETING, Edmonton, Alberta, Canada.

Nov. 22-24, 1984---14th ANNUAL SYMPOSIUM ON THE ANALYTICAL CHEMISTRY OF POLLUTANTS, 3rd International Congress on Analytical Techniques on Environmental Chemistry-Expoquimia, Barcelona Spain. For more information write: Av. Reina Ma. Christina Palacio No. 1, Barcelona-4 Spain.

JFP Abstracts

Abstracts of papers in the January Journal of Food Protection

To receive the Journal of Food Protection in its entirety each month call 515-232-6699, ext. A.

IgA, IgG, IgM and Lactoferrin Contents of Human Milk During Early Lactation and the Effect of Processing and Storage, Sara J. Goldsmith, James S. Dickson, Harold M. Barnhart, Romeo T. Toledo and Ronald R. Eitenmiller, Department of Food Science, University of Georgia, Athens, Georgia 30602

J. Food Prot. 46:4-7

The total IgA, IgG, IgM and lactoferrin concentrations in human milk from 89 donors were studied at three lactational stages: early transitional (3 to 8 d postpartum), transitional (10 to 14 d postpartum) and mature (30 to 47 d postpartum). The effects of processing and storage on these components in composite samples of mature human milk were determined. There were no significant diurnal variations in any of the four protective factors at either the transitional or mature stages. Concentrations of total IgA, IgM and lactoferrin decreased significantly as time postpartum increased, whereas the IgG content showed no significant changes. The total IgA, IgM and lactoferrin levels were significantly decreased by all heat treatments (62.5°C for 30 min, 72°C for 15 s, 88°C for 5 s, and 100°C for 5 min). Heating at 62.5°C for 30 min did not affect the IgG content; however, the other heat treatments significantly reduced IgG concentration. At the times and temperatures selected for this study, the two lower temperature treatments were less detrimental to the protective factors than the higher temperature treatments.

Antitumor Activity of Yogurt Components, C. V. Reddy, B. A. Friend, K. M. Shahani and R. E. Farmer, Department of Food Science and Technology, University of Nebraska, Lincoln, Nebraska 68583-0919

J. Food Prot. 46:8-11

Male swiss mice were implanted with Ehrlich ascites tumor cells and fed ad libitum either yogurt or yogurt components. Ad libitum feeding of yogurt for 7 consecutive days after tumor implantation significantly ($P<0.05$) inhibited cell counts by 24 to 28% and DNA synthesis by 23 to 31%. When milk or 1.5% lactic acid was fed, there was no significant effect. Feeding yogurt for 7 d before implantation, in addition to yogurt feeding for 7 d after implantation, did not increase inhibition. The level of inhibition was decreased, however, when feeding was initiated more than 1 d after tumor implantation. While yogurt effectively inhibited initial tumor growth, continuous feeding from day 1 until death had no significant effect on the survival rate of the mice. Centrifugal separation of yogurt into solids and supernatant fluid fractions revealed that the antitumor activity was localized in the solids fraction; the supernatant fluid possessed no activity. Concentration of the solids fraction did not significantly increase the antitumor activity.

Competitive Growth of Chicken Skin Microflora and *Clostridium botulinum* Type E after an Irradiation Dose of 0.3 Mrad, Ruth Firstenberg-Eden, Durwood B. Rowley and G. Edgar Shattuck, Food Microbiology Group, Science and Advanced Technology Laboratory, U.S. Army Natick Research and Development Laboratories, Natick, Massachusetts 01760

J. Food Prot. 46:12-15

Chicken skins with chicken exudate were used as a model system to determine if low dose irradiation might cause a health hazard by eliminating the natural flora and allowing *Clostridium botulinum* type E spores, if present, to produce toxin in the absence of typical spoilage. Irradiation (0.3 Mrad, 5°C) reduced the natural flora from 10^4 to 10^6 to 10 to 500 cells/7 cm^2, whereas *C. botulinum* type E (Beluga) spores were reduced only by one $\log_{10}$. At 10°C, the irradiation survivors of the natural flora were able to multiply and produce spoilage odors within 8 d, whereas the *C. botulinum* survivors could not produce toxin within 14 d. At an abuse temperature of 30°C, the natural survivors grew fasthan *C. botulinum* spores and produced an off-odor before the sample was toxic.

Simplified Procedure for Estimating the Effect of a Change in Heating Rate on Sterilization Value, D. Naveh, I. J. Pflug and I. J. Kopelman, Department of Food Science and Nutrition, University of Minnesota, 1334 Eckles Avenue, St. Paul, Minnesota 55108 and Department of Food Engineering and Biotechnology Technion, Haifa, Israel

J. Food Prot. 46:16-18

A general relationship between a relative change in the temperature response parameter, f, and the sterilization value delivered in a thermal process has been developed. The relationship is based on numerical differentiation of Ball's formula method and employs a dimensionless elasticity term to express the relative change in sterilization value due to a relative change in heating rate. The funtion presented can be used for g's of up to 30°F and for changes of 3 to 20% in the value of the temperature response parameter.

Effect of Cooking on Bacteriological Populations of "Soul Foods", Adelle W. Stewart, Department of Natural Sciences, South Carolina State College, Orangeburg, South Carolina 29117
J. Food Prot. 46:19-20

Effect of typical cooking procedures on viable bacteria present in "soul foods" was determined. Time and temperature used were those determined to give a satisfactory product. Except for an aerobic plate count of 60 CFU/g in puddings (liver) and 10 CFU/g in jaws and neckbones, survival of vegetative bacterial cells in the cooked foods was nil.

Psychophysical Relationship between Sweetness and Redness in Strawberry-Flavored Drinks, J. L. Johnson, E. Dzendolet and F. M. Clydesdale, Department of Food Science and Nutrition and Department of Psychology, University of Massachusetts, Amherst, Massachusetts 01003
J. Food Prot. 46:21-25

A consumer-like taste panel of 10 men and women, ages 22-50, evaluated the sweetness, pleasantness and color acceptability of five sweetened, strawberry-red colored beverages, containing 3.2% to 4.8% sucrose, using magnitude estimation. Five intensities of strawberry colors were formulated using increasing volumes of FD&C Red 40 and a constant volume of both FD&C Yellow 6 and imitation strawberry flavoring. Color measurements from the Gardner XL-23 colorimeter and the G. E. Recording Spectrophotometer were converted to L*, a*, b*. Sensory responses were evaluated against the value arctan (a*/b*), representing color intensity, and sucrose concentration, as percent sugar. Sweetness perception increased with increasing sucrose concentration, producing a slope greater than 2.00 ($r^2 \geq 0.87$) but produced an exponent less than 1.0 ($r^2 < 0.91$) when evaluated against arctan (a*/b*). Sweetness increased approximately 2 to 12% with increasing color intensity in 4% sucrose solutions. Perceived sweetness was influenced by pleasantness effects and color acceptability. Color 3 samples were rated as the sweetest, most pleasant-tasting drinks and had the most acceptable color. The color-sweetness function was linear over a narrow color range.

Bacteriology of Restructured Lamb Roasts Made with Mechanically Deboned Meat, Bibek Ray and R. A. Field, Animal Science Division, University Station Box 3354, University of Wyoming, Laramie, Wyoming 82071
J. Food Prot. 46:26-28

Composite samples of restructured lamb roast containing 10 or 30% mechanically deboned meat (MDM) were analyzed for bacteriological quality before and after cooking to 62.8°C (145°F). Uncooked samples had less than 3.0×10^4 colony forming units/g mesophilic and psychrotrophic aerobes and anaerobes including lactobacilli. In general, these groups, as well as coliforms and fecal coliforms, were present in higher numbers in uncooked roasts containing higher percentages of MDM. *Staphylococcus aureus, Clostridium perfringens, Salmonella* sp., *Yersinia enterocolitica* and *Campylobacter jejuni* were not detected in uncooked samples. Cooking reduced the number of aerobic and anaerobic spoilage bacteria and eliminated index bacteria (in 0.1 g) effectively.

Combined Effects of Antioxidants and Temperature on Survival of *Saccharomyces cerevisiae,* V. L. Eubanks and L. R. Beuchat, Department of Food Science, University of Georgia Agricultural Experiment Station, Experiment, Georgia 30212
J. Food Prot. 46:29-33

The effects of butylated hydroxyanisole (BHA), tertiary butylhydroquinone (TBHQ) and propyl gallate on survival and growth of *Saccharomyces cerevisiae* upon exposure to elevated and reduced temperatures were determined. The rate of death of cells heated at 50°C was enhanced by as little as 50 ppm of BHA, 100 ppm of TBHQ and 500 ppm of propyl gallate. Sucrose afforded a protective effect against heat inactivation, but this effect was reduced substantially by 100 ppm of BHA, 200 ppm of TBHQ and 750 ppm of propyl gallate. At 4°C, antioxidants either significantly retarded or prohibited the rate of growth and, at -18°C, antioxidants enhanced the rate of death of *S. cerevisiae*. It is suggested that antioxidants may play a more extensive role as antimycotic agents during processing and storage of foods than previously recognized.

Microbiological Quality of Frozen Cream-Type Pies Sold in Canada, E. C. D. Todd, G. A. Jarvis, K. F. Weiss, G. W. Riedel and S. Charbonneau, Food Directorate and Field Operations Directorate, Health Protection Branch, Health and Welfare Canada, Ottawa, Ontario, Canada K1A 0L2
J. Food Prot. 46:34-40

Ten types of frozen cream-type pies, manufactured in Canada and imported from the United States, were analyzed for aerobic colony counts, yeasts and molds, coliforms, *Escherichia coli, Staphylococcus aureus* and *Salmonella*. The variations in counts

depended more on the manufacturer than on the type of pie and the ingredients used. Five of the 465 examined pies had an excess of 10^5 aerobic colony counts/g, whereas the median value for all the pies examined was between 10^2 and 10^3 CFU/g. *E. coli* and *S. aureus* were present in few pies, mainly made by one manufacturer, but there was no correlation between high aerobic colony counts and these organisms. *Salmonella* was not found in any of the pies. Percentage distributions of the estimated 'population' of pies available nationally at the time of the survey were statistically determined. These were then compared with suggested national guidelines in the form of a three-class acceptance plan based on United States surveys and desirable manufacturing practices. These indicate that pies should contain aerobic colony counts of <50,000/g, yeast and mold counts of <500/g, *S. aureus* counts of <100/g, coliform counts of <50/g, *E. coli* counts of <10/g, and no *Salmonella*. Three of the six manufacturers would have had an estimated 5.4 to 32.6% of lots in excess of the guidelines at the time of the survey.

Sources and Content of Iodine in California Milk and Dairy Products, J. C. Bruhn, A. A. Franke, R. B. Bushnell, H. Weisheit, G. H. Hutton and G. C. Gurtle, University of California, Davis, California 95616

J. Food Prot. 46:41-46

In recent years, milk and milk products have been implicated as a major contributor to dietary iodine. The possible sources of iodine in milk are supplemental iodine in dairy feeds, iodophor-containing sanitizers used at the dairy farm and/or the processing plant, iodophor-containing teat dips used to control the spread of mastitis among dairy cows, and iodine-containing medications used by veterinarians. A five-year program to determine the California raw milk iodine concentration and identify the sources of adventitious iodine has resulted in the California dairy industry deciding late in 1980 to reduce iodine supplementation of dairy feeds. This resulted in a decrease in milk iodine concentration in samples received in 1981 to 256 ± 234 μg/kg compared to 1980, when the concentration was 474 ± 304 μg/kg. The industry has set up a program to monitor the raw milk iodine concentration at the producer level, thus ensuring that the concentration will continue to decline.

Vacuum Packaging Versus Modified Atmosphere Packaging of Lamb Loins, G. C. Smith, S. C. Seideman, J. W. Savell, C. W. Dill and C. Vanderzant, Meats and Muscle Biology Section, Department of Animal Science, Texas Agricultural Experiment Station, Texas A&M University, College Station, Texas 77843

J. Food Prot. 46:47-51

Lamb loins were allocated (30 loins/treatment) to three packaging treatments: (a) vacuum-packaged, (b) vacuum-packaged followed immediately by injection of a 20% CO_2:80% N_2 atmosphere, and (c) vacuum-packaged followed immediately by injection of a 40% CO_2:60% N_2 atmosphere. Loins in each packaging treatment were then assigned (6 loins/period) to one of five storage periods--0, 7, 14, 21 or 28 d. During storage, the CO_2 concentration increased in vacuum packages (initial vs. 21 d) and decreased in modified atmosphere packages (initial vs. 7 or 28 d); O_2 concentration was higher in vacuum packages than in modified atmosphere packages at every storage period. Vacuum packaging was superior to modified atmosphere packaging for maintaining desirable appearance of wholesale loins, particularly if the atmosphere contained a high CO_2 concentration. Appearance of retail chops was not substantively affected by the method used to package (vacuum vs. modified atmosphere) the wholesale loin from which they originated. Palatability of cooked chops was not affected by packaging method in 28 or 30 comparisons among product from loins that had been stored for 0 to 28 d before organoleptic testing.

Use of Time-Temperature Indicators as Quality Control Devices for Market Milk, V. V. Mistry and F. V. Kosikowski, Department of Food Science, Cornell University, Ithaca, New York 14853

J. Food Prot. 46:52-57

i-Point TTM and 3M Monitormark time-temperature indicators were evaluated for their use as quality monitors for market milk. i-Point indicators exhibiting a life span of 10 d at 4.4°C, 8 d at 6.8°C and 6.5 d at 10°C and 3M Monitormark having a response temperature of 5°C and a 14 d maximum exposure time were selected. Fresh HTST pasteurized commercial market milk was stored at 4.4, 6.8 or 10°C. Time temperature indicators, activated at the time of storage of milk were followed daily at the three storage temperatures for color development in i-Point TTM and index number in 3M Monitormark. Milks were evaluated for bacterial numbers and acceptability at selected time intervals. Milks generally remained acceptable approximately 4 d after the end of the life span of i-Point indicators at 10°C and more than 10 d at 4.4°C. 3M Monitormark exhibited insensitivity in the temperature range of 4-10°C. This integration of time as well as temperature makes it possible to replace the sell-by-date on market milk with i-Point TTM indicator to more effectively monitor quality.

Effect of Low-Temperature Cleaning of Milking Equipment on the Microbiological Quality of Raw Milk, J. B. Stone, A. N. Myhr and I. Davie, University of Guelph, Guelph, Ontario, Canada N1G 2W1

J. Food Prot. 46:58-60

Effect on the microbiological quality of milk of using a special cleaning detergent (Diversey-Wyandotte, Inc.) for low-temperature (initial 43.8°C, end of wash 35.4°C) washing in a milking parlor pipeline system was compared to regular high-temperature (initial 73°C, end of wash 43.8°C) wash of the system. Microbiological quality of the milk was determined by standard plate count (SPC) and psychrotrophic bacterial count (PBC). Cleanliness of equipment was evaluated by measurement of calcium deposits and visual inspection. Statistical analysis of data over time (June 5 to September 16, 1980) indicated no difference in SPC and PBC of milk between low-and high-temperature washing and, although there was a significant negative slope of PBC with time, this was due to factors other than treatment. Calcium soil deposition and visible evaluation of the equipment were not different for the wash temperatures.

Effect of Processing on Chemical and Nutritional Changes in Food Lipids, D. A. Lillard, Department of Food Science, University of Georgia, Athens, Georgia 30602

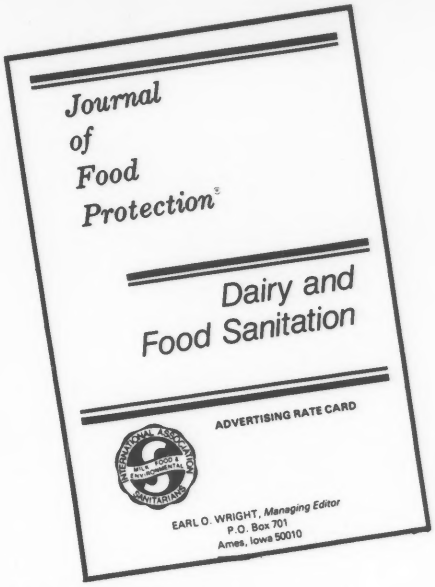
J. Food Prot. 46:61-67

Commercial processing of fats and oil into edible products is done to remove the impurities from the oil. Unless the oil is hydrogenated, very few chemical changes occur during this process to alter the nutritional quality of the oils. Trans fatty acids that are formed during hydrogenation have limited nutritional and metabolic effects if consumed with an adequate supply of essential fatty acids. When lipids or foods containing lipids are heated in the presence of oxygen, they undergo oxidation, which causes degradation of the fatty acids. The free radicals produced in these oxidation reactions may react with proteins, vitamins, or other food constituents and reduce the nutritive quality of the food. However, destruction of flavor or color by these reactions is often noticed before major nutritional damage can occur.

Enumeration and Confirmation of *Clostridium perfringens,* Ronald G. Labbe, Food Microbiology Laboratory, Department of Food Science and Nutrition and Agricultural Experiment Station, University of Massachusetts, Amherst, Massachusetts 01003

J. Food Prot. 46:68-73

A number of media have been proposed for the enumeration and confirmation of *Clostridium perfringens* in food and water. Most of these employ sulfite and iron together with selective antibiotics. This report discusses these various media and conditions for their use.



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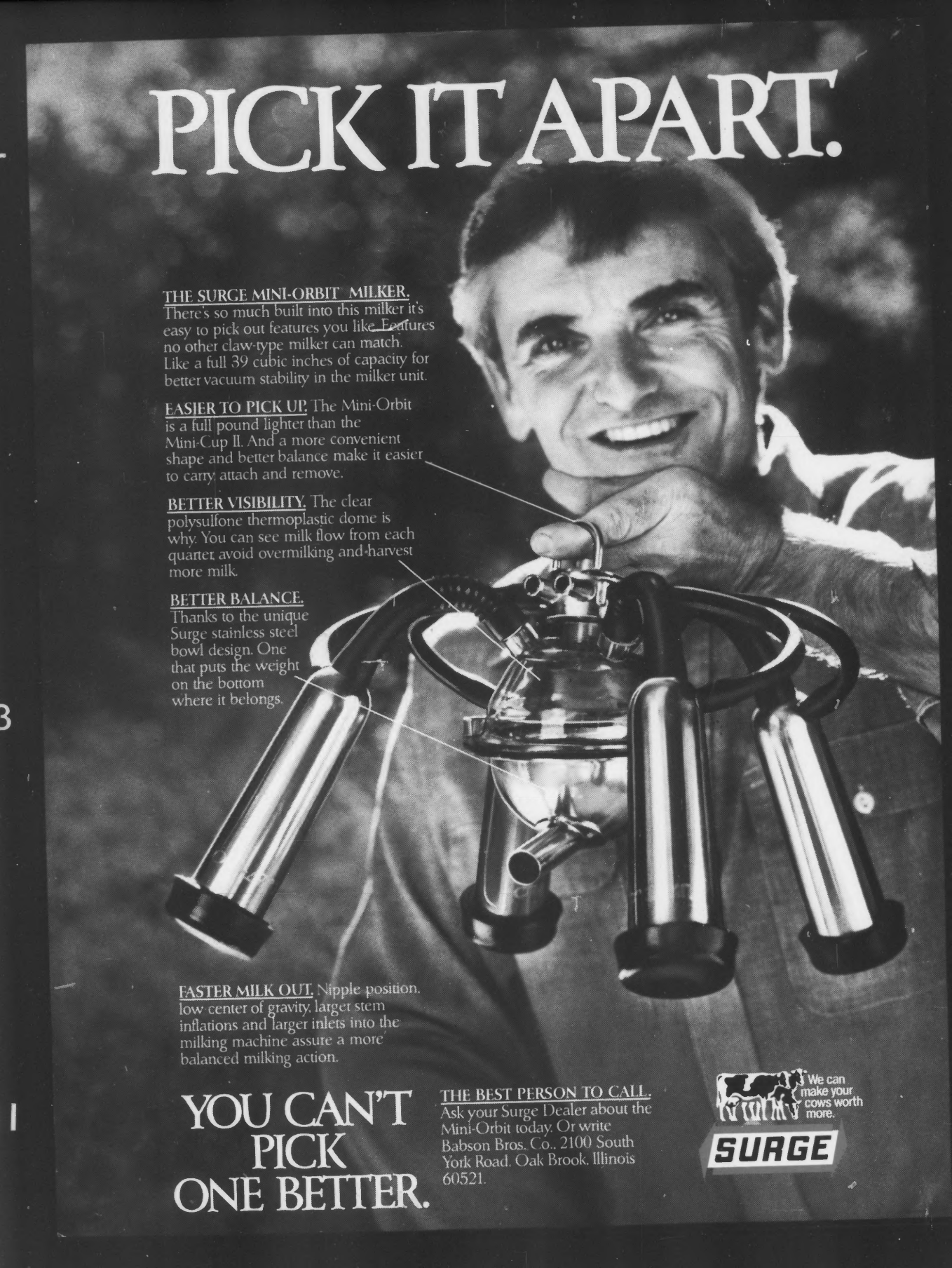

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