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Thoughts From the President . . .

By
Ron Case
IAMFES President

The Spring Executive Board Meeting was held March 22 and 23 at the Woodfield Hilton in Arlington Heights, IL. This is also the location for this year's International Meeting. At the spring meeting the board works on goals and the budget for the upcoming fiscal year which starts July 1.

The budget is of great concern to your board. During the last three years our membership has increased, we have expanded our annual meetings and have become more involved in food safety issues. During this same time we have spent more than we received. For the present fiscal year it looks like we will be in the "black" but not by much. To be able to do this we have had to make changes from the way we operated in the past. We no longer have a membership department in the Ames office. There wasn't enough return for the money spent getting new members. This means YOU, our present members, will have to do more to recruit new members. We have selectively reduced travel and used the travel to get more for our money. One travel expense we added last year was for the Program Advisory Committee to meet in January to plan the program for the annual meeting. This has improved the quality of the sessions. Employee benefits improvements have been postponed and office hours have been increased. Overall employee costs have been reduced. We are making changes in printing and publishing our journals. So far this has not greatly reduced our expenses but has kept them from rising. We have changed telephone companies to reduce our expenses and increase our service. Cost analyses have been done on advertising and publications. At this time we do not see any changes taking place with advertising but are considering a new profit policy for our publications. Details of this will be worked out at the August board meeting. Our investment program has been reviewed and changes made to give us the best return with the safety and flexibility we need. We have not cut services to our affiliates and, in fact, have increased them since they are vital to IAMFES. We continue to support our committees and their work.

Looking into the next fiscal year, we do not think we can maintain our present programs without more income. We continue to try and develop sources of non-dues income but do not see them increasing enough next year to balance our expenses. We will spend over $45,000 this year on postage. The projected postal increase of 20% on first class mail will hit us hard. We are planning to do more desk top publishing to reduce our publication cost. In order to do this and to increase the productivity of the office, we are planning to add a new computer system this coming year. In order to meet our expenses for the coming year we are having to increase membership and subscription fees. Regular membership will increase from $36 to $40 and from $64 to $70 if the member also receives JFP. Sustaining membership will increase from $375 to $400. Student and Retired membership will continue to be one half of the regular membership. Subscriptions for DFES will increase from $83 to $100, for JFP from $110 to $135 and for both $151 to $185. Foreign and airmail postage will also increase. These increases will go into effect September 1, 1990.

We did not like to take these measures but felt that if the Association was going to continue its programs they were necessary. You are still getting a lot for your money at these prices. IAMFES is the premier association in dairy and food protection.

The Board met with the local arrangement committee to discuss the plans for the upcoming International Meeting. The preliminary program and the activities that are planned will make this an outstanding meeting. We are having all the committee meetings on Sunday, August 5. You may want to plan and come to Chicago on Saturday to take advantage of lower air fares and to enjoy the city before the meeting starts. There is lots to do in Chicago.

As a follow up on February's column, I will be working with Robert Sellars, president of the American Dairy Science Association, to find ways we might share our journals and other publications with third world countries to help them improve their sanitation standards. We usually have extra journals we could share with people in these countries but the cost of sending them is high. Anyone who is willing to help in this effort please let me know.

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Dairy, Food and Environmental Sanitation, Vol. 10, No. 5, Pages 266-267 (May 1990)

"Egg Production and Processing"

Ken Klippen
United Egg Producers
3951 Snapfinger Parkway, Suite 580
Decatur, GA 30035

This paper was presented at the 76th Annual Meeting of the International Association of Milk, Food and Environmental Sanitarians in Kansas City, Mo on August 16, 1989.

Modern egg production and processing facilities are a perfect blend of business management, economics, marketing and animal agriculture. The individual egg producer, the farmer, is the one in the driver's seat of his company or corporation. Today, we have egg producers in our organization with as few as 20,000 laying chickens on up to 20 million, and all ranges in between, producing and processing eggs, only on different scales of production.

Overall View

The size of individual egg operations may change over time due to consolidations or cutbacks because of poor economics; the total number of laying hens has remained relatively constant with yearly variances between 1-3%. In 1989, the nation's laying flock will average around 235 million hens, in 1988 it was 237, in 1987 it was 244, in 1986 it was 240. The high for the last ten years was in 1979 with 253 million hens. Production of eggs, therefore, remains within that same constant with ranges between 67-69 billion eggs yearly. Egg producer numbers have fallen dramatically, however, over the recent years. In the last 10 years, producer numbers have diminished by nearly 73%...from more than 6,000 in 1979 to under 1,600 today. The narrow profit margins in egg production forces the egg producer to expand his flock size, squeezing out those producers less competitive. And in those years when there are no profits...such as 1988 when oversupply was further compounded by a *Salmonella* scare...many producers simply quit. During the last six months of 1988, 300 egg producers went out of business due to the poor economic situation. The industry drained its equity by $280 million. But a 3% reduction in supplies is currently firming up prices.

Egg Production

What's the first impression one gets when first entering a commercial egg production facility? It's difficult to put into words ...but the first thing one notices are the heads with the red combs bobbing with frenetic regularity into the feed trough. There is a cacophony of cackling that envelopes you. Four hens occupy each 12 x 18 inch cage. Each cage contributes to a row which may be as long as 300 feet. Each row is stacked upon another to a height of six feet.

These chickens live in a highly controlled environment where temperature, air circulation, feed mix, water supply, sanitation and health are all engineered to serve one purpose: to maximize egg production efficiency and thus provide the consumer with an economical food source.

On the average, three eggs daily are laid from the four chickens in each cage where it rolls down the sloped cage floor to the collection conveyer where it joins hundreds of others. The conveyers are timed and run usually by a 3/4 horse motor toward a central collection area or directly into the processing room.

But this stage where the chicken is laying eggs for table consumption is not the beginning point in the egg subsector. It actually begins several chicken generations sooner.

Time Line for Egg Production

There are less than one dozen primary breeder firms with the great grandparent stock for all the laying strain chickens today.

The primary breeders retain both hens and roosters. One rooster is maintained with 15-18 hens and the eggs are collected, cleaned, then incubated. After 21 days the chick that hatches undergoes a 20 week growout period before she starts to lay the first egg. It's another 12 weeks before the eggs are of the proper size for incubation. This next layer is the grandparent stock. Her offspring undergo the same 20 weeks before they start laying eggs that you eventually eat at your breakfast table. So before you crack that egg into the skillet, realize that it took 58 weeks of planning and production before that egg could be developed.

In the Hen House

The egg producer controls the environment in the house. He augments natural lighting with artificial (incandescent, fluorescent) lighting or he has a house with complete light control (baffles over the fans) and uses 100% artificial lighting. Chickens are photosensitive and react to increases or decreases in the daylength. In the wild, birds lay eggs only in the spring and the reason is the increasing daylength. Commercial egg production attempts to simulate the daylength of springtime with the amount of daylight remaining constant above 14 hours. The chickens are then induced to lay eggs the year around.

Once the eggs are laid, they are collected and processed. The eggs may travel directly from the house into the processing plant in farms known as in-line systems or the eggs are trucked to a processing plant where they are stored temporarily in a cool room until they can be treated.

Egg Processing

Egg processing today has all the sophistication of any modern day assembly line complete with computers and mechanical egg handlers. Larger processing facilities can wash, sanitize, candle, grade, and package 100,000 eggs every hour. Sometimes plants of this size must bring in the eggs by the semi-tractor trailer simply to keep the machine operating efficiently.

Wash Water 110-110 Degree F

After washing and sanitizing - eggs are oiled with a food grade oil. Oiling reseals the pores after the natural bloom is washed from the shell.

Candling

At the candling station, a bright light is shown through the eggs. Experts examine each egg for irregularities in the shell, blood spots on the yolk or meat spots. Defects are removed as undergrades. An inspector is present and makes random checks on the quality of eggs. After candling, the eggs are packed in one of several ways. Either they can be graded and cartoned for retail or shipped as loose eggs for institutional use or by another packer for use in his label.

Egg Breaking

Egg breaking is a controlled, scientific operation. Upon arriving at the plant, eggs are usually put in cold storage. Once the egg is ready to be cracked, it is moved into a room of intermediate temperature which helps increase yields by reducing the amount of egg that clings to the shell after it is broken. Most breaking operations have their own washing and candling operations perform the cleaning tasks described in the egg processing facility. Mechanical breakers operating at speeds of 30,000 eggs per hour are typically used. Depending on customers needs, the processors develop products including frozen, liquid or dried eggs and components.

Therefore, egg production is not, as some people mistakenly believe, backyard flocks you see in pictures. Instead it's a dynamic agribusiness encompassing the sophistication of computers and animal science along with the skills associated with business management, economics and marketing.

Dairy, Food and Environmental Sanitation, Vol. 10, No. 5, Pages 268-270 (May 1990)

Salmonella enteritidis Contamination of Whole Chicken Eggs

Joseph M. Madden, Ph.D.
Acting Director, Division of Microbiology, Center for Food Safety & Applied Nutrition
U.S. Food and Drug Administration, 200 C Street, S.W., Washington, DC 20204

This paper was presented at the 76th Annual Meeting of the International Association of Milk, Food and Environmental Sanitarians, Kansas City, MO on August 16, 1989. Data have been updated since the time of presentation.

For many years, *Salmonella enteritidis* accounted for only about 6% of the *Salmonella* isolates associated with human illnesses reported to the Centers for Disease Control (CDC). However, that percentage began to rise in 1976. Although this organism is generally confined to northeastern United States(1,2), its isolation rate has been increasing in the mid-Atlantic, south Atlantic, east north central, mountain and Pacific regions (3). A definite link between foodborne disease outbreaks caused by *S. enteritidis* and the consumption of Grade A whole shell eggs was not established until 1988 when St. Louis et al. (4) analyzed the results of 65 foodborne outbreaks which occurred from January 1985 to May 1987. According to CDC, these outbreaks accounted for 2,119 cases and 11 deaths. Of the 35 outbreaks with identified food vehicles, 27 were associated with the consumption of eggs or egg-containing foods. The latest data from CDC(5) show that *S. enteritidis* illnesses in the U.S. continue to increase (Table 1), are spreading across the U.S., and have been reported from Puerto Rico (Table 2). Because evidence shows that eggs involved in interstate commerce have been responsible for some of these outbreaks(3,5), the problem falls under the purview of the Food and Drug Administration (FDA).

Table 1. Number of outbreaks, cases, and deaths of *Salmonella enteritidis* in the U.S. and its territories reported to the CDC from January 1985 to October 1989.[a]

Year	Outbreaks	Cases	Deaths
1985	19	608	1
1986	34	1042	6
1987	50	2370	15
1988	37	956	8
1989	49	1628	13

[a]Morbid. Mortal. Weekly Rep. 38:877-880, 1990.

Table 2. States and territories reporting egg-related outbreaks of *Salmonella enteritidis* to CDC from January 1985 to October 1989.

Alabama	Connecticut	District of Columbia
Illinois	Maine	Maryland
Massachusetss	Nevada	New Jersey
New York	Ohio	Pennsylvania
Puerto Rico	Tennessee	Virginia
Washington	Wisconsin	

Transmission of *Salmonella*

Illnesses caused by *Salmonella* and related to whole shell eggs are not new in the U.S. Many cases of salmonellosis in the 1960s (2) were found to be caused by fecal contamination of egg shells. Following the passage of the Egg Inspection Act in 1970(6), which stipulated that Grade A eggs be washed and sanitized, these outbreaks decreased dramatically. Outbreaks occurring today are due to the actual presence of the microbe within the chicken egg, transmitted there by the infected laying hen. The passage from hen to egg (vertical transmission), which is known as transovarian infection, may cause embryonated eggs of infected hens to hatch as infected chicks. Consumption of inadequately cooked embryonated or nonembryonated eggs can cause salmonellosis in humans. Chickens may also become infected by horizontal transmission, i.e., bird-to-bird, man-to-bird, feed-to-bird, or environment-to-bird.

The increase in number of cases caused by *S. enteritidis* is not limited to the U.S. It is occurring in Europe and the United Kingdom(7), where the disease is linked to the consumption of chicken as well as raw or incompletely cooked whole shell eggs. Strains of *S. enteritidis* isolated in Europe and the United Kingdom belong mainly to phage type 4, which seems to be more pathogenic to humans than

other phage types of the microbe and is also pathogenic to chickens. In contrast, U.S. strains of *S. enteritidis*, predominantly phage types 8 and 13a, although pathogenic to humans, have only minor effects on infected birds. The coincidental emergence of *S. enteritidis in both Europe and the U.S. suggests that the organism may have adapted to coexist with infected hens.* Strain differences must be taken into account when methods of control of this microbe are considered.

Both domestic and wild birds as well as other animals harbor this microbe, although the strains they harbor may or may not be of the phage type that can coexist with chickens and may be passed by vertical transmission. Identification of the phage types of *S. enteritidis* and determination of the differences between environmental strains and the infective strains that are transmitted vertically by hens are areas targeted for research.

Foodborne Outbreaks

Symptoms of human gastroenteritis associated with *S. enteritidis* infection include diarrhea, abdominal pain, chills, fever, vomiting and headache. The illness is not restricted to a particular age group, although most outbreaks and deaths reported to CDC have occurred in hospitals or nursing homes, where many individuals are debilitated or elderly and may have underlying illnesses. In December 1988, CDC(8) recommended that institutional providers substitute pasteurized egg products in their recipes whenever possible, that eggs be properly cooked, and that utensils be washed after coming in contact with raw egg or egg-containing foods. When the incidence of outbreaks in these settings remained high, the recommendations were again emphasized, this time in the February 1989 FDA Drug Bulletin(9). Pasteurized egg products, such as those recommended, are generally available only at the wholesale level; however, small retail-sized containers of ultrapasteurized eggs are now available in some parts of the country on an FDA/U.S. Department of Agriculture (USDA) approved test-marketing basis. Some of the reported outbreaks may have been due to mishandling of eggs (including temperature abuse) by food handlers; others seemed to involve no mishandling(3,5). Research has not yet indicated whether the numbers of bacteria in the egg when laid are high enough to cause human infection or whether refrigeration (45°F) is necessary to stop *S. enteritidis* from multiplying to numbers sufficient to cause human infection.

Control of *S. enteritidis* in Eggs

In April 1988, the FDA and the USDA formed a task force to devise strategies to control the continued increase in egg-related *S. enteritidis* outbreaks and to develop research programs necessary to control this public health hazard. A national public meeting co-sponsored by FDA and USDA was held in Washington, DC, on September 15, 1988. Comments received at this meeting were incorporated into a control program strategy originally prepared by members of the Northeast Conference on Avian Diseases. A Voluntary Model State Program for *Salmonella enteritidis* Quality Assurance was then issued to the states and territories on November 2, 1988.

The program called for the testing of all breeder and multiplier flocks (Table 3). Details of the plan included monitoring of the hen house environment, serological testing of birds within a house to determine their exposure to *S. enteritidis*, microbiological culturing of the internal organs of randomly selected birds within a house, and periodic testing of dead-in-shell embryos. A flock was considered to be positive for *S. enteritidis* only if the microbe was cultured from the internal organs (excluding lungs and intestines) of selected birds. The plan further called for the testing of commercial flocks if they are epidemiologically linked to human illnesses or if they were derived from a multiplier flock found positive for the organism.

Table 3. Approximate number of hens in chicken flocks located within the U.S.

Primary Breeders (880,000) - Genetic stock birds from which future generation of multipliers will be derived. Also referred to as hybrid, library, or grandparent birds.
Multiplier Breeders (23 million) - Birds derived from primary breeders. Purpose is to lay embryonated eggs to be used to stock commercial houses. Also called parent birds.
Commercial Egg Laying (235 million) - Flocks that produce nonembryonated eggs that are sold at the commercial level for home and retail use.

Research Plans

Many scientific questions remained unanswered. After the September 15, 1988, public meeting, veterinarians and scientists from USDA, FDA, and CDC, and academicians and veterinarians from a variety of institutions, reviewed the literature and established research priorities. Various research projects were then funded by USDA through the Cooperative State Research Service and the Agricultural Research Service; USDA and FDA conducted in-house research; and the egg production industry itself spent more than a million dollars on research (Southeastern Poultry and Egg Association). The fruits of all these efforts have not yet been realized, but much has been learned about this disease in chickens and the possible means of removing or excluding it from a chicken flock.

Education

The federal government has conducted a disease prevention campaign. FDA and USDA have sent more than 50,000 flyers to state food regulatory agencies, trade

associations, and consumer groups. Flyers were also made available to consumers who requested information from the USDA Extension Hotline and from FDA Consumer Affairs Officers (CAOs). The information provided in the flyers is shown in Table 4. Newspapers and organizational newsletters have used this information to warn the public of the dangers associated with the consumption of raw eggs and egg-containing dishes. FDA and CDC have also prepared and distributed a video tape on the proper handling and cooking of foods, including eggs and egg-containing foods, by individuals with AIDS.

Table 4. General instructions provided by USDA and FDA regarding the safe consumption of Grade A whole shell eggs.

Cook eggs thoroughly until both the yolk and white are firm, not runny. There is some risk associated with eating soft, runny scrambled eggs, soft-boiled eggs and eggs fried "sunny-side up" with a liquid yolk.
Avoid eating raw eggs or foods containing raw eggs, such as Hollandaise and Bernaise sauces and Caesar salads.
Avoid homemade eggnog, ice creams made with uncooked eggs and mayonnaise. Commercially prepared items use pasteurized eggs and are thus safe.
Avoid eating lightly cooked foods containing eggs, such as soft custards, meringues, French toast and Monte Christo sandwiches.
Clean all utensils that come into contact with raw eggs before using them again.

Mandatory Testing of Flocks

Despite the adoption of the Voluntary Model State Program by many states, the number of cases of *S. enteritidis* associated with the consumption of eggs seems to be increasing, indicating that the Program and the educational efforts are not dealing effectively with the problem. Both the FDA and USDA, therefore, agree that it is time to call for a mandatory testing program of primary and multiplier flocks. Analytical procedures and protocols will be standardized in the proposed testing program to make sampling and testing uniform from state to state.

Industry has repeatedly stated that it is being singled-out unfairly as the culprit and claims that its breeder flocks have already been tested. However, since the government has no evidence to substantiate that claim, it is necessary to mandate such testing and require that results be made available to both USDA and FDA. The call for a mandatory testing program with uniform testing requirements and analytical procedures has been heard from various states and even from producers. In some states, producers must now test flocks by different protocols, depending on the requirements of the egg-receiving state. Such non-uniformity can prove costly to producers.

The mandatory testing plan should not stop at the breeder level, however. Hatcheries and pullet-growing facilities must also be included, so that an egg producer restocking a hen house can be guaranteed that the new birds have been hatched from eggs laid by birds that tested negative for the presence of *S. enteritidis*. Producers of commercial eggs must also be included in the mandatory plan. Although they need not be required to follow the same serological and microbiological testing as the new breeders, they should test the house environment before bringing in new birds. Closing of this loop would ensure that chicken eggs are safe to eat.

The combined cooperative efforts of USDA, FDA, state veterinarians, and industry will eventually lead to control of the *S. enteritidis* problem in Grade A whole shell eggs. In the interim, our combined efforts must be directed toward consumer education about proper egg handling and cooking.

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Salmonella enteritidis Control

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This paper was presented at the 76th Annual Meeting of the International Association of Milk, Food and Environmental Sanitarians in Kansas City, MO on August 16, 1989.

In 1986, it became apparent that the rise in *Salmonella enteritidis* (SE) infections in human cases traced to Grade A shell eggs and products made from those eggs was not going to be a temporary one. During 1985 and 1986, CDC recorded 4,976 cases and 30 deaths as a result of SE infection.

New England and the Northeast was targeted in the "Morbidity and Mortality Weekly Report" of April 10, 1987 as experiencing a five-fold increase in human SE cases, and it was made clear that most of the cases were traced to Grade A shell eggs.

This new public health problem seemed to indicate that a change had taken place. Did we have an increased incidence of SE infections in laying hens in the Northeast? And was there a greater frequency of transovarian transmission in the laying hens in the same region?

The New England Poultry Health Roundtable conducted one initial survey early in 1987 of laying flocks in Connecticut, Maine, Massachusetts, and Vermont, collecting 300 fresh eggs per flock for a total of 6,600 eggs, 362 environmental samples, and 167 feed samples. No SE was isolated from any of the above samples and no *Salmonella* serotypes were isolated from any of the 6,600 eggs tested. *Salmonella heidelberg, S. hadar, S. infantis*, and *S. typhimurium* were the four most frequently isolated serotypes from the environment. These results indicated that if SE was present in the New England states, it would take a more intensive search to find it.

The Northeast Conference on Avian Diseases (successor to the Northeast Pullorum Worker's Conference) Committee on *Salmonella* felt it necessary to develop a quality assurance program that could help in the collection of epidemiological information in a standardized manner from state to state and laboratory to laboratory.

In addition to standardization of methodology of the sample collection, serology, microbiology and reporting, the objectives were to identify flocks with SE, the source of any SE found and to determine the guilt or innocence of implicated flocks in an SE human outbreak.

Our present levels of surveillance available to us include primary breeding flocks (grandparents), multiplier breeding flocks (parents), hatcheries, replacement pullet flocks (chicks to 20 weeks of age), commercial laying hens, and feed ingredients.

Sources to test for SE or SE antibodies are blood, swabs of empty cages and buildings, nest and floor litter, swabs of egg belts and manure scrapers, dead embryoes, feed, fresh eggs, and other environmental areas.

To survey an age group of commercial laying hens (one source of parents and all raised by one pullet grower), the Northeast Conference on Avian Diseases (NECAD) Committee suggests 300 blood samples to be tested with pullorum-typhoid antigens and leg banded for later culture, if necessary, the egg belts and manure scrapers to be swabbed and cultured with at least two media according to a specified protocol from an avian microbiology text.

For breeders, the proposed program suggests 300 blood samples at 16-20 weeks of age, environmental samples of nest and litter, and dead in shell embryoes on a continuous basis every 30 days.

The Model State Plan (MSP) recommends *Salmonella* prevention by the use of sanitation, disinfection, isolation and extensive biosecurity of all flocks, but especially the new baby chicks to be grown as pullets.

Swabbing of the empty cages and other equipment prior to housing chicks and the same technique for the manure papers when the chicks are 5-15 days of age will assist in locating the SE, if it is present.

Commercial pullets need to be raised in *Salmonella* clean buildings and equipment. Chicks purchased from tested breeders, kept in sanitary, isolated facilities and fed diets known to be free of *Salmonella* are requirements for the program to be successful. Pelleted feeds are strongly recommended and feeds that contain animal protein; the protein should derive from rendering plants participating in the APPI Salmonella Reduction Education Program.

It is further recommended that all routine diagnostic specimens be tested for *Salmonella* also.

With regard to the feed supply for all levels of production, ingredients should only come from suppliers who participate in the APPI *Salmonella* Reduction Education Program of the National Renderers Association.

A sanitation and biosecurity program for the feed mill is recommended. Further recommendations include setting up a statistically valid quality assurance culturing program for feed ingredients, equipment and the plant facilities.

Lastly for the feed mill, the pelleting techniques, (time, temperature, etc.) should be monitored closely.

Other areas that must not be ignored are programs of egg washing, egg sanitizing, facilities and equipment sanitizing and temperatures of eggs in storage and transport.

The original purpose of the Model State Program was to develop methods for use in collecting field data on SE infections. Much has been done but more research is needed before a Mandatory Testing Program with the ability to certify the safety of eggs is available.

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Survival of *Salmonella enteritidis* on and in Shelled Eggs, Liquid Eggs, and Cooked Egg Products

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This paper was part of the Symposium on Salmonella enteritidis in eggs presented at the Seventy Sixth IAMFES annual meeting in Kansas City, MO on August 16, 1989.

Our laboratory at Cornell has done considerable work on the problem of *Salmonella enteritidis* and eggs in New York State. When we first heard about the increase in the number of outbreaks from *S. enteritidis* and of the possibility of eggs being the vehicle of transmission, we decided to conduct a microbiological survey of New York State poultry farms to determine the prevalence of *S. enteritidis*. We began our study by sampling 46 commercial egg farms that represent over 80% of the eggs produced in the state. From each farm we gathered 100 eggs, manure, and feed and then analyzed for the presence of *S. enteritidis*. The methods used were those recommended by FDA. The results showed that no *S. enteritidis* were present in or on the eggs, in the feed or in the feces of the birds. We also checked eggs, feed, and feces from some backyard flocks but no *S. enteritidis* were found.

In addition, samples of ovaries and intestines from a New York State fowl dressing plant were tested for the presence of *S. enteritidis*. Approximately 3,600 ovaries and 1,200 pieces of intestines were collected from each of 14 different commercial laying flocks, and no *S. enteritidis* were found. We also examined 40 samples each of meat scrap, feather meal and bone meal that were obtained from all parts of New York State. Many different *Salmonella* serotypes were found in 40% of the samples but no *S. enteritidis* were present.

We also have infected laying birds with several plasmid phenotypes (strains) of *S. enteritidis*. The organisms at high concentrations were injected into the blood stream of some layers and into the crop of others. Two plasmid phenotypes were transovarian while the others were not.

The purpose of the paper is to report research on the survival of *S. enteritidis* on and in shelled eggs, liquid egg and cooked egg products. For the survival studies, several different strains of *S. enteritidis* were used as shown in Table 1. Many of these strains were received from Dr. H. M. Opitz of the University of Maine.

A portion of this project was to study the survival of three strains of (the Benson, Rochester, and Duck strains) *S. enteritidis* in egg albumen and egg yolk from one-day old eggs. Albumen was aseptically separated from yolk and each was inoculated with a low and high number of cells. For the low inoculum, approximately 15 cells were used for each egg portion while for the high inoculum approximately 1,500 *S. enteritidis* cells were used. The albumen and yolk portions were incubated at 37°C for 19 days. The results can be seen in Table 2. With a low inoculum of the Benson strain in albumen, the organism survived for no longer than four days. With the high inoculum, one sample in five showed survival for up to seven days. For the Rochester and Duck strains at the high inoculum, survival was somewhat longer than for the Benson strain. As expected, all strains of *S. enteritidis* survived and grew in the yolk samples for the entire 19 days. It can be concluded that *S. enteritidis* can live and grow in egg yolk but they do not survive well in egg albumen.

Table 1. Strains of almonella enteritidis used in the study

Strain	Source
Benson	Egg yolk, isolated by Dr. Benson at the University of Pennsylvania.
Rochester	Stool of a patient at Strong Memorial Hospital, Rochester, NY.
Puerto Rico	From Dr. John Timoney, Cornell University College of Veterinary Medicine.
Duck	Shell of duck egg.
Orono 586-82-EB1	Environmental isolate.
Orono B6996	Human isolate CDC.
Orono 7-1-GUT	Isolate from gut of a laying hen.
Orono 314-8-ORG	Isolate from visceral organs of a chicken.
Orono 204818-OV	Isolate from ovary of a chicken.
Orono 83-EB-1A	Environmental isolate.

Table 2. Survival of S. enteritidis strains in albumen and yolk[a].

	Albumen						Yolk					
	Benson		Rochester		Duck	Control	Benson		Rochester		Duck	Control
Day	Low	High	Low	High	High		Low	High	Low	High	High	
1	2/5	5/5	4/5	5/5	5/5	0/5	3/3	3/3	3/3	3/3	3/3	0/3
2	2/5	5/5	3/5	5/5	5/5	0/5	3/3	3/3	3/3	3/3	3/3	0/3
3	3/5	5/5	2/5	5/5	5/5	0/5	3/3	3/3	3/3	3/3	3/3	0/3
4	2/5	3/5	1/5	5/5	5/5	0/5	3/3	3/3	3/3	3/3	3/3	0/3
5	0/5	1/5	1/5	1/5	5/5	0/5	3/3	3/3	3/3	3/3	3/3	0/3
7	0/5	1/5	1/5	2/5	4/5	0/5	3/3	3/3	3/3	3/3	3/3	0/3
9	0/5	0/5	0/5	2/5	3/5	0/5	3/3	3/3	3/3	3/3	3/3	0/3
12	0/5	0/5	0/5	1/5	1/5	0/5	3/3	3/3	3/3	3/3	3/3	0/3
14	0/5	0/5	0/5	1/5	1/5	0/5	3/3	3/3	3/3	3/3	3/3	0/3
16	0/5	0/5	0/5	0/5	1/5	0/5	3/3	3/3	3/3	3/3	3/3	0/3
19	0/5	0/5	0/5	1/5	1/5	0/5	3/3	3/3	3/3	3/3	3/3	0/3

[a]Numbers in numerator are egg(s) positive for S. enteritidis; denominators are total number of eggs sampled each day. Low inoculum was 15 cells per egg portion, high inoculum was 1500 cells per egg portion. All yolk samples were positive, except for the control.

Another part of the study investigated the possible migration of *S. enteritidis* from albumen to the yolk in shell eggs. This was done by using intact eggs and drilling small holes in the shells. *S. enteritidis* (about 50 cells per egg) were injected into albumen, the holes were sealed with Duco^{R} Cement and the eggs were stored at 8°C for up to 14 days. The results can be seen in Table 3. With the Benson strain, one yolk was positive for *S. enteritidis* on day 5 and for the Rochester strain one yolk was positive on the second day and one on the sixth day. With the Duck strain, no *S. enteritidis* reached the yolk. It would appear from this study that it is possible for some strains of *S. enteritidis* to migrate from the albumen to the yolk but the percentage is quite low.

Table 3. Migration of S. enteritidis cells from albumen to the yolk

	Benson		Rochester		Duck		Control	
Days	Albumen	Yolk	Albumen	Yolk	Albumen	Yolk	Albumen	Yolk
0	3/3	0/3	3/3	0/3	3/3	0/3	0/3	0/3
1	1/5	0/5	0/5	0/5	1/5	0/5	0/5	0/5
2	2/5	0/5	2/5	1/5	4/5	0/5	0/5	0/5
3	4/5	0/5	3/5	0/5	1/5	0/5	0/5	0/5
5	3/5	1/5	1/5	1/5	2/5	0/5	0/5	0/5
7	0/5	0/3	0/3	0/3	1/4	0/3	0/3	0/3
8	0/5	0/3	1/3	0/3	0/3	0/3	0/3	0/3
11	1/5	0/3	1/3	0/3	0/3	0/3	0/3	0/3
13	0/3	0/3	0/3	0/3	0/3	0/3	0/3	0/3
14	1/3	0/3	1/3	0/3	0/3	0/3	0/3	0/3

The survival of *S. enteritidis* on egg shells was also investigated. For this study only one strain of *S. enteritidis* (Benson) was used. As soon as eggs were laid they were dipped into 41°C water (same temperature as a freshly laid egg) containing 1 x 10^6 organisms per ml for five seconds. The eggs were then stored at room temperature and at 7°C for 15 days. On several of the days, five eggs at each temperature were checked for survival of *S. enteritidis*. The results are shown on Table 4. At room temperature, *S. enteritidis* only survived for one day while those eggs stored at 7°C showed some positives for up to five days. On the ninth and 12th day of storage at 7°C one egg in five on each day were positive. A possible explanation for this difference is the dryness of the egg shells. At room temperature the shells became quite dry while at 7°C the relative humidity of the storage was much higher.

Table 4. Survival of S. enteritidis (Benson strain) on egg shells[1]

Day	Room Temperature	7°C
1	+	+
2	-	+
5	-	+
6	-	-
8	-	-
9	-	- (1+)
12	-	- (1+)
14	-	-
15	-	-

[1]Eggs were dipped in a cell suspension containing (1 x 10^6 organisms/ml) for 5 seconds.

Thermal Death Times were determined using several strains of *S. enteritidis* in liquid whole egg. The method was that of Stumbo where a Woulff three neck flask was used. An Omni mixer was placed in the center neck and a thermocouple was introduced in another neck to monitor the egg temperature. The third neck was used to add and withdraw samples. The liquid egg was brought to the desired temperature in a water bath set at 63°C. Once the liquid egg reached 60°C a 10 ml inoculum (1 x 10^8) cells per ml were introduced. Recording of time started at this point and 2 ml samples were taken every 15 seconds for three minutes. Plate counts were made from several dilutions from each sample and survivor numbers recorded. From these numbers a survivor curve was drawn and the D value calculated from the slopes of the curve. The results can be seen in Table 5. The present recommendation for pasteurizing liquid whole egg is 60°C for 3.5 minutes, and these parameters will provide at least a 7D reduction for all strains tested except the Benson strain.

Table 5. Decimal reduction time (D) values of S. enteritidis in whole egg

Strain	D_{60} (min)	Reduction achieved within 3.5 min
Benson	0.69	5D
Rochester	0.45	8D
586-82EB1	0.32	11D
76-EB-4	0.39	9D
B6996	0.45	8D
76-1GUT	0.31	11D
314-8-ORG	0.37	9D
204818-ov	0.42	8D
Puerto Rico	0.36	9D

The last part of the project determined the time required to destroy *S. enteritidis* in eggs prepared by several cooking methods. The cooking methods included scrambling, poaching, boiling, and frying. For scrambling and frying an electric fry pan set at 121°C was used while, for boiling and poaching boiling water was used. Only one 1strain of *S. enteritidis* (Rochester) was used in this experiment. The inoculum (0.5 ml) containing 1 x 10^8 organisms were injected into the yolks of shelled eggs. Following injection the eggs were incubated at 12°C for 24 hours before being cooked. The eggs were cooked until visually done and then samples were taken every 15 seconds. Temperatures were taken using thermocouples.

In summary it appears that *S. enteritidis* can survive in egg albumen for only a few days but can live and grow in egg yolk. It is possible for some strains of the organism to

migrate from the albumen of an egg to the yolk but the probability is quite low. *S. enteritidis* survives on the shell of eggs only about one day at room temperature but can survive several days under refrigeration where the relative humidity is high.

Thermal Death Times were determined and it appears that the present recommendation for pasteurizing liquid whole egg will provide at least a 7D reduction for all strains tested except for the Benson strain. With the Benson strain there was a 5D reduction. According to the results of this study using an electric fry pan set at 121°C, scrambled eggs should be cooked for one minute to be free of *S. enteritidis* while frying at the same temperature varies in time according to the method used. For covered the time was four minutes, for sunnyside seven minutes and for turned over, three minutes on one side and two minutes on the other. When using boiling water, five minutes was needed for complete kill when poaching eggs and seven minutes for boiled eggs in the shell.

Table 6. Time required to destroy Salmonella enteritidis in cooked eggs.

Method of cooking	Inoculum cfu/ml	Time needed for complete kill	Final temp. (°C)
Scrambling	4.2×10^5	1 min	74
Poaching	3.2×10^4	5 min	75
Boiling	5.9×10^4	7 min	75
Frying	2.7×10^5		
covered		4 min	70
sunnyside		7 min	64
turned over		3 + 2 min	61

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Current ARS Research on *Salmonella enteritidis* in Chickens: Experimental Infections in Laying Hens

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This paper was presented at the 76th Annual Meeting of the International Association of Milk, Food and Environmental Sanitarians in Kansas City, MO on August 16, 1989.

Abstract

Experimental *Salmonella enteritidis* (SE) infections were established in laying hens by oral inoculation. The effects of this treatment on the total egg production of infected hens, the fraction of these eggs that were contaminated with SE, the duration of fecal shedding of SE, and the frequency of isolation of SE from internal organs the hens were then determined. A variety of serological tests were performed with antigens derived from several *Salmonella* strains to evaluate the humoral antibody response of infected hens. This information will be valuable in assessing the significance of SE infections in laying hens and in developing accurate techniques for identifying infected flocks.

Introduction

A 1988 report authored by several investigators at the Centers for Disease Control (7) publicly asserted a connection between the consumption of uncracked Grade A eggs and human infections with *Salmonella enteritidis* (SE). The implication of eggs as a factor in the high reported incidence of *S. enteritidis* infections in recent years (1,2) has provided a new threat to the already embattled egg production industry and has necessitated a more comprehensive understanding of SE infections in laying hens. Our current research program, the initial stages of which are described briefly in this paper, involves utilizing an experimental model to characterize SE infections in chickens and to develop and test detection and control strategies. The design and results of these studies are being presented in detail elsewhere (unpublished data).

A remark by a deputy health minister regarding *Salmonella* contamination of eggs created considerable fear among British consumers that their egg supply was unsafe and resulted in a precipitous decline in egg consumption. The British and American *S. enteritidis* situations, however, differ in several important aspects. Epidemiologically important SE isolates in the United Kingdom have been predominantly phage type 4 and have also been responsible for serious disease losses in poultry flocks (3,4,5,6). In the United States, on the other hand, a variety of phage types, not including type 4, have been identified. Some disruption of egg production has been observed in infected flocks, but overt clinical disease has rarely been associated with SE infections in the U.S.

Research on SE in chickens must be directed to meet three pressing needs. First, an understanding of the dynamics and consequences of SE infections of laying hens is essential, in terms of both the pathological effects on the hen and the production of contaminated eggs. Effective detection and control measures cannot be selected or evaluated unless the complex interaction between host and pathogen is understood in detail. Second, the sensitivity and accuracy of detection of infected hens and contaminated eggs must be improved. Specific identification of epidemiologically relevant strains would be particularly useful. Third, intervention options such as vaccination must be explored.

Experimental Approach

Our controlled-access compound of disease-containment isolation buildings at the Southeast Poultry Research Laboratory has provided us with a nearly ideal setting for conducting detailed experiments under very precisely defined conditions. Laying hens from our in-house specific-pathogen-free flock have been housed in single-bird laying cages in rooms that can accommodate 48-96 hens. We have initiated experimental infections in these hens by oral inoculations with broth cultures of various SE strains. Although the exposure dosage of SE is a critical variable, which we are continuing to evaluate, all experiments discussed in this paper involved the administration of very large doses of SE (approximately 10^9 cells per bird). We have inoculated hens with a variety of SE strains, including isolates derived from both poultry and human sources. Several useful and interesting SE cultures were provided to us by Dr. Charles Benson of the University of Pennsylvania. The experiments described in this paper, except where

otherwise noted, were all performed using one of the poultry isolates (which we have designated SE6) obtained from Dr. Benson.

Using experimental infections permits us to control several key variables, thereby facilitating analysis of the components of the SE problem in greater depth than is possible in retrospective epidemiological studies. We can vary the age or egg production status of the hens and house them under precisely selected environmental conditions. We can choose which SE strain the birds will be exposed to, by what route and at what dosage level they will be exposed, and we can provide an opportunity for horizontal and vertical transmission of SE to other birds. We can collect a wide variety of samples from each hen, at known intervals following exposure, and we can assess the effects of intervention treatments on this range of measured responses.

We have characterized the experimental SE infections on the basis of several principal parameters. The frequency and duration of intestinal colonization has been measured by cloacal swabbing. The total egg production of each group of hens has been recorded before and after exposure to SE. The production of eggs with shells or contents contaminated by SE has been monitored. The dissemination of SE to several internal organ sites has been examined. And, finally, we have looked at several qualitative and quantitative aspects of the serological response of hens to SE infection.

Intestinal Colonization

Intestinal colonization following SE inoculation has been evaluated by the weekly collection of cloacal swabs from each hen. Most of the swabs from orally inoculated hens were SE-positive at one week post-inoculation. The percentage of SE-positive cloacal swabs declined gradually during the subsequent weeks, but a small percentage of hens was found to be colonized for as long as 22 weeks. Other hens were not orally inoculated, but were exposed to horizontal contact transmission of SE from inoculated birds. Although the frequency of cloacal swab isolation of SE from contact-exposed hens was comparatively low, a few of these hens demonstrated highly persistent intestinal colonization.

Egg Production

We examined the effects of experimental SE infection on total egg production by comparing the exposed hens to unexposed, sham-inoculated control hens. We have conducted similar experiments with hens of several different ages at the time of inoculation. The control hens in each trial maintained fairly constant egg production values throughout the experiment. Daily total egg production by SE-exposed hens, however, dropped sharply during the first two weeks post-inoculation and then showed signs of recovery.

SE-Contaminated Eggs

In preliminary experiments with several SE isolates we found that a small percentage of the shells of eggs layed by infected hens were contaminated by SE (at frequencies that paralleled those for intestinal colonization), but no *Salmonella* was recovered from the contents of these eggs. In subsequent trials with a few other SE cultures, however, we observed a distinctly different pattern. Hens infected with SE6 produced eggs with contaminated yolks and albumens for as long as 23 days after inoculation. Some contact-exposed hens also produced eggs with contaminated contents. The highest frequency of production of eggs with SE6-contaminated yolks or albumens occurred between approximately the 3rd and 11th days post-inoculation.

Our recovery rate of SE from yolks and albumen after 48 hours of incubation of egg material in enrichment broth was significantly higher than after only 24 hours. We interpret this as indicating that the actual numbers of contaminating SE6 cells in the egg contents were relatively low. We also evaluated approximately 400 samples of yolk membrane and albumen. Although many of these samples came from yolks that were subsequently found to be SE-positive when the whole yolk was sampled, we isolated no *Salmonella* from the yolk contents. This suggests, in our opinion, that the initial contamination was of the yolk membrane and/or albumen.

SE in Internal Organs

We found SE6 in the ceca of most orally inoculated hens when sampled during the first three weeks after inoculation. SE was recovered from the majority of the livers and spleens and many of the ovaries and oviducts of inoculated hens. Samples from all of these internal organ sites have been identified as SE-positive for up to 22 weeks after inoculation. We also isolated SE from the internal organs of contact-exposed hens, but at lower frequencies than from inoculated birds.

Serological Testing to Identify SE-Infected Hens

We collected blood at weekly intervals and examined it for anti-SE antibodies with three conventional agglutination tests. Antigens prepared from a variety of strains of *S. enteritidis* and *S. pullorum* were utilized in these assays. *S. pullorum* has historically been of significant interest to the poultry industry as the cause of an important systemic disease of chickens and is antigenically very closely related to *S. enteritidis*. *S. pullorum* antigens are commercially produced and therefore readily available, and should be sufficiently cross-reactive to detect antibodies to SE.

We compared a rapid whole blood plate test, a tube agglutination test, and a microagglutination test for their sensitivity in detecting SE-infected hens. All three tests identified most infected hens and indicated that the hens mounted a rapid serological response to SE infection, with the percentage of birds identified as seropositive peaking at three weeks post-inoculation and declining gradually thereafter. As late as 18 weeks post-inoculation, however, the majority of the exposed hens were still seropositive. Contact-exposed hens also became seropositive, although more slowly and at lower peak levels than their orally inoculated counterparts.

Although no consequential differences were identified in the sensitivity of the various tests, the detection of infected hens varied considerably with the use of different antigens. For example, the percentage of exposed hens identified as seropositive with the microagglutination test using an antigen prepared from a poultry SE isolate was greater than that obtained with an antigen prepared from a SE strain of human origin. The sensitivity of a *S. pullorum* antigen was even lower. All antigens tested, nevertheless, identified most exposed hens as seropositive.

Characterizing Experimental SE Infections

Opportunities for the detection and control of SE can be assessed by considering the chronology of some of the parameters of experimental infection. The rate of intestinal colonization peaked very quickly after exposure and then gradually declined over time, although many birds showed evidence of very persistent SE colonization. The dissemination of SE to internal tissues similarly resulted in the persistence of SE for several months in some internal organ sites. The adverse effects of infection on total egg production were transient, and a trend toward recovery to production values similar to control hens was observed after the third week post-inoculation. Most infected hens mounted a rapid serological response to SE that was easily detectable by standard agglutination tests for a long period after exposure. The production of contaminated eggs, however, occurred only during a comparatively brief interval following exposure. Serological and bacteriological tests thus detected infection long after the hens had ceased to produce SE-contaminated eggs.

Opportunities for Further Research

Several unresolved issues merit further consideration in subsequent studies. First, the minimum exposure dose of various SE strains required to produce pathological effects and contaminated eggs must be determined. Second, the sensitivity and specificity of techniques for detecting infected flocks need to be further refined. Third, the numbers of SE cells in eggs produced by infected hens and the effect of storage conditions on these numbers must be determined. Finally, the basis for the differences in pathological behavior of various SE strains must be identified, both to permit identification of flocks infected with epidemiologically important strains and to provide a more clearly defined target for the design of intervention and control measures.

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Salmonella enteritidis and Eggs: Assessment of Risk

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This paper was presented at the 76th Annual Meeting of the International Association of Milk, Food and Environmental Sanitarians in Kansas City, MO on August 16, 1989.

For the past eighteen months, I have been working with the Egg Nutrition Center in Washington, DC on methods for reducing the risks of human *Salmonella enteritidis* infections from eggs. The problem involves an increased incidence of *Salmonella enteritidis* infections in humans associated with Grade A shell eggs. Eggs previously have had a good safety record. Foodborne disease problems that have been associated with eggs in the past have usually been due to fecal contamination of unwashed, unsanitary, and/or cracked non-Grade A eggs. To analyze risks associated with eggs, we need to look at all aspects of the problem.

Recent Human Health Problems

A report by the Centers for Disease Control(4) indicated that the incidence of the *Salmonella enteritidis* (SE) infections has increased significantly over the past decade. The increase was most dramatic in the Northeast, where a total of 65 outbreaks were reported between January 1985 and May 1987. Twenty-seven of these outbreaks were believed to be caused by contaminated Grade A shell eggs or foods that contained such eggs. During the two years since this report, the problem has continued to expand. When the rate of increase in the various regions of the United States were compared, it was observed that the increase in the Northeastern states began about 10 years ago, an increase in the mid-Atlantic states began about 1984, and a recent small increase has been observed in the South-Atlantic states.

The new link between eggs and *Salmonella* is of special concern to public health authorities and the egg industry. It appears to be occurring despite the implementation of the Egg Products Inspection Act in 1970. This Act requires the pasteurization of bulk eggs and improved procedures for cleaning, sanitizing and grading eggs. This action successfully eradicated an earlier problem with *Salmonella* outbreaks (not limited to *Salmonella enteritidis*) in the 1960's resulting primarily from eggs with cracked and dirty shells. The new cases caused by Grade A shell eggs raises the possibility that SE organisms were present, not on the shell, but in the interior of the eggs.

We need to place in perspective the risks of eating a contaminated egg, becoming ill from such ingestion, and incurring serious complications. If we understand the risks and the factors affecting them, we may be able to implement appropriate measures to reduce or eliminate the risks.

To determine the factors affecting risks, we need to review some past outbreaks. In one review of six outbreaks traced to eggs, five of the outbreaks were caused by improper food handling techniques(1,3). The first outbreak was traced to locally made creamed pies sold at a farmer's market. Lack of proper refrigeration of the cream pies with potential increase in bacterial numbers was cited as a contributing cause of the outbreak. The second outbreak was caused by montecristo sandwiches. Montecristo sandwiches are prepared from slices of turkey, ham and cheese which are placed between 2 slices of bread which has been dipped in raw eggs and grilled. A contributing factor was that the eggs were pooled and held overnight before use which may have permitted growth of the organisms. The third outbreak was caused by hollandaise sauce. Hollandaise sauce is made with raw eggs. Substantial time/temperature abuse was cited as a contributing factor. The fourth outbreak was caused by scrambled eggs served to job corps trainees. Again, pooling raw eggs before cooking was cited as a contributing factor. The fifth outbreak was caused by scrambled eggs served at a nursing home. Pooling the raw eggs, holding them overnight, and insufficient cooking were listed as contributing factors. Also, a contributing factor is that nursing homes contain elderly, debilitated, and immunocompromised people; this is the group with the greatest susceptibility to disease. The sixth outbreak was caused by homemade ice cream served at a preparatory school. Although, a careful epidemiological investigation was conducted, no food handling abuses were noted.

From the facts learned in the epidemiological study of outbreaks, we know that most egg-associated *Salmonella enteritidis* outbreak are caused by food handling abuses, and that certain factors increase risks of infection. Some of these factors are as follows: 1) exposure of highly susceptible individuals such as those that are very young, very old, debilitated, or immunocompromised; 2) cracking a large number of eggs at one time and combining them (frequently referred to as pooling); 3) exposing eggs to time and temperature abuse (leaving pooled eggs unrefrigerated for more than 1 hour); 4) eating raw and undercooked eggs; 5) partial cooking of eggs; 6) reheating partially cooked eggs; 7) use of cracks, checks or leaker type eggs; 8) mixing egg shells with egg contents; and 9) poor blender sanitation.

Facts about *Salmonella enteritidis* and Eggs

Shell eggs are relatively free of bacteria compared to other foods. Intact eggs have a built-in protection against bacterial invasion and growth. The first is the egg shell and shell membranes, which if intact, protects the egg against the invasion of bacteria. There are also antimicrobial substances in the albumen. Once eggs are broken out, these protective barriers are no longer in place. As Dr. Baker has already discussed in this Symposium, the strain of *Salmonella enteritidis* causing egg-associated outbreaks has the usual sensitivity to heat and is killed by pasteurization or cooking. On the other hand, *Salmonella* organisms may grow rapidly in the egg mixture at warm temperatures. At ideal medium and temperatures, bacterial cells may divide every 15-30 min, and at this rate the number of bacteria may increase as rapidly as 10-fold per hour. In other words, one bacterial cell could possibly increase to 1,000,000 cells in 6 hours under ideal conditions. Therefore, it is not surprising that the occurrence of *Salmonella enteritidis* outbreaks show a seasonal pattern, and that these outbreaks occur more frequent in the Summer. This is often seen with food related outbreaks, because picnics and other outdoor outings occur more frequently in the Summer, creating more opportunities for foods to be left unrefrigerated in warm weather, resulting in more ideal conditions for bacterial growth.

Pathologic testing of infected hens have shown that the *Salmonella enteritidis* strains implicated in the recent egg-associated outbreaks cause systemic infections in hens, infect the ovary of the chicken, and may contaminate the yolk of the egg, rather than the egg shell. This may also be related to the seasonal pattern of *Salmonella enteritidis* outbreaks associated with eggs. There would be more opportunities for *Salmonella* organisms to grow in shell eggs exposed to warm Summer temperatures.

Studies do not indicate that this particular strain of *Salmonella enteritidis* is more pathogenic for humans than other strains. The fact that the *Salmonella* organisms are naturally deposited by the hen on the internal portion of the egg, rather than the egg shell, may explain why this particular strain of bacterium is more likely to survive the cooking process and cause human disease.

There are other significant facts that we have learned about *Salmonella enteritidis* during the recent crisis: 1) a very small number of layer flocks pose a risk for *Salmonella enteritidis* infections in humans, and when a flock is positive, less than 1 in 1,000 eggs will be contaminated; 2) very few birds are infected, and when a bird is infected with *Salmonella enteritidis*, only about 1 in 200 eggs from infected hens will be contaminated; 3) very few eggs are infected, and even when eggs are collected from farm area known to be endemic for this organism, only about 1 in 10,000 to 14,000 eggs are contaminated; 4) about 0.9% of eggs are thought to be eaten in dishes requiring no cooking, but the number of eggs eaten undercooked is not known.

How Risks are Increased

The most important risk factors for egg-associated *Salmonella enteritidis* infections are pooling of large numbers of eggs, and permitting the pooled eggs to stand unrefrigerated. The increase in risk are proportional to number of eggs pooled. One contaminated egg contaminates the whole mixture. Cracking and combining 100 eggs may increase the risks 100-fold. Undercooking the mishandled egg is the next step in food handling abuse leading to human infections. In outbreak situations, multiple factors usually are involved.

In a recent outbreak investigation reported by Lin, *et al.*(2), numerous food-handling problems were reported. The following is a quote from their paper: "The eggs used in preparing the scrambled eggs were cracked by hand and stored in a 20 gallon container prior to cooking. As many as five cases (1800 eggs) might be cracked at one time, with the egg mixture sometimes left without refrigeration for up to six hours prior to cooking. Additional eggs would sometimes be added to the existing supply of egg mixture, and egg mixture left over at the end of the day might be refrigerated for use the following day. Scrambled eggs were cooked in volume to serve the breakfast bar. The cooks were advised not to overcook the eggs because the maintenance temperature (77°C) on the breakfast bar unit would continue to cook the eggs and dry them out. Cooked scrambled eggs were placed in clean plastic containers. When a new container of eggs was placed in the bar, the old container was removed and any remaining eggs were placed on top of the new eggs. During slow periods, the temperature of the heating unit on the breakfast bar would be turned down to avoid continued cooking and drying of the items on the bar." There were at least 7 serious breaks in food handling techniques.

I estimate that the risk of eating eggs at the implicated restaurant to be more than 2,000-fold greater than the person who prepares his eggs individually and eats them promptly. The reasons are as follows: Up to 1800 eggs were prepared at one time, the egg mixture was exposed to time and temperature abuse, more eggs were sometimes added to raw egg mixture, left over eggs were used the next day, cooks were urged not to over-cook the eggs which might encourage under-cooking, freshly cooked eggs were combined with the previously cooked batch, and the holding temperature was sometimes reduced.

Risk Groups

Therefore, by utilizing risk factor data, we can divide people into at least 4 risk groups as follows:

Risk Group 1 is the group at least risk. This group includes the healthy adult, who usually eats his eggs fully cooked, and rarely eats foods containing raw or undercooked eggs. Assuming this person was eating eggs from an endemic area, where 1 in 14,000 eggs may be contaminated and assuming he consumes 0.9% of his eggs raw, his risk is less than 1 in 1,600,000. Assuming he eats 250 eggs per year and he lives to be 80 years old, his risk is about 1 in 80 lifetimes.

Risk Group 2 also includes the healthy adult, but in contrast to Risk Group 1, people in Risk Group 2 eat eggs cooked sunnyside, soft boiled, and in other ways not fully cooked, but people in this group consume Grade A eggs

prepared and eaten promptly. Even though they eat eggs not fully cooked, any amount of cooking may reduce the number of *Salmonella enteritidis* organisms and thereby reduce the risk. Risk group 2 is at slightly greater risk than Risk Group 1. The risk of Group 2 cannot be calculated, but is very low.

Risk Group 3 is at greater risks than Risk Groups 1 and 2. People in this Group 3 includes the healthy adults who eat eggs not fully cooked, and in addition, frequently eats eggs at restaurants and other places that pool and store eggs before cooking. The pooling and storing of eggs before cooking will increase risk depending on the number of eggs combined. If 10 eggs are pooled and left to stand at room temperature, the risk is increased 10-fold. If 100 eggs are pooled, the risk is increased 100-fold. Or, as we discussed with the outbreak reported by Lin, *et al.*(2), the risks may have been 2,000-fold greater for people eating at that restaurant than the risks for people who prepare eggs individually and eat them promptly.

Risk Group 4 is the highest risk group. People in Group 4 eat eggs handled and cooked in a similar way as people in Group 3, but people in Group 4 are individuals that are most susceptible to infection, such as those people in nursing homes and hospitals. Most outbreaks have occurred among people in Risk Group 4.

In summary, risks are reduced by cooking eggs; even partial cooking reduces the risk. Eggs should not be pooled but should be prepared individually or in small portions. Eggs should be served promptly after cooking. Shell eggs should be refrigerated. After eggs are broken, they should be held refrigerated and used promptly. Food service establishments should use pasteurized eggs for those recipes that require pooled eggs, especially when serving people in Risk Group 4.

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Department of Agriculture

Poultry Affected by *Salmonella enteritidis*

Federal Register, Vol. 55, No. 33, Friday, February 16, 1990

Summary: We are amending our regulations concerning avian and poultry diseases by declaring poultry disease caused by *Salmonella enteritidis* serotype *enteritidis* (SE) to be a communicable disease of poultry in the United States. We are adding restrictions on the interstate movement of chickens, eggs and associate articles from egg production flocks that have been tested for SE and classified as Test Flocks based on positive environmental samples or classified as Infected Flocks based on recovery of SE from internal organs of flock chickens. We are also adding testing requirements for egg production flocks that are identified as possibly being infected with SE, to determine whether the flocks are infected. To control the spread of SE in breeding flocks, and to allow us to trace and control its spread from breeding flocks to egg production flocks, we are also adding requirements regarding egg-type chicken breeding flocks. Such flocks must be classified "U.S. Sanitation Monitored" under the National Poultry Improvement Plan, or meet a State plan determined by the Administrator to be equivalent, in order for the hatching eggs and newly-hatched chicks from the flocks to be moved interstate. These actions are considered necessary to prevent the spread of disease caused by SE in poultry flocks in the United States.

Supplementary Information: The bacterium known as *Salmonella enteritidis* serotype *enteritidis* (referred to below as SE) is associated with clinical disease problems in poultry, and is known to occur in poultry in the United States. In recent years this bacterium has been isolated from egg-type chicken breeding flocks and egg production flocks. Recent scientific evidence has shown vertical passage of SE from hens to chicks, and suggests that SE may be passed along to eggs before shell formation occurs if the laying hen is infected systemically with SE bacteria.

In addition to this vertical mode of transmission, SE can be spread horizontally among poultry through direct contact and through contact with articles associated with infected poultry, such as feed, pens and litter.

SE is a serious poultry disease and public health concern that shows no sign of abatement, but instead appears to be increasing. During the past three years, SE has infected a number of domestic commercial egg-laying chicken flocks, causing morbidity and decreased production, and has also contaminated a quantity of commercial table eggs, causing a growing number of cases of human illness and death.

The domestic egg industry is organized in a pyramidal structure, with primary breeder and multiplier flocks, which number approximately 900, at the top of the pyramid. The primary breeder and multiplier flocks then supply offspring to form the base of the pyramid which consists of approximately 3,500 commercial laying flocks. The National Poultry Improvement Plan (NPIP), an industry supported national system with oversight by the Animal and Plant Health Inspection Service (APHIS), United States Department of Agriculture (USDA), was amended in 1989 to require SE testing in participating primary breeding and multiplier flocks (see Docket No. 89-049, 54 FR 23953-23958, June 5, 1989). The basis for these amendments was the recommendations of the voting delegates to the biennial conference of the NPIP held in June of 1988.

There is also concern that the Voluntary Model State Program adopted by a USDA/Food and Drug Administration task force has not been completely implemented, and may lack standardization, proper reporting, and shared information. The result is an increase in the magnitude of the SE problem. Intensified Federal efforts are necessary at this time to enable containment of SE and to control the spread of SE in egg-type breeding and production flocks. If not controlled, SE will continue to spread and will cause adverse economic impact on the table egg industry by lowering productivity and decreasing demand for eggs due to lack of consumer confidence that eggs are a safe food. Increases in SE in egg producing flocks would also increase the risk of SE spreading to broiler and turkey flocks, threatening even larger segments of the poultry industry.

To control these risks, we are adding two sets of regulatory requirements; one to address the spread of SE in primary and multiplier breeding flocks, and one to address the spread of SE in egg production flocks.

First, we are requiring that all hatching eggs and newly-hatched chicks from egg-type chicken flocks moved interstate must be classified "U.S. Sanitation Monitored" under the NPIP, or meet the requirements of a State classification plan determined by the Administrator to be equivalent to the "U.S. Sanitation Monitored" program under

the NPIP. Such flocks, which are called "Certified *Salmonella enteritidis* serotype *enteritidis* Tested Free Flocks" for the purpose of this regulation, may move hatching eggs and newly-hatched chicks interstate without further restriction under the regulation. Making this plan mandatory should ensure that the spread of SE associated with breeding flocks will not occur, because flocks must follow testing, sanitation, and flock management techniques designed to exclude SE to quality for classification under the NPIP or a State program determined to be equivalent by the Administrator.

Second we will identify egg production flocks to be studied for possible infection with SE, using reports of clinical signs of disease in these flocks and reports implicating particular egg production flocks as the probable source of outbreaks of SE in poultry or humans. These "Study Flocks" must undergo testing of environmental samples from chickens in the flocks for evidence of SE. Study Flocks with positive environmental samples will be identified as "Test Flocks," and we will restrict the interstate movement of chickens, eggs, and other articles from these flocks. These Test Flocks must be tested for SE through blood tests and culture of internal organs, and those flocks found to be infected will continue to be subject to interstate movement restrictions. This change should reduce the interstate spread of SE in egg production flocks.

News

Seafood Industry Contributes Billions to U.S. Economy

Directly and indirectly, the United States seafood industry contributes $49 billion to the nation's economy. "If recent market trends continue, the economic activity associated with seafood products in the United States will reach $62.9 billion by the turn of the century," says Lee Weddig, Executive Vice President of the National Fisheries Institute (NFI). Of the $49 billion the seafood industry contributes, $20.3 billion is paid as wages and salaries to over 1.8 million full-time equivalent positions.

The NFI is the nation's largest seafood trade association. Its research division, the National Fisheries Education and Research Foundation, released the report entitled *Economic Activity Associated with Fishery Products in the United States* in mid-January.

The report captures all economic activity from the harvesting sector to retailers and restaurants. Of the six market sectors included in the analysis, the food service sector generates the greatest direct and indirect impacts -- $22 billion in economic activity and over 1.2 million full-time jobs. (Throughout the analysis, jobs are defined as full-time equivalent positions.) Processing contributes the next greatest impact -- $13 billion in economic activity and 304,000 jobs. The harvesting sector accounts for $7.1 billion in economic activity and 108,000 workers. Next is the distribution sector, which contributes $3.2 billion to the nation's economy and 69,000 jobs. Finally, seafood sold in retail stores accounts for $3.1 billion in economic activity and 102 thousand jobs.

Using landings, import-export data and industry costs from 1986, the report also breaks down the economic impacts of the seafood industry by domestic products, imports, regions and species. Increases in consumption since 1986 indicate that the economic impacts occurring today are much greater. Nonetheless, this report is the first comprehensive economic analysis to link all sectors of the U.S. seafood industry including exports, aquaculture products and high-seas landings to the nation's economy.

Other results of the study include:

- U.S. produced aquaculture products accounted for $4.15 billion in economic activity of which $1.70 billion in income was paid to 140,000 full-time employees.
- Impacts associated with fish and shellfish caught in the U.S. account for most of the industry totals.
- Annual economic activity amounts to $26.7 billion of which $10.7 billion are wages and salaries.
- Industrial fish products (such as fish meals and oils) have a wholesale value of $170 million.
- Average mark-up from wholesaling to processing is 119%, but varied from 78% for industrial products to 295% for cured and smoked products.

The study was performed by Kearney/Centaur, a division of the international management consulting firm of A.T. Kearney. Copies of the report are available from the National Fisheries Education and Research Foundation. For information on costs and how to order, please contact NFI Communications Department, The National Fisheries Institute, 1525 Wilson Boulevard, Suite 500, Arlington, VA 22209 (703)524-8881.

Michael Del Duca Named President of Jon Donaire Division of Presto Food Products

Michael Del Duca has been appointed president of Presto Food Products' Jon Donaire Division, announced Bruce Coffey, Presto's chairman and chief executive officer.

A 21-year Presto veteran, Del Duca will oversee the sales, marketing and manufacturing of Jon Donaire and Sensational Foods as part of an effort to enhance the full development of Presto's potential in the fast-changing dessert market.

Jon Donaire produces an extensive line of specialty desserts; including cheesecakes, moussecakes and ice cream desserts, which are distributed nationally through Presto's foodservice division. A part of Presto since 1979, Jon Donaire's office and manufacturing facility are located in Santa Fe Springs, CA.

Del Duca joined Presto in 1969 as production supervisor. He was named vice president in 1976 and appointed to the Board of Directors in 1980. He held the post of Presto executive vice president prior to this appointment.

Presto Food Products, Inc. is headquartered at 18275 Arenth Avenue in the City of Industry, CA. For more information contact Berkhemer Kline Golin/Harris, Barbara Beckley at (213)620-5711.

MIF & IICA and NMPF Announce Three-Point Program to Maintain Safe Milk Supply

In a recent letter to Food and Drug Administration (FDA) Acting Commissioner James Benson, Milk Industry Foundation and International Ice Cream Association (MIF & IICA) President E. Linwood Tipton, joined National Milk Producers Federation (NMPF) CEO James C.

Barr, in responding to concerns about animal drug residues found in milk. The letter outlines a three-point program, jointly developed by NMPF and MIF & IICA, to ensure a continued supply of safe and wholesome milk for all those who enjoy dairy products.

"We are once again undertaking a review and analysis of the current situation regarding possible animal drug residues in milk," wrote Tipton, in the January 11 letter to the Commissioner. "The first step of this review has already been taken."

Scientists from many of the dairy industry's major companies and dairy farmer organizations met early last week to discuss the issue. The participants stressed that industry testing results show a much lower incidence of residues than reported in the December 29, 1989 *Wall Street Journal*. They further concluded that industry efforts, beyond those of the regulatory agencies, are effective in preventing milk with illegal drugs from reaching the retail shelf. While reassuring consumers that the milk they purchase is safe, the scientists also committed to developing plants to enhance and strengthen the industry's safety network.

The specific elements of this three-point program include:

1. **An initiation of an immediate review of present testing/monitoring procedures in the Pasteurized Milk Ordinance.**

   This includes examining present methodology for adequacy, efficiency, and developing recommendations for changes, as necessary. Activities will be coordinated with the FDA and the National Conference on Interstate Milk Shipments.

2. **Continuing and expanding a comprehensive dairy farmer and veterinarian animal drug education program.**

   An extensive educational program for dairy farmers and veterinarians about the proper use of animal drugs was undertaken last year. This has been greatly expanded to include guidelines on proper animal drug usage and a quality assurance pharmaceutical checklist for farmers; creating and distributing announcements and flyers delineating approved and unapproved drugs; and conducting educational seminars on proper animal drug usage. Much of the work on this has been completed already and is currently being reviewed by FDA and USDA. As soon as the review is completed, this expanded program will be implemented throughout the country.

3. **Implementing a public information program to accurately inform consumers about the safety of our nation's milk supply.**

   A public information program will be developed to provide facts to consumers and the media regarding actions being taken and about any possible animal drug residues, and their significance, which might be in the food supply.

"To supplement the industry program, we believe FDA must also initiate a review of the same issues and take positive action to ensure that withdrawal times and tolerances for approved animal drugs are realistic, based on the sensitivity of testing methods used and public health significance," Tipton said. "This is an area that deserves the immediate attention of FDA, and we are prepared to work with the Agency in this regard."

MIF & IICA are national trade associations representing milk processors and ice cream manufacturers. Activities range from legislative and regulatory advocacy to market research, education and training. MIF has 220 member companies that process 80 percent of the fluid milk and fluid milk products consumed nationwide. IICA has 200 member companies that manufacture and distribute an estimated 85 percent of the ice cream and ice cream-related products consumed in the United States.

For more information contact Jerry Kozak (202) 296-4250.

Low-Income Kids Score High with School Breakfast Program

Recent findings indicate that breakfast before the bell improves academic performance and school attendance in low-income elementary school children, according to a study published in the *American Journal of Diseases of Children*. Over 1,000 children in grades 3 through 6 eligible to participate in the School Breakfast Program (SBP) participated in the study. Scores were compared on standardized achievement tests and rates of absence and tardiness between those children who qualified and participated in SPB and those who qualified but did not participate. This study by a team of Boston researchers demonstrates the potential benefits and importance of children getting a well balanced meal before school. Administered by the USDA, the SBP assists some 37,000 schools in serving breakfast to 3.7 million kids each day. In contrast, about 90,000 schools serve lunch to 24 million children.

Note to the Elderly: Keep Dairy Diary for Better Health

If you are 65 years of age or older, chances are your diet contains too few dairy products, according to a national study on eating habits of the elderly. The National Health and Nutrition Examination Survey's (NHANES 1) Epidemiologic Followup Study (HNEFS) found, on average, both elderly men and women consume fewer than adequate daily servings of dairy foods. Researchers in

this study also noted that "calcium intakes are marginal for many elderly." The recently published Recommended Dietary Allowances (RDA) suggests persons over age 51 consume 800 milligrams of calcium per day, but many health experts feel a calcium intake of 1,000/mg/day or higher may be necessary to assure the aged person gets enough of this essential mineral. The RDA for calcium can easily be met by consuming 2 to 3 servings of milk and other dairy foods per day.

Milk, Vitamin D May Reduce Risk of Colon Cancer

Drinking your milk may be good preventive "medicine" against colon cancer. A recent study following over 25,000 people for eight years found higher blood levels of vitamin D to be associated with lower incidence of colon cancer, as reported in *The Lancet*. Researchers at the University of California, San Diego Cancer Center feel vitamin D alone probably helps to protect against colon cancer but it may work in conjunction with calcium to lower the risk of the disease. Three daily servings of milk, excellent sources of vitamin D and calcium, provide about three-quarters of the Recommended Dietary Allowances for vitamin D and calcium.

For more information contact Lisa Coe or Kevin Livermore at (312)696-1860.

Rosemount Inc. Acquires Analytical Instrument Company

Rosemount, Inc. has acquired the Tekmar Company, a Cincinnati, Ohio laboratory analytical instrument company, Vernon H. Heath, Rosemount Inc. chief executive officer, announced today.

Tekmar^{R} has become a wholly owned subsidiary of Rosemount Inc. and retains its present name. Lothar Witt, Tekmar Company founder, is the company's chairman and Jim Grote, formerly executive vice president, is the president and general manager. There are no plans to alter the 124-employee Tekmar workforce or its Ohio location.

Founded in 1971, Tekmar manufacturers a series of Purge and Trap Liquid Sample Concentrators which are used with standard laboratory gas chromatographs to do environmental sample analyses which comply with Environmental Protection Agency methods. The Purge & Trap product line accounted for the majority of Tekmar total sales in 1989.

Tekmar serves the laboratory analytical and biological measurement markets, primarily in the environmental laboratory field.

Rosemount, Inc. is a worldwide manufacturer and marketer of high precision measurement and analytical instrumentation, distributed control systems and valves for the process and aerospace industries.

For more information contact Becky Crowder at (612)828-3199 or Robert Cox at (612)828-3201.

Northland Food Laboratory, Inc. Announces Promotion

Jay Hinkens has been promoted to Sales and Customer Service Manager effective March 1, 1990 for Northland Food Laboratory, Inc. Jay's areas of responsibility will include sales and technical service, setting up HACCP programs and technical training and consulting. Jay is a graduate of the University of Wisconsin, Madison. His major was bacteriology and his minor included chemistry and mathematics.

Northland Food Laboratory, Inc. is a full service food microbiology, nutritional and chemical testing laboratory since 1949. It is located in both Green Bay and in Manitowoc, WI.

For more information contact Mr. Steve Kohl at (414)682-7998 or (414)336-7465.

Sparta Brush Announces Management Changes

Joe Larson, Chairman of the Board and Chief Executive Officer of Sparta Brush, has announced the following management changes.

Jack Larson, former General Manager and Executive Vice President, has assumed the office of President and Chief Operating Officer. Milan Peters has been promoted to Vice President of National Accounts. Jack Horner continues as Vice President of Sales, with added responsibilities for administration.

Larson also announced that Jim Dunn has joined Sparta as Vice President of Marketing. Dunn was previously with Lincoln/Wearever, as Regional Vice President.

Sparta Brush Company is a leading manufacturer of high quality specialized brushes for the food service, dairy, process, janitor supply and gourmet industries.

For further information contact Mr. Jack Horner, Vice President of Sales, Sparta Brush Company, 400 Black River Street, Sparta, WI 54656 1-800-356-8366.

National Mastitis Council

Crist Elected NMC President

Bill Crist, Extension Dairy Specialist at the University of Kentucky, was elected President of the National Mastitis Council (NMC) at the organizations's 29th annual

meeting held February 12-14 in Louisville, Kentucky. Serving with Crist this year is Terry Mitchell, Vice President of Sales and Marketing for Babson Brothers Company, Naperville, Illinois. As NMC Vice President, Mitchell is program chairperson for the 1991 annual meeting scheduled for February 11-13 in Reno, Nevada. John Adams, Director of Milk Safety and Animal Health, National Milk Producers Federation, Arlington, Virginia, was re-elected Treasurer, and Leo Timms, Extension Dairy Specialist at Iowa State University was elected Secretary.

The NMC is a not for profit organization that works to increase the quality of milk and dairy products through educational and research efforts aimed at mastitis control. Members include veterinarians, producers, dairy suppliers, researchers, extension agents, regulatory officials, field representatives, quality control personnel and others serving the dairy industry. The NMC brings these groups together to address mastitis problems and related milk quality concerns.

Packaging and Bulk Handling of Teat Dips

The National Mastitis Council technical advisory subcommittee on bulk teat dips has issued the following policy statement regarding the packaging and bulk handling of teat dips:

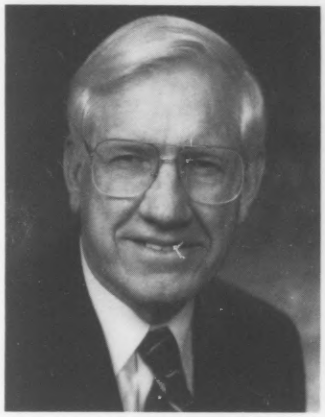
"Teat dips are considered a drug by the Food and Drug Administration (FDA), and must be manufactured in accordance with Good Manufacturing Practices established by FDA. To insure product integrity, teat dips should be purchased in the manufacturers' original, unopened, labeled container directly from the manufacturer or an authorized distributor or agent. On-farm deliveries of teat dips from portable tanks into containers maintained at the farm is not recommended because contamination of the teat dip by any substance will interfere with product safety and efficacy."

The National Mastitis Council works to increase the quality of milk and dairy products through educational and research efforts aimed at udder health, milking management, and milk quality.

For additional information, contact the NMC, 1840 Wilson Boulevard, Suite 400, Arlington, VA 22201; (703)243-8268.

Denton Receives 1990 Harold Macy Award

Dr. Arnold E. Denton, Senior Vice President with Campbell Soup Company in Camden, NJ, has been named the 1990 recipient of the Harold Macy Award. The purpose of the award, which is sponsored by the Minnesota IFT Section, is to honor Harold Macy through the selection of food scientists among academia, government, and private industry who have been exemplary in the transfer of technology.



Dr. Arnold E. Denton

Several of Dr. Denton's accomplishments and activities make him uniquely qualified for this award. Although his entire career has been with the food industry, he has had a long and fruitful relationship with academia. From 1985-1988, he was Chair of the IFT Committee on Research Needs. In this capacity, he led the effort to commission Dr. John Connor, Agricultural Economist from Purdue University, to prepare the first comprehensive economic analysis of the impact of the food processing industry on the U.S. economy. Over 4,000 copies of this book have been distributed to legislators and administrators in state and federal agencies.

In recent years, he has met personally with leaders in USDA and in Congress as a proponent of a new line item for competitive grants in Food Science in the USDA Cooperative State Research Budget. In addition, he has made a strong case for inclusion of value added research in the $500 million Board of Agriculture funding.

He has also worked closely with government agencies, serving on the Board of Directors of USAID Project SUSTAIN, and on the Executive Advisory Committee for USDA's Office of Higher Education's INTERACT. He has been on the review panel for the USDA graduate fellowship program for Food and Agricultural Sciences Needs.

Dr. Denton is a professional member of the Institute of Food Technologists. He is active in many other professional societies including the American Chemical Society, the American Association for Advancement of Science, the American Institute of Nutrition, Phi Tau Sigma, Alpha Zeta and Sigma Xi. He is listed in American Men and Women of Science, and in Who Who's in America.

For more information contact Mike Liewen, General Mills, Inc., 9000 Plymouth Avenue North, Minneapolis, MN 55427.

Douglas L. Marshall

Assistant Professor is Named at Louisiana State University

Douglas L. Marshall has been appointed as an assistant professor in the Department of Food Science, College of Agriculture, Louisiana Agricultural Experiment Station, Louisiana State University. His duties include teaching and research in the area of food microbiology.

He received his B.S. in life science and M.S. in food science and technology from the University of Nebraska and his Ph.D. degree in food science and human nutrition from the University of Florida. He is a member of IAMFES, the Institute of Food Technologists and the American Society for Microbiology.

His research at LSU will focus on conventional and novel approaches to assure the microbial safety of muscle foods, including seafood, poultry and meat.

Industry Urges Immediate Action on Inspection Legislation

"Seafood inspection must be mandatory to be effective . . . it should be administered by the U.S. Department of Agriculture (USDA), . . . and it should be legislated this session of Congress," said Lee Weddig, Executive Vice President of the National Fisheries Institute (FDI) in comments on legislation being considered by an agricultural committee today.

The Institute commends Committee Chairman, Kika de la Garza and Subcommittee Chairman, George Brown, for the early action on seafood inspection legislation in this session of Congress. "With such a rapid start we are optimistic that legislation can be enacted by year end," added Weddig.

"The national association supports the establishment of a dedicated regulatory-inspection system, designed specifically to meet current and future concerns. Like the dedicated systems in place for meat and poultry products, the seafood system should be handled by USDA," he said. An expansion of the current voluntary program cannot be looked on as an adequate response to consumer and industry needs. NFI urges the agriculture committee to report on inspection legislation within the next month. For more information contact: NFI Communications Department, The National Fisheries Institute, 1525 Wilson Boulevard, Suite 500, Arlington, VA 22209 (703)524-8881.

Industrial Wastewater Treatment Brochure Available from Solmar Corporation

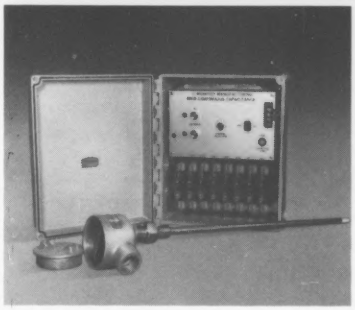
Solmar Corp. announced the availability of a four-page brochure entitled "The Use of Advanced Biocultures in Industrial Wastewater Treatment Facilities."

The brochure discusses the advantages of using bioaugmentation techniques over other methods to meet effluent standards in industrial wastewater treatment. Issues such as malodors, high sludge volumes, hydrogen sulfide corrosion and BOD_5 removals are addressed as problems that can be effectively resolved through the use of prepared microbial formulations. The brochure succinctly discusses how and why to institute a bioaugmentation program. It outlines the variety of benefits to be expected from such programs and takes the reader through a typical treatment schedule to illustrate how these expectations are met.

Solmar Corp. is recognized as the pioneer in the development of micro-organisms for the treatment of organic hazardous wastes and industrial environmental wastes. The company offers a complete line of bacterial formulations sold under the Advanced BioCultures trademark. Solmar's highly trained staff has extensive experience in the field and provides technical support for the use of these biological additives.

For more information and/or copies of "The Use of Advanced Biocultures in Industrial Wastewater Treatment Facilities" contact Solmar Corp., 625 West Katella, Suite #5, Orange, CA 92667. Telephone (714)538-0881.

Industry Products



MK III Continuous Capacitance Level Control System Features Multiple Tank Level Control

The latest in Monitor Manufacturing's series of "Capacitance Probes That Work" is the new MK III with continuous 4-20 mA output. The MK III system is capable not only of providing precise level information on the contents of tanks to 12' in depth, but its controller is capable of handling up to eight separate inputs from probes installed in tanks of varying sizes and shapes, each containing different materials. Each probe in the system is wired to a plug-in I/O card in the console, so that a system can be expanded as necessary without the cost of eight channels of input as a part of the initial investment.

The amplifier/probe module consists of a water tight cast aluminum housing with stainless steel probe. A choice of 3/4" NPT or flange type mounting is available. The probe is available in lengths to 12'. For applications in highly conductive or extremely viscous materials, the probe is available with Teflon coating. The probe may be located up to 2,500' from the control console.

Monitor Mfg/TankMate - Elburn, IL

Please circle No. 241
on your Reader Service Card

The Baker Company offers Eight Page Brochure on their Space-Saving Class II, Type A/B3 Biological Safety Cabinet SterilGARD® 2.5

The Baker Company, Inc. offers an 8-page, 4-color brochure detailing their compact, bench top Class II, Type A/B3 vertical, laminar flow biological safety cabinet, SterilGARD 2.5, ideal for satellite pharmacies, diagnostic laboratories, etc., with limited space. Airflow patterns are discussed and clearly illustrated in color diagrams, including an explanation of Baker's unique zoned airflow principle. Design details are discussed, including HEPA filter rating, testing and installation, motor/blower capabilities, work surface characteristics, and SterilGARD 2.5's construction features. In addition, numerous user-features such as work area lighting, air balance capabilities, work area electrical outlets and the sliding viewscreen are presented. Dimensions, specifications and warranty are also included for this UL® listed safety cabinet.

The Baker Company - Sanford, ME

Please circle No. 242
on your Reader Service Card

New and Economical Digital Scanning Electron Microscope Features Leading Edge Technology

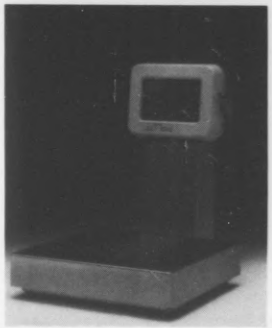
Carl Zeiss is introducing the DSM 940, a digital scanning electron microscope (SEM) specifically designed for routine applications and many research problems. The DSM 940 extends the pioneering digital SEM technology of the Zeiss DSM 950. An integrated frame store and digital controls offer a high-performance instrument that is easy to use, and cost-effective.

Microprocessor controls simplify operation by monitoring functional settings and optimizing operational outputs. This prevents the image from changing if operating parameters are altered.

An integrated frame buffer provides a steady, brilliant, noise-free image for evaluation. Since this image can be read directly into the photographic system, perfect micrographs are assured. For the first time in SEM technology, it is no longer necessary to take a micrograph to see exactly what's in a SEM image. A noise-free image is presented on a large TV monitor, and the image can be recorded on a wide variety of video media, including optical laser disc, still frame video recorders, and video printers.

Carl Zeiss, Inc. - Thornwood, NY

Please circle No. 243
on your Reader Service Card



Weigh-Tronix Introduces the NCI 3270 Checkweigher

This fall Weigh-Tronix is introducing the NCI 3270 Checkweigher in capacities of 6, 12, 30, 60, 110 and 210 lbs.

Immediately noticeable is the three color, fan-shaped graphic display, designed for instantaneous scale reading. Operators doing repetitive work will have no need to read numbers or graduation marks. Under, Accept, and Over are vividly indicated with red, green and amber lighted sections of the display. A simple setup from the controls on the face of the scale allows the selection of target weight, tare, over, under and acceptance range.

The Model 3270 checkweigher switches easily to any one of its four units of measure (lb, oz, kg, and g) and scale settings already entered will automatically adjust to the new selection. RS232 and RS485 outputs are available for tracking scale information with a computer or printer, or networking several 3270's for data collection, yield tests, or Quality Assurance documentation.

Weigh-Tronix - Fairmont, MN

Please circle No. 244
on your Reader Service Card

Free Application Information

Antek Instruments, Inc. offers several brochures detailing various applications using their Pyro-chemiluminescent™ Nitrogen Systems, Pyro-fluorescent™ Sulfur Systems, and Gas Chromatographs. Called *Application Notes*, these brochures are from two to six pages in length. Included in each brochure is information on the application, methods, data, and calculations as well as diagrams, chromatograms, and photos. Titles include:

- •Total Urinary Nitrogen Procedure
- •Insulin Production Monitoring
- •Analysis of Additives in Polyolefins
- •MTBE and Other Oxygenates in Gasoline

Antek Instruments, Inc. - Houston, TX

Please circle No. 245
on your Reader Service Card

Announcing ... Augment GT Pouch

AUGMENT GT powdered bacterial digestor ... THE GOOD GUYS BACTERIA ...is now packaged in a 2 oz. soluble pouch, 40 pouches (lbs) per jar. 4 jars (20 lbs) per case.

AUGMENT GT POUCH enables the user to more accurately and economically measure the necessary quantity of AUGMENT GT powder for drain maintenance. The pouch will dissolve in water within 15 seconds! Rochester Midland recommends pre-dissolving the pouch(es) in a small container, and then pouring into the drain.

AUGMENT GT POUCH maintains clean drains by augmenting natural bacteria with genetically engineered bacterial strains, which rapidly digest oil, fat, grease, starch, cellulose and other organic wastes. These "good guy" bacteria convert solid organic waste to biologically and ecologically acceptable liquid. No damage to the ecology. Beneficial to septic systems and leach fields.

Rochester Midland - Rochester, NY

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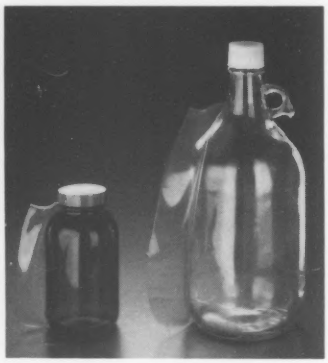
on your Reader Service Card



"Second Skin" Safety Containers

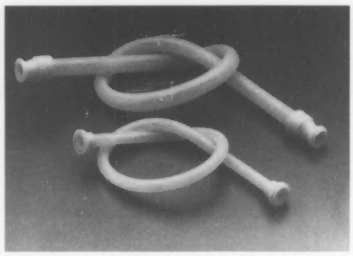
Qorpak has announced the addition of a complete line of "Second Skin" Safety Coated Glass Containers to their already extensive line of glass and plastic bottles.

Qorpak offers bottles and jars with caps attached. The capped containers are offered in the convenience pack, a ready-to-use working stock for the laboratory or the field. Caps and bottles are always together, always clean.

Safety Coated glass containers provide an added layer of safety. In the event of breakage, the plastisol coating contains acids, solvents, alcohols, surfactants, esters, ethers, and glass particles long enough for proper disposal.

QORPAK - Pittsburgh, PA

Please circle No. 247
on your Reader Service Card



Sani-Tech Silastic sanitary tubing features unitized molded silicone end connections for a variety of high purity medical and/or food grade applications.

Built-In Sanitary Gaskets Now Available on Highly Flexible Silicone Medical/Food Grade Tubing

Sanitary gaskets molded directly into unitized sanitary silicone ends provide completely sanitary end connections for versatile, medical and/or food grade applications.

The built-in sanitary gaskets are part of a unitized design that features unrestricted flow. Sani-Tech Silastic tubing sections can be quickly and easily installed into any stainless steel or Sani-Tech sanitary systems, to completely eliminate any potential for sediment build-up.

Available in 1/8" and 1/2" sizes, the smooth bore interior surfaces of the molded silicone ends and tube sections provide the complete bacteria-free conditions demanded in the highest purity operations--making them ideal for sanitary peristaltic pump applications, and chromatographic processing.

Sani-Tech Silastic silicone tubing with built-in gaskets are easily cleaned by CIP or COP methods to save on time, labor and expense.

Sani-Tech - Andover, NJ

Please circle No. 248
on your Reader Service Card

Chili Today - Hot Tamale!

Bulk frozen foods which contain meat have become difficult for the industry to produce. The government regulation to cool the product from 120°F to 40°F in two hours is not an easy task. It becomes even more difficult as the size of the containers become larger.

The Lee Vacuum Cooling System solves this problem in one easy step. The cooking vessel also acts as a cooling chamber in which as much as 1,000 gallons of product can be cooled from 185°F to 40°F in 30 minutes.

A recent test performed in the Lee laboratory in Philipsburg, PA, took 250 pounds of chili meat sauce heated to 190°F and cooled to 50° in less than 30 minutes. The product integrity and flavor were reported to be superior. The greatest concern was the thickening of the product as it cooled. The "fat" sets and makes it difficult to discharge from the vessel. However, by using a 4" full port Lee flush bottom ball valve and Lee's exclusive offset agitator design, this type of high-solid product can easily be forced out to a pump. The vessel is also designed to be pressurized so it can be blown out.

The processing vessel is closed which becomes sterilized while cooking, and can hold the chilled product for hours without the USDA clock running. Waste from transferring is minimized.

Lee Process Systems & Equipment - Philipsburg, PA

Please circle No. 249
on your Reader Service Card

FiSan Tetradet

Oakite Products, Inc. is pleased to announce the launch of FiSan Tetradet, a specially designed heavy duty alkaline powder detergent that removes tenacious residues from stainless steel processing equipment in food plants. It is low foaming and highly chelated for hard water areas. FiSan Tetradet is authorized by the USDA for use in federally inspected meat and poultry plants.

Oakite Products, Inc. - Berkeley Heights, CA

Please circle No. 250
on your Reader Service Card

Free Colorful Guide Outlines Largest Variety of Tubing and Pipe

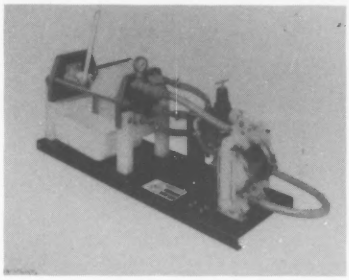
A wide selection of flexible and rigid tubing, pipe and fittings extruded in more than 25 thermoplastic resins is outlined in a colorful new guide from Thermoplastic Processes, Inc.

Thermoplastic offers the nation's largest variety of in-stock specialty tubing and pipe.

Over 1,000 stocked items in flexible and rigid configurations are available in sizes from .01" ID to 6" ID for wide ranging applications in food, laboratory, pharmaceutical, electronic, chemical and general industry. Among the items detailed in the handy guide are lightweight flexible and rigid tubing which offer a transparent, anti-bacterial, non-toxic design to provide safe, effective use in sanitary processing.

Thermoplastic Processes - Stirling, NJ

Please circle No. 251
on your Reader Service Card



Laboratory Filter Press

A small capacity, 0.01 cu. ft. plate and frame filter press is available from SERFILCO for evaluating the filterability of treated metal hydroxide sludges and the determination of moisture content.

Assembly includes diaphragm pump and air controls so a range of flow rates and terminal operating pressures can be established.

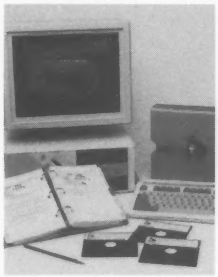
The Laboratory Filter Press allows evaluation and lab analysis of influent, sludge moisture and metals content, and effluent quality before commitment to invest in a production size press.

Filter plates, cloth and air operated diaphragm pump are polypropylene; piping and hose are PVC.

This small press may also be used for testing aqueous solutions, creams, syrups and other liquids for their filterability, solids recovery or effluent quality.

SERFILCO, Ltd. - Glenview, IL

Please circle No. 252
on your Reader Service Card



Enhancements to Powerful SPC Software Announced by Stochos, Inc.

A powerful, menu-driven, statistical process control (SPC) program featuring an enhanced user interface is now available from Stochos, Inc.

Called Custom/QC Version 3, the software is a comprehensive, easy-to-use package for IBM PCs and compatibles that combines fast, meaningful SPC analysis with presentation-quality graphics. Custom/QC enables users to meet growing customer demands for detailed quality assurance (QA) data on critical processes and components.

The new version of Custom/QC incorporates color "pop-up" menus, greater speed, new custom configurations, enhanced control charts, and a wider range of data analysis functions for specialized applications. The basic operating characteristics, which many QA professionals have come to rely on, have been retained. Custom/QC Version 3 offers a number of powerful new features, including:

Although it contains all the sophisticated SPC procedures a user could need, Custom/QC does not require users to learn any computer programming code. With the new user interface, it typically takes just five menu selections to print any one of over 20 available reports.

Stochos, Inc. - Schenectady, NY

Please circle No. 253
on your Reader Service Card

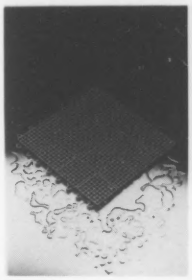
New Traffic Door Combines High-Speed with Low-Maintenance User-Friendly Design

A motorized traffic door that moves traffic quicker, lasts longer and costs less than other motorized doors is offered by Chase-Durus, Cincinnati traffic door manufacturer.

Named "Quicky," the new high-speed industrial door opens and closes in as little as 3 to 8 seconds (depending on door size), minimizing air loss and saving energy. Using two overlapping panels with air space between, they provide a superb air/noise barrier. Panels are made of light industrial PVC or tough long-lasting Hypalon(R). Complete drive mechanism is located overhead where it's inaccessible to lift trucks ...and reckless drivers! USDA accepted construction is easy to maintain and keep clean, which makes it particularly well-suited to dairy, meat and other food processing plans where effective thermal barriers are needed.

CHASE-DURUS - Cincinnati, OH

Please circle No. 254
on your Reader Service Card



McNichols Company Introduces New Product Line - "Flexmat"(R) A Polypropylene and Rubber Interlocking Floor Mat

A new thermo-plastic floor tile matting with a unique locking, flex-joint system, *FLEXMAT* has many features: it is mildew and fungus resistant, non-corrosive, high impact resistant, lessens leg fatigue, requires low maintenance, helps limit breakage of glassware or fragile items, provides for quick drainage and has positive locks for roll-ability. It will not oxidize in sea or marine air and is practically indestructible. Ultra-violet inhibitors make it ideal for outdoor as well as indoor applications.

The polypropylene and rubber combination is characterized by toughness and near-zero moisture absorption.

FLEXMAT comes in black, safety yellow or gray tiles with matching border and corner modules. Marking buttons are also available that snap into the face of the grid pattern to personalize or identify the mat. Other colors are available on inquiry.

McNichols Company - Tampa, FL

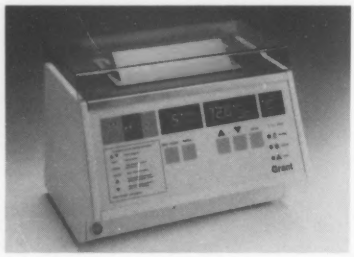
Please circle No. 255
on your Reader Service Card

DYN-A-MED PRODUCTS Announces Improved Glass Fiber Pads

These pads are used in Microwave Units and infrared analyzers for moisture determination of liquids, semi-liquids, dairy, meat and other food products. The new pads are stiffer and easier to handle. There is no crumbling or tearing. Available in three sizes.

DYN-A-MED Products - Barrington, IL

Please circle No. 256
on your Reader Service Card



Autogene: *The Programmable Water Bath for Rapid Temperature Cycling*

Autogene is an advanced system designed to satisfy the requirements of an increasing number of applications for rapid automated temperature cycling within the range 0-99°C.

Using water maximizes efficient thermal transfer, and rapid cycling offers considerable benefits over metal thermostats. **Autogene** provides optimum conditions for accurate and repeatable temperature cycling, and good temperature control with a high degree of stability and uniformity throughout the bath. Suitable for any laboratory environment, it is extremely simple to operate and easy to program. Up to 9 programs can be stored in the memory; a 10th program is available for temporary use for experimental purposes. Each program offers the facility to enter pre- and post-treatment parameters, as well as up to 99 repeats of a cycle. Each cycle provides up to 3 set point/polled segments, and a rapid rate of temperature change between set points.

Science/Electronics - Dayton, OH

Please circle No. 257
on your Reader Service Card

New Medium Simplifies ***Listeria*** *Detection*

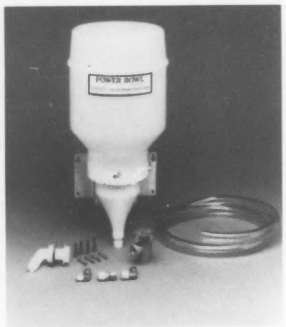
Simplify testing food and dairy samples for the presence of *Listeria monocytogenes* with Bacto Oxford Medium Base. This selective medium isolates and differentiates *Listeria monocytogenes,* which has caused recent outbreaks of food-borne illness resulting in severe illness and death.

The presence of an indicator system within the medium eliminates the need for equipment and preparation of an oblique-transmitted light source for the detection of typical colonies. *Listeria monocytogenes* isolates are capable of hydrolyzing esculin, which results in the blackening of the medium around the colonies. Other bacteria capable of hydrolyzing esculin are inhibited by lithium and antibiotics which are added to the final medium.

Bacto Oxford Medium Base further extends the line of recommended *Listeria* testing media which are available from Difco Laboratories. Oxford Medium Base, LPM Agar Base, Listeria Enrichment Broth, McBride Listeria Agar, UVM Modified Listeria Enrichment Broth and Listeria typing sera are available from leading laboratory distributors.

Difco Laboratories - Detroit, MI

Please circle No. 258
on your Reader Service Card



Power Bowl VI Knight's "Power Bowl" Detergent Dispensers

Knight's Power Bowl VI dry detergent dispenser is a very safe and convenient to use, powder feed system.

The new Power Bowl VI is designed specifically for powder detergent and requires no safety switch hook up to the water solenoid. This bulkfeed unit will accept up to 10 lbs. of detergent at a time and liquifies the powder evenly without internal caking or clogging.

You can "see" the detergent level! Easy to install and service. Comes complete with fittings and vinyl tube for average installation.

Knight Equipment Corp. - Costa Mesa, CA

Please circle No. 259
on your Reader Service Card

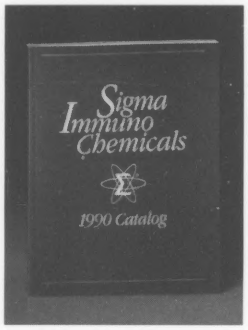
Delco's Compact Versa 200C Pressure Washer Provides Powerful Big Cleaning Performance

Delco's Versa 200C has been designed with the user in mind. This hot water pressure washer is small enough to move and operate easily. Yet it's big enough to blast away dirt, grease and grime on farm equipment, airplanes, sanitation equipment and a variety of other soiled surfaces.

The Versa 200C produces a powerful combination of pressure and flow; 3.6 gpm at 1,200 psi. Other features include an automatic unloader that protects the pump when the trigger is closed, and a vacuum switch that provides protection from low water flow. An adjustable chemical diluation valve assures proper chemical mixture.

Clarke Industries, Inc. - St. Louis, MO

Please circle No. 260
on your Reader Service Card

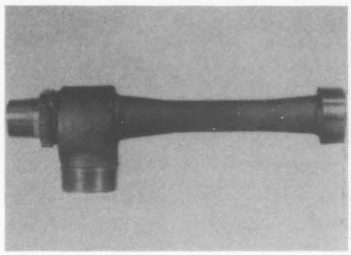


Sigma Immunochemicals 1990 Catalog

Sigma Immunochemicals is proud to present its 1990 Catalog which lists over 1,100 quality immunochemicals and related products. Over 100 new products are offered for 1990 including antisera to drugs with matched enzyme, fluorochrome or radiolabeled ligands developed for use in RIA, EIA or fluorescent immunoassays. Purified growth factors and antisera to growth factors, monoclonal antibodies and their FITC and Biotin conjugates, and antisera for immunohistological applications have also been expanded for 1990. These innovative new products compliment a broad range of traditional immunochemical reagents all developed, manufactured and tested by Sigma Immunochemicals. Comprehensive technical assistance and product information is available through a Toll-Free Immunochemicals Technical Service Number.

Sigma Immunochemicals - St. Louis, MO

Please circle No. 261
on your Reader Service Card



Penberthy Jet Products

Though the use of jet pumps and eductors seems mysterious, they offer a practical solution to many processing tasks. Penberthy has manufactured jet products for over 100 years to pump liquids, gases, slurries, steam or granular materials, as well as heat or mix liquids and gases. Jet pumps may also be used to enhance the operation of conventional pumps.

The Penberthy jet product line includes eductors, heaters, injectors and flocculant dispersers. Jet products may be designed for applications ranging from heavy industrial to sanitary; and constructed of nearly any desired material from plastic to stainless steel. The absence of moving parts eliminates maintenance of Penberthy jet products, thereby offering additional cost savings to their low initial cost.

Penberthy, Inc. - Prophetstown, IL

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Lubriplate Div. Fiske Bros. Refining Co.

Lubriplate's new FGL-1 is the next generation in food machinery lubricants. It is exceptionally resistant to hot water and caustic solution washdowns and is fortified with anti-rust, anti-corrosion and anti-wear additives which give it an excellent load carrying capability to deliver significantly longer lubrication life.

Lubriplate FGL-1 is also USDA H-1 approved for use in food processing and federally inspected meat and poultry establishments. It has outstanding stay-put characteristics and maintains consistent stability to help reduce grease consumption. Lubriplate FGL-1 is non-separating in pumping devices and high speed equipment and it is an NLGI #1 density lubricant.

Fiske Bros./Lubriplate Div.
Newark, NJ

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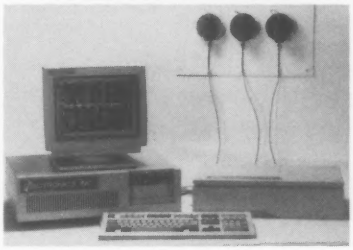
on your Reader Service Card



Multipoint Oxygen Monitoring Systems (MOMS)

Alerts workers to oxygen deficiencies around packaging or freezing lines, in up to 16 points.

The Neutronics Multipoint Oxygen Monitoring System (MOMS) continuously monitors ambient air oxygen levels for worker safety around flushing and freezing lines that utilize nitrogen or carbon dioxide. Operators can see the safety status of up to 16 points with a quick glance at the color-coded bar chart display. Full screen, menu-driven video displays make operation easy. Password protected, user definable alarm setpoints provide for a wide variety of alarm solutions. The complete PC based system features automatic calibration, on-screen instructions, tutorial and troubleshooting. Neutronics oxygen sensors may be mounted thousands of feet from the main terminal.

Neutronics, Inc. - Exton, PA

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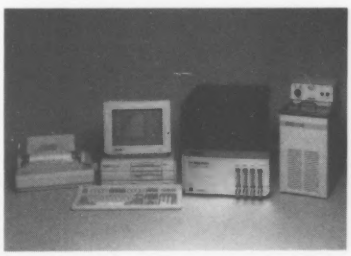

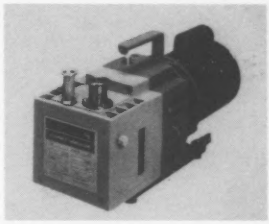

Single- and Two-Stage Direct Drive Vane Pumps

Kinney Series KVS and KVC vane pumps offer superior performance in single- and two-stage designs void of belts, pulleys, or other external moving parts.

All KVS and KVC models are functionally vibration-free and compatible with a wide range of instruments. Systems offer free air displacement from 1.6 to 5.8 cfm and are protected by fail-safe oil feed mechanisms which prevent reverse oil flow if the pump should stop under vacuum.

Both KVS and KVC Series pumps are quiet and portable. Built-in oil pumps assure proper lubrication even at high inlet pressures.

KVS and KVC Series pumps offer superior performance in a wide range of applications and are an inexpensive alternative for use in laboratory and in industry.

Kinney Vacuum Company - Canton, MA

Please circle No. 265
on your Reader Service Card

MOCON Announces Measure Barrier Oxygen Permeation at Very-Low Levels with Precise Relative Humidity, with the New Ox-Tran 300H

With new sensor capabilities, very-low oxygen transmission rate (O_2TR) testing of films and packages can now be performed, and at precise relative humidities. The new OX-TRAN 300H from MOCON incorporates an extremely sensitive, patent-pending, self humidifying sensor which provides for extended dry testing capabilities, without damaging the sensor. The "H" version of the OX-TRAN series allows for testing O_2TR at *precise relative humidities* while at levels 20 times more sensitive than previous systems. This new state-of-the-art OX-TRAN is the choice for testing today's sophisticated barrier materials.

MOCON - Minneapolis, MN

Please circle No. 266
on your Reader Service Card

Food and Environmental Hazards To Health

Lung Cancer and Exposure to Radon in Women - New Jersey

In 1985, the New Jersey State Department of Health (NJDOH) initiated an epidemiologic study of lung cancer and exposure to radon in New Jersey women. In collaboration with the New Jersey State Department of Environmental Protection and the National Cancer Institute, NJDOH examined whether exposure to radon in homes is associated with increased lung cancer risk.

This study was based on a previous statewide case-control study of risk for lung cancer. In that study, cases were defined as lung cancer diagnosed in women (n=994) between August 1982 and September 1983; controls were 995 women selected from drivers' license, Health Care Financing Administration, and death certificate files. The 1985 radon substudy focused on New Jersey dwellings in which participants had lived for at least 10 years from 10 to 30 years before lung cancer diagnosis or control selection.

For a 1-year period, radon concentrations, in living areas were measured by alpha-tract detectors. In basements, 4-day exposures were measured using charcoal canisters to provide rapid screening assessments for current residents, thereby enabling immediate remediation if necessary, and providing alternate data in the event year-long measurements of radon could not be completed. Mean differences in duplicate alpha-track measurements, conducted for about 10% of the residences, were considered sufficiently small to exclude measurement error as a major contributor to exposure misclassification.

Analysis of exposure data by radon concentration for 433 cases and 402 controls found no statistically significant differences. However, the trend for increasing risk for lung cancer with increasing radon exposure was statistically significant. When cumulative exposure (concentration multiplied by duration) was considered, a similar but not statistically significant trend of increasing risk with increasing exposure was seen.

The relative risk coefficient (i.e., the increase in lung cancer risk over background risk per unit of cumulative exposure) was 3.4% (90% confidence limits=0, 8.0%) per working level month.* In studies of underground miners, for whom the occupational exposures were much higher, the range was 0.5%-4.0% per working level month. Analyses by smoking categories indicated that, for persons who smoke <15 cigarettes a day, the association between radon exposure and lung cancer was strongest.

The data indicated that year-round exposures in living areas were two to five times lower than basement measurements taken during heating season. The difference increased with higher concentrations. For example, the average annual living area radon concentration was generally below 4 pCi/L (the Environmental Protection Agency's maximum exposure guideline) in houses with basement screening results approaching 20 pCi/L.

Editorial Note: Radon is a chemically inert gas produced by the radioactive decay of uranium. The immediate decay products of radon are chemically reactive metals (polonium, bismuth, and lead) that tend to be retained in the lung when inhaled. The polonium decay products emit highly ionizing alpha particles. Studies of underground miners, animals, and dosimetry modeling have shown that radon decay products are lung carcinogens. In particular, epidemiologic studies of miners have shown a strong and consistent dose-response relationship between lung cancer and radon exposure. However, information on residential risk from exposure to radon has been limited, and other residential studies either have not addressed other risk factors for lung cancer, such as smoking, and/or have not measured radon in the houses of all participants.

The New Jersey study is the first major epidemiologic study of radon exposure and lung cancer that used both measurements of radon levels in homes and detailed smoking histories for participants. NJDOH believes its findings support the use of the studies of miners for risk extrapolations to the residential setting.

An important limitation on the interpretation of this study is the small number of persons who were in the highest radon-exposure categories. NJDOH also considered other possible biases introduced by reducing the potential study population to persons for whom radon-exposure estimates were collected.

The relationship between short-term screening measurements and year-round living area measurements requires improved characterization for public policy purposes and clear understanding before remediation decisions are made. When winter and summer short-term measurements are averaged to obtain year-round exposure estimates, overestimations may result.

NJDOH has recommended that existing actions to reduce radon exposure to the lowest feasible levels should be maintained pending other research, and remedial action should be taken in New Jersey residences where both short- and long-term testing indicate that typical exposures for occupants exceed 4 pCi/L. This recommendation is based on the limited feasibility of remediating residences with radon levels <4 pCi/L. Building code modification to prevent radon entry may be effective in reducing overall population risks from radon exposure and appropriate New Jersey legislation has been enacted. Health-care providers in New Jersey should advise their patients, particularly those who smoke, of the health risks associated with radon exposure and should consider recommending indoor radon concentration testing.

MMWR 10/27/89

*One hundred seventy hours exposure to any combination of radon daughters in 1 liter of air that results in 1.3 x 10^5 million electron volts of potential alpha energy.

Letter to the Editor

IF IT'S NOT BROKE DON'T FIX IT!

This expresses my feelings regarding a name change in the association.

As I was involved as a member of the Executive Board in 1982-83, I remember quite well the discussions involving this very emotional issue.

Only a hand full of members were really strong for a name change. Many were strongly against the change.

I remember quite clearly, several Sustaining Members expressing doubt they would continue to actively support the association should the word "MILK" be removed from the name.

Although I am not against change, change without sufficient evidence of benefits to the association would be a grave mistake.

We are predominantly a milk, food and sanitarians organization. Adding the name environmental to the name was a positive move in order to better attract this element. We have been moderately successful in this area, and I believe we will be more successful in the future.

Many improvements have been made in IAMFES in the past several years. I believe our membership is at an all time high. Attendance at our annual meetings has been higher the past 4-5 years then ever in our history. IAMFES is recognized by most everyone as a dedicated, active association of great education benefit.

The association was hurt somewhat by the 82-83 move to change our name to satisfy only a few. We have overcome this and we are stronger now than ever before.

Let's not pursue issues that will slow down the positive growth of IAMFES.

Sincerely,
Leon Townsend
IAMFES Past President

Updates . . .

IAMFES Annual Meeting Exhibit Space Still Available

The 77th Annual Meeting of the International Association of Milk, Food and Environmental Sanitarians, August 5-8, 1990 at the Woodfield Hilton & Towers in Arlington Heights, IL, will once again feature commercial exhibits. Over half of the 70 available exhibit booths have already been reserved. These exhibiting companies will display new products, services and technologies in a variety of areas. Equipment, product and service areas covered by the displays include:

- Dairy & Food Microbiology
- Dairy & Food Processing
- Sanitation
- Pest Control
- Foodservice
- Waste Treatment
- Education/Information
- Quality Control

The IAMFES Annual Meeting Exhibits provide a unique opportunity for personal interaction between attendees and exhibitors. Each IAMFES member is invited to encourage his or her company to reserve an exhibit booth, before they are all filled. For more information on the IAMFES Annual Meeting Exhibits, please contact Scott Wells at the IAMFES Office, (800)369-6337 or (515)232-6699.

What's Good For You??

R.H. Schmidt, Prof.
Food, Science & Human Nutr.
Univ. of FL, Gainesville, FL

Each day we place upon our plates, much goodies to devour,
From sweets to eat, fats so neat, and lumpy cauliflower,
We are told each day by experts what to eat or to avoid,
Being ever mindful of the presence of the "noid."

Today cholesterol is bad for you, tomorrow it's okay.
The saturation level's the real devil; Be sure to exercise and play.
The fatty acid composition is as important as can be.
Stoaric or palmitic which one shouldn't we see.

They say, "virtues lie with fish oils with those wondrous omega 3's".
Eat oat bran, and avoid that tan; and life should be a breeze.
Calcium is always good for you, and sodium's bad of course.
But also be careful to include the proper fiber source.

Fibers yes are different, and some are not so good.
With all their cells and hemicells, some just taste like wood.
But one thing is certain, you can bet your last thin dime,
All of them will do their best to decrease that transit time.

And now everyone is worried, I'm not meaning to be snide.
But alar is in our apples, and grapes have cyanide??
And don't forget our big concern throughout this wondrous nation.
That is to say, "Just what are the risks of food irradiation?"

What further problems could there be, I here you say "Alas."
Toxins that will make you ill; bugs to give you gas.
The solution is very simple; I don't mean to be a piet.
Just comb your hair, tie your shoes, and eat a balanced diet.

PS Forum For Professional Sanitarians

Since 1971 the Conference for Food Protection has provided a unique and valuable forum for local and state health agencies, professional organizations, consumer groups and members of the food industry to discuss and exchange information on major food safety issues. While the 1990 Conference is over, the discussions and recommendations from the various work groups are just beginning to shape important food safety agendas for the 90's.

During the next several months this column will focus on issues discussed during the 90 Conference. Sanitarians in local health departments are in a position to significantly influence recommendations made by the Conference to promote food safety and consumer protection.

This year's Conference was especially valuable due in part to the number and quality of food safety issues submitted for discussion. Several of the major issues discussed at the conference were submitted by IAMFES members through their local or state health department and by IAMFES members representing the food service industry. All Sanitarians submitting issues or attending the Conference are to be congratulated for making this year's event a great success.

If you didn't get a chance to attend the Conference for Food Protection you will still have an opportunity to discuss recommendations from the Conference by attending Food Safety Committee meetings during the August IAMFES meeting. Start making plans to attend this year's gathering in Arlington Heights, Illinois, August 5 to 8. Watch the journal for details.

Last February we talked about professional appearance and handwashing during inspections. From Manhattan, Kansas, Judy Willingham, R.S. describes inspection protocols used in the Riley County-Manhattan Public Health Department: "the first thing the inspector does is not necessarily handwashing; it is to don the appropriate hair restraint. The next step is to wash hands at the hand sink. Many times the lack of hot water, soap, or paper towels or evidence of inappropriate usage of the hand sink will be noted at this time."

Judy also raised the question of the Sanitarian's clipboard as a fomite. "I have observed inspectors laying their clipboard down on the floor and later laying the same clipboard on a food contact surface." She adds "If one wants the privileges and rewards of a profession, one must conduct oneself in a responsible manner at all times."

OFF THE CLIPBOARD: - If you need to obtain information on pesticides try the National Pesticide Telecommunications Network. Texas Tech provides a hotline to provide information on pesticide related health, toxicity, and minor cleanup questions. The hotline number is 1-800-858-7378.

- This is a request to IAMFES members on the East coast from New England to Virginia, the Mid-west (Wisconsin and Minnesota), and the Pacific Northwest. Are you involved in Lyme Disease control programs? If you have developed educational materials for the general public on preventing Lyme Disease please send copies to share with other IAMFES members.

- What do smoking 1.4 cigarettes, living 2 months in Denver, or eating 40 tablespoons of peanut butter have in common? Based on assessments methods now being used to determine health risk these factors increase your chances of death by 1 part per million.

- Are any local/state health departments involved in the testing and certification of home water treatment system dealers? The public is being provided all types of information about the quality and health effects of tap water. "Treatment" devices ranging from ion exchange to reverse osmosis systems are now being installed in the home to "protect" the public's health. We would like to receive information on local and state programs.

- In the early 70's the solid waste crisis appeared; then for some reason disappeared. (It wasn't solved, just buried.) With the help of the famous New Jersey Garbage Barge and the Needles on the Beach, the solid waste crisis was again uncovered in the late 80's. A number of Sanitarians are involved in solid waste management. Send us a description of your solid waste program. Do you have Sanitarians participating in the city/county solid waste planning efforts? How about recycling efforts?

- Keep sending your items in for the Field Inspection Quiz. It has been recommended that the best FIQ item submitted from the field be recognized. As recommended, the Great IAMFES Summer Fun FIQ Contest is announced. The Sanitarian submitting the best FIQ item from May through July will receive a "Clean Up America" Tee Shirt. Send your FIQ items to PS, P.O. Box 1832, Frederick, MD 21701.

Homer C. Emery, RS
Chair, FDA Interpretations Committee

May Field Inspection Quiz

1. Lyme Disease is named for:
   A. Dr. Daniel Lyme
   B. Old Lyme, Connecticut
   C. The Lyme Tick
   D. Lyme, New York

2. Lyme disease transmission involves:
   A. Ixodid Ticks
   B. White-tailed Deer
   C. White-footed Mice
   D. All the above

3. The causative agent of Lyme Disease is:
   A. *Ixodid dammini*
   B. *Borrelia burgdorferi*
   C. *Serratia marcescens*
   D. *Thamnidium elegans*

4. An operator has asked you to recommend the safest maximum storage time at 40°F for refrigeration of a ready-to-eat potentially hazardous food. Based on the time for *Listeria monocytogenes* to multiply at this temperature your recommendation should be:
   A. 14 days
   B. 21 days
   C. 5 days
   D. don't worry the current code only requires 45°F

5. A manager has submitted a written HACCP plan for Lemon Chicken "Sous Vide." Control factors (hurdles) in the HACCP plan include: pH of 4.9, water activity of 0.92, cooking temperature of 180°F, and cooling to 45°F within 45 minutes. The manager desires to have a product shelf life of 7 days at current code refrigerator temperatures (45°F). How could the HACCP plan be improved for this menu item?
   A. adjust pH to 4.6 or below
   B. adjust water activity to 0.95 or higher
   C. adjust pH to 5.0 or higher
   D. adjust cooking temperature to 200°F

Answers to April FIQ: 1. (D); 2. (F); 3. (B); 4. (D); 5. (A).

Synopsis of Papers for the 77th Annual Meeting

Abstracts of papers to be presented at the 77th Annual Meeting of the International Association of Milk, Food and Environmental Sanitarians, Inc. to be held in Arlington Heights, IL, August 5-8, 1990.

Effective Control of *Listeria monocytogenes* in a Dairy Processing And Packaging Plant by Isothiazolone Microbicide, *J. Charles Hsu*, Rohm and Haas Co., Research Division, 727 Norristown Road, Springhouse, PA 19477.

The incidence of contamination with *Listeria monocytogenes* in food, especially dairy and beer products, has caused public health concerns. A microbicide, 2-Methyl/5-Chloro-2-Methyl Isothiazolones (MCI), was evaluated for the control of *L. monocytogenes* on the conveyors in a dairy processing and packaging plant. This conveyor lubrication system used about 3,200 gallons of a 1 : 125 dilution of the lubricant per day. The pH of the use-dilution lubricant was 11. Microbial slimes and *L. monocytogenes* were present on the conveyors at the start of trials. The MCI microbicide provided complete control of *L. monocytogenes* when it was incorporated in the use dilution of a conveyor lubricant at a continuous dosing rate of 10 ppm active ingredient. At this use rate, the overall microbial population on the conveyors was also greatly reduced. The same treatment regimen is recommended for most conveyor lubricants to control Listeria on the conveyors.

Combined Effect of Modified Atmosphere Packaging and Low Dose Irradiation on Toxin Production by *Clostridium botulinum* in Pork, *A.D. Lambert*, McGill University, Dept. of Food Science, 21,111 Lakeshore Road, Ste-Anne-de-Bellevue, Quebec H9X 1CO.

The effects of three initial levels of oxygen (0, 10 and 20%), irradiation dose (0, 0.5 and 1 kGy) and storage temperature (5, 15 and 25°C) on toxin production by *Clostridium botulinum* in modified atmosphere packaged pork inoculated with a mixture of proteolytic strains to approx. 10^3 spores/g were investigated using factorial design experiments. Toxin was detected after only 2 days in all treatments stored at 25°C. No toxin was detected in any sample stored at 5°C, even after 44 days. At 15°C, irradiated and non-irradiated treatments packaged with 10 or 20% headspace oxygen were toxic after 14 days. For product packaged with 0% oxygen and an oxygen absorbant, toxin was found after 21 days in non-irradiated samples compared to 43 days for product treated with 1 kGy. Headspace oxygen in product initially packaged with 20% oxygen decreased to 0.1% after 14 days at either 15 or 25°C, with a concomitant increase in CO_2 to 25-40%. For product packaged with 0% O_2 and an oxygen absorbant, oxygen remained at <1.0% throughout the storage trial, while CO_2 increased to an average of 8.4%. Therefore, the initial packaging of product with O_2 appeared to enhance toxin production by *C. botulinum* in product stored at 15°C, probably due to increased levels of CO_2.

Performance of a Colorimetric DNA Hybridization Method in the Detection of *Salmonella* in Dried Pasteurized Egg Products, *G. Riley*, Henningsen Foods, Inc. 14334 Industrial Road, Omaha, NE 68144.

A rapid DNA hybridization method employing a colorimetric detection system was evaluated for use in identification of *Salmonella* contamination of dried pasteurized egg products. A parallel comparative analysis was conducted by the conventional culture procedure of the Agricultural Marketing Service of the U.S. Department of Agriculture (USDA-AMS). A total of 220 samples were analyzed, comprised of multiple samples of ten different dried pasteurized egg product types inoculated with *Salmonella* and/or non-*Salmonella* competitor bacteria. Results indicated false-negative rates for the DNA hybridization method and the USDA-AMS culture procedure of 0% and 3.9%, respectively. It is concluded that the colorimetric DNA hybridization method is an effective procedure for the detection of *Salmonella* in dried pasteurized egg products and offers a more rapid analytical alternative to conventional microbiological methods.

The Effect of Starch Degrading Enzymes on Food Grade, Corn Starch containing Polyethylene film, *A.A. Strantz*, University of Minnesota, Department of Food Science and Nutrition, 1334 Eckles Avenue, St. Paul, MN 55108.

Corn starch has been added to plastic polymers to make biodegradable plastic bags. The effect of starch degrading enzymes on food grade polyethylene (PE) film that contained 6% corn starch (CSPE) was examined. Control PE film with no added starch, CSPE and laboratory grade soluble starch were placed in solutions that contained an excess of alpha-amylase (AA) or amyloglucocidase (AG). The pH and temperature of the solutions were optimized for each enzyme. Samples were removed periodically and were subjected to the Nelson-Somogyi method for the determination of reducing sugar content. Treatment with AA released 20% of the soluble starch as glucose, while only 1% of the starch in CSPE was released. AG activity released up to 50% of the soluble starch as reducing sugar. However, less than 4% of the CSPE starch was liberated. Microscopic examination of films stained in Lugol's Iodine solution showed that enzymatic treatment did not remove surface starch granules. These results indicated that breakdown of CSPE by starch degrading enzymes was limited.

Rapid Identification of Antibiotic Residues by High Performance Liquid Chromatography Coupled with the Microbial Receptor Assays - HPLC Receptor-Grams, *E. Zomer*, Penicillin Assays, Inc., 36 Franklin Street, Malden, MA 02148.

A simple, rapid confirmation procedure has been established to identify and quantitate antibiotic residues in milk, meat, urine, serum and eggs. Samples that were found positive by screening methods, using the Receptor Assay and/or Microbial Inhibition assay, were confirmed, and drug species were identified by the HPLC-Receptorgram method. The procedure involves a fast high yield extraction of antibiotics from the tissue followed by a single step purification using Sep-Pac C-18 hydrophobic columns. These preparation steps take less than 30 minutes. The eluate is concentrated using rotavaporator, re-dissolved in HPLC buffer, then analyzed by HPLC equipped with a fraction collector. Using an isocratic system and Lichrsorb RP-8 column, a single buffer can separate sulfonamides, beta-lactams, and chloramphenicol species into individual fractions in less than 30 minutes. The HPLC fractions with retention time (RT) similar to antibiotic standards are tested and quantitated using the Microbial Receptor assay. Other buffers are used to separate and identify tetracyclines, aminoglycosides, spectinomycin, and macrolides. If multi-group analysis is required a gradient system is needed; however, using the receptor assay for screening eliminates this need. Recovery levels are calculated using radioactive tracers. Limit of detection with the HPLC-Receptorgram for: beta-lactams -- 2-20 ppb, sulfonamides -- 1-10 ppb, tetracyclines -- 50-200 ppb, chlormphenicol -- 50 ppb, aminoglycosides -- 20-100 ppb and macrolides -- 20-50 ppb. The HPLC-Receptorgram has been found to be superior to UV or Fluorescent monitoring because of its group biospecificity, which eliminate interferences.

Affiliate News

The following four candidates are running for Affiliate Council Office. Nominated for Affiliate Council Chairman are Ronald H. Schmidt, Gainesville, FL and James Steele, Edmonton, Alberta, Canada. The two individuals running for Affiliate Secretary are Ruth Fuqua, Mt. Juliet, TN and Helene Uhlman, Hobart, IN. The winners will be announced in the June issue of Dairy, Food and Environmental Sanitation.

Candidate - Affiliate Council Chairman
Ronald H. Schmidt, Ph.D.

Dr. Ron Schmidt was raised on a dairy farm in central Minnesota. He attended the Univ. of Minnesota, receiving his Bachelor of Science degree in 1965 with a major in Dairy Industries, and his Master of Science degree in 1968 in Food Science with a minor in Analytical Chemistry. His MS thesis research related to investigating effects of hydrogen peroxide treatment on milk proteins in cheese processing systems.

Upon completion of his MS degree in 1968, Ron assumed the position of Reg. Milk and Food Consultant with the U.S. Public Health Service, Chicago region. In this role, he was involved in dairy sanitation as federal rating officer for the Grade A-Interstate milk shippers program and in development of food service sanitation programs.

In 1970, he returned to the Univ. of Minnesota where he completed his Ph.D. degree in 1974 with a major in Food Science & Nutrition and minor in Biochemistry. His Ph.D. dissertation research involved the characterization of the peptidase system of cheese starter cultures and their effect on cheese bitterness.

Schmidt joined the Food Science & Human Nutrition Department faculty at the Univ. of Florida in 1974. his appointment was that of teaching/research in which he has had significant involvement in teaching, undergraduate counseling and departmental, college and university committee activities. He has taught undergraduate courses in Food Science, Food Analysis and Food Chemistry and graduate courses in Advanced Food Chemistry, Proteins & Enzymes, Lipid & Flavor Chemistry and Food Fermentations. His research has been primarily directed towards cultured dairy products, flavor chemistry and microbiology. He has authored/coauthored greater than 80 scientific publications and presentations at national/international meetings.

As part of a one year sabbatical, Ron was visiting Assoc. Professor at the Univ. of Minnesota in 1982-83. Since 1986, he has been the Dairy Products Extension Specialist, an extension/research position, and currently holds the rank of Professor at the Univ. of Florida.

Ron has been a long time member of the IAMFES and is president of the Florida affiliate. He has served on several different committees of the International and is currently a member of the 3-A Sanitary Standards Committee. Ron received the IAMFES Certificate of Merit Award in 1987. His impressive list of professional involvement include President (1988-90) of the Institute of Food Technologists (IFT), American Dairy Science Assoc. (ADSA) and American Cultured Dairy Products Institute (ACDPI).

Candidate - Affiliate Council Chairman
James Steele

James Steele is a Food and Microbiology Specialist for Environmental Health Services, Alberta Health, Edmonton, Alberta, Canada. He has worked for the Environmental Health Services since 1979.

As a consultant in Environmental Health Services and to 27 local health authorities, James has had significant involvement in the development, use and interpretation of the Public Health Act and the regulations under this act; is developing and implementing food programs for public health inspection in Alberta; and is determining the acceptable public health limits of toxological data as it relates to food. He also conducts refresher seminars for Public Health Inspectors, and is a member of numerous interdepartmental and Federal/Provencial committees. These include the Alberta Biotechnology Committee, the Antitampering Network, the Food Inspection Agencies Committee, the Tourism Standards Council and the Advisory Committee on Certification in Food Sanitation and Hygiene.

James graduated with a B.S. in Biochemistry and Zoology and 2nd class honors from the University of the West Indies. Later he earned his M.S. in Food Microbiology from the University of Alberta. Prior to this, James attended the Grenada Boys Secondary School, Grenada, West Indies. There he matriculated with the University of Cambridge, receiving 'O' and 'A' level certificates of education.

In addition to this, James has enhanced his education by successfully completing a number of short courses. Through the PAO, he took a Management Development Course and two internal courses - Consulting Skills I and II, learning management and interpersonal theories and skills and the means to apply them. Courses in Applied Epidemiology and Biostatistics, computer programming and a certification course for Supervisors of Retort Operations round out his education.

James has been a member of the International Association of Milk, Food and Environmental Sanitarians for ten years. He has also been very active in the Alberta Association of Milk, Food and Environmental Sanitarians since that time, holding the offices of secretary and president.

Presently, James is the editor of the Sanitarian Review. But, he has found time to do some writing himself, having articles published in scientific journals.

Hockey is an interest of James'. He put that interest together with his managing skills, serving as the manager for a couple of teams in the St. Alberta Minor Hockey Association house league.

Candidate - Affiliate Council Secretary
Ruth Fuqua

Ruth Fuqua, Affiliate Delegate from Tennessee, has been an IAMFES member for 14 years. She also serves on the "Dairy, Food and Environmental Sanitation" Management Committee and Editorial Board. Ruth served as IAMFES membership committee chairman 1986-1988, and was Local Arrangements Chairman for the 1985 IAMFES Annual Meeting in Nashville, Tennessee.

A native of Tennessee, Ruth holds a B.S. degree in Food Science and Nutrition form the University of Tennessee. She has worked in various aspects of quality assurance for Dairymen/Flav-O-Rich, Inc. since 1974. She currently is Director of Quality Assurance for Flav-O-Rich, Inc., Louisville, KY, and oversees all aspects of Plant QA, Regulatory Compliance, Consumer Relations, and Sanitation in Flav-O-Rich's plant Facilities in the Southeast.

Candidate - Affiliate Council Secretary
Helene Uhlman, RPS

A member of International Association of Milk, Food and Environmental Sanitarians' Inc. for over 25 years. During that time has served as Affiliate Chairperson and served on the Executive Board. Has represented IAMFES as liaison person to N.E.H.A. Has served on numerous committees including Farm Methods Committee, Laboratory Committee and Pesticide Labelling Committee. Chaired Bulk Tank Milk Sampling Committee and Pipeline Milking Plans and Standards Committee. Now representing State of Indiana as Indiana Affiliate Delegate and have represented Indiana on the Delegate Council for a number of years. In Indiana, Past President of Indiana Association of Sanitarians. Currently serving as Chapter President and on Indiana Environmental Health Association's Executive Board. Member and serving on Public Relations' Committee for Interstate Milk Shipment's Conference. Member of National Environmental Health Association, Illinois Environmental Health Association, Indiana Environmental Health Association and Indiana Public Health Association. Professional Registered Sanitarian in Indiana and Illinois. Employed with Gary Health Department as Health Co-ordinator in Gary, Indiana.

Upcoming IAMFES Affiliate Meetings

JUNE

•**5-6, Texas Association of Milk, Food & Environmental Sanitarians Annual Meeting,** held at the Howard Johnson-South Plaza, Austin, Texas. For more information contact Janie Park, Secretary, P.O. Box 2363, Cedar Park, TX 78613-2363, (512)458-7281.

•**14, Alabama Association of Milk, Food and Environmental Sanitarians 1st Annual Spring Meeting** will be held in Montgomery, AL at the Hotel Monticello on South Monticello Drive. For further information and agenda, write or call T.A. McCaskey, Dept. Animal & Dairy Sciences, Auburn University, Auburn, AL 36849-5415, (205) 844-1518.

SEPTEMBER

•**13-14, Minnesota Sanitarians Association, Inc.** Annual Conference will start at 1:00 p.m. on September 13 at the Earle Brown Center, University of Minnesota. Annual meeting will start at 4:30 p.m. on September 13 with the Awards Banquest at 6:00 p.m. at the Holiday Inn, Shoreview. For further information call Roy E. Ginn at (612)785-0484.

•**18-20, New York State Association of Milk and Food Sanitarians Annual Meeting,** at the Sheraton Inn-Syracuse, Liverpool, NY. For more information contact Paul Dersam, 27 Sullivan Rd., Alden, NY 14004, (716)937-3432.

•**19-20, Wisconsin Association of Milk and Food Sanitarians Annual Meeting,** Pioneer Inn, Oshkosh, WI. For more information contact Neil Vassau (608)267-3504.

•**26-28, Kansas Association of Sanitarians Annual Meeting,** Red Coach Inn, Salina, KS. For more information contact John Davis, 1900 East 19th, Wichita, KS 67214, (316)268-8351.

NOVEMBER

•**28, Ontario Food Protection Association Annual Meeting,** will be held at the Airport Hilton Hotel, Toronto, Ontario. The title of the all-day symposium is "FOOD PROTECTION: HOT TOPICS FOR THE '90's". For more information, please contact program convenors: Garth Sundeen (416)239-8411 or FAX (416)239-2416 or Patrick Kwan (416)671-5080 or FAX (416)671-5176.

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77th IAMFES Annual Meeting Registration

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Other Fees: (Per Person)

Cheese & Wine Reception (Sun., 8/5)
"Taste of Chicago" (Mon., 8/6)

Art Institute, Lunch, Sears Tower (Mon., 8/6)
Long Grove Shopping, Lunch (Mon., 8/6)
Water Tower Place, Lunch, Shopping (Tues.,
Haeger Pottery Tour, Lunch, Shopping (Tues
Morton Arboretum, Lunch, Shopping (Wed.,
Kraft Cooking Demo (Hotel) (Wed., 8/8)
IAMFES Awards Banquet (Wed., 8/8)

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Send payment with registration to IAMFES, 502 E. Lincoln Way, Ames, IA 50010-6666. Make checks payable to IAMFES. Pre-registration must be post-marked by July 30, 1990. The pre-registration deadline will be strictly observed. For additional information contact Julie Heim at 1-800-369-6337.

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"Registration fees, minus a $15.00 process
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registration may be transferred with written

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ust 5-8, 1990

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Date Rec'd._____ First initial Last name

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	$ 70 ($100 on-site)		_____
	$109 ($139 on-site)		_____
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Mon/Tues/Wed)	$ 40 ($50 on-site)		_____
ircle: Mon/Tues/Wed)	$ 60 ($70 on-site)		_____
_____	$ 15 ($20 on-site)		_____
_____	$ 15 ($20 on-site)		_____
	$ 36		_____
equired)	$ 19		_____
Sanitation		# of tickets	
6)	FREE	_____	- 0 -
	Adult $20	_____	_____
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Mon., 8/6)	$ 25	_____	_____
, 8/6)	$ 20	_____	_____
g (Tues., 8/7)	$ 25	_____	_____
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8)	$ 25	_____	_____

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g cancellation/refunds is as follows:) processing fee, will be refunded for l at least two (2) weeks prior to the will be made for cancellations made he start of the meeting, however, the th written notification to a colleague.

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Make Your Reservation Now

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IAMFES

77th Annual Meeting
Special Events Program

LONG GROVE VILLAGE/HOBSON HOUSE RESTAURANT

Monday, August 6, 1990
9:30 a.m. - 3:30 p.m.
Cost: $20.00 (Includes Lunch)

Turn your watch back to yesteryear and explore the treasures at a crossroads in our country's past! We'll be taking you to Long Grove, a 19th Century village featuring antiques, boutiques and over 100 charming and unique specality shops. Relax and enjoy lunch at Hobson House Restaurant, family-owned for more than 25 years and featuring a homemade, buffet-style lunch served in garden surroundings. Your afternoon is free to continue shopping, sampling fresh apple cider and homemade fudge or simply visiting with friends in a charming atmosphere untouched by progress. **(Tour limited to 46 people).**

ART INSTITUTE TOUR

Monday, August 6, 1990
Cost: $25.00 (Includes Lunch)

One of the World's leading art museums is located in Chicago. This tour will show it to you. You will be picked up at the hotel and driven to the Art Institute. The price of admission is included and Monet's Series Paintings will be on exhibit during the time of your visit. Lunch is provided in the garden level restaurant of the Institute. After lunch you will be taken to the Sears Tower. Here on the 103rd floor of the World's tallest building, you will look down upon the East, West, North and South beauty of Chicago. Admission to the Tower is included. **(Tour limited to 46 people).**

HAEGER POTTERY/MILK PAIL VILLAGE

Tuesday, August 7, 1990
9:00 a.m. - 3:30 p.m.
Cost: $20.00 (Includes Lunch)

The world's largest art pottery awaits you on this guided walking tour of Haeger Potteries. Watch the old world master potter spin works of art on his potter's wheel. You will browse through the factory outlet salesroom and select your favorite art pottery pieces. We've planned a quaint lunch at the Milk Pail Restaurant, nestled in the beautiful woods and fields of Milk Pail Village and famous for its country fare. Following a delicious meal, shop leisurely through over 20 shops of country ware, paintings, clothing, crafts and one-of-a-kind treasures. **(Tour limited to 46 people).**

"MAGNIFICENT MILE" — WATER TOWER PLACE TOUR

Tuesday, August 7, 1990
Cost: $25.00 (Includes Lunch)

Experience the Crown Jewel of Chicago's Magnificent Mile. You will be taken from the hotel, driven along beautiful Michigan Avenue and dropped off at Water Tower Place. Glass-enclosed elevators, fountains and beautiful greenery are just a part of this tremendous shopping and architectural marvel. Not a millionaire? That's O.K., browsing is fun, too! Lunch is provided at "the 95th" — an elite Chicago dining experience. Situated on the 95th floor of the John Hancock building, this restaurant offers an unparalleled view of Chicago. **(Tour limited to 45 people).**

MORTON ARBORETUM TOUR

Wednesday, August 8, 1990
Cost: $20.00 (Includes Lunch)

The Morton Arboretum is a 1,500 acre preserve consisting of native Illinois prairie and forest land and beautiful cultivated gardens. Tour participants will be taken from the hotel to the Arboretum. Once there, an Arboretum Naturalist will come on board the bus to narrate a tour of the grounds. Lunch is included and will be served in picturesque "Ginkgo Restaurant" overlooking Crabapple Lake. After lunch, ample time will be given for browsing in the gift shop, strolling among the flower gardens or viewing a slide show provided by the Arboretum. **(Tour limited to 45 people).**

KRAFT COOKING DEMONSTRATION (WOODFIELD HILTON AND TOWERS HOTEL)

Wednesday, August 8, 1990
Cost: FREE

Kraft Cooking Demo will be held at the Woodfield Hilton and Towers. Details on this event will be published at a later date.

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CIRCLE READER SERVICE NO. 358

3-A SANITARY STANDARDS FOR AIR DRIVEN DIAPHRAGM PUMPS FOR MILK AND MILK PRODUCTS

Number 44-00

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

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

A

SCOPE

A.1

These standards cover the sanitary aspects of air driven diaphragm pumps for milk and milk products.

A.2

In order to conform to these 3-A Sanitary Standards, diaphragm pumps shall comply with the following design, material, and fabrication criteria.

B

DEFINITIONS

B.1

Product: Shall mean milk and milk products.

B.2

Surfaces

B.2.1

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

B.2.2

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

B.3

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

C

MATERIALS

C.1

All product contact surfaces shall be of stainless steel of the AISI 300 series*1 or corresponding ACI*2 types (See Appendix, Section E.), or metal which under conditions of intended use is at least as corrosion-resistant as stainless steel of the foregoing types and is non-toxic and non-absorbent, except that:

---

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

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

C.1.1
Rubber and rubber-like materials may be used for O-Rings, seals, diaphragms, valve seats, check valve balls and flaps, and parts having the same functional purposes.

C.1.2
Rubber and rubber-like materials when used for specified applications shall comply with the applicable provisions of the 3-A Sanitary Standards for Multiple-Use Rubber and Rubber-Like Materials, Number 18-00.

C.1.3
Plastic materials may be used for O-Rings, seals, diaphragms, valve seats, check valve balls and flaps, and parts having the same functional purposes.

C.1.4
Plastic materials when used for specified applications shall comply with the applicable provisions of the 3-A Sanitary Standards for Multiple-Use Plastic Materials, Number 20-15.

C.1.5
Bonded rubber and rubber-like materials and bonded plastic materials having product contact surfaces shall be of such composition as to retain their surface and conformation characteristics when exposed to the conditions of intended use and in cleaning and bactericidal treatment.

C.1.6
The final bond and residual adhesive, if used, of bonded rubber and rubber-like materials and bonded plastic materials shall be non-toxic.

C.1.7
Check valve balls may also be of hard rubber (a vulcanized rubber having a ratio of combined sulfur to rubber hydrocarbon in excess of 15% and a Shore A Durometer value in excess of 90) that is non-toxic and relatively resistant to abrasion, will not affect the product and shall when subjected to the test regimen set forth in the 3-A Sanitary Standards for Multiple-Use Plastic Materials, Number 20-15, as amended (a) comply with the criteria in Section I (1) and Section I (3), (b) have maximum weight gains as set forth in Section I (2) of 0.30 and in the Cleanability Response, 0.30 in Product Treatment with Solution I and 0.30 in Product Treatment with Solution J.

C.2
Non-product contact surfaces shall be of corrosion-resistant material or material that is rendered corrosion-resistant. If coated, the coating used shall adhere. Non-product contact surfaces shall be relatively non-absorbent, durable and cleanable. Parts removable for cleaning having both product contact and non-product contact surfaces shall not be painted.

D
FABRICATION

D.1
All product contact surfaces shall have a finish at least as smooth as a No. 4 ground finish on stainless steel sheets, and be free of imperfections such as pits, folds, and crevices in the final fabricated form. (See Appendix, Section F.)

D.2
All permanent joints in metallic product contact surfaces shall be continuously welded. Welded areas on product contact surfaces shall be at least as smooth as a No. 4 ground finish on stainless steel sheets and be free of imperfections such as pits, folds and crevices in the final fabricated form.

D.3
Rubber or rubber-like materials, hard (vulcanized) rubber and plastic materials having product contact surfaces that are a coating or covering shall be bonded in such a manner that the bond is continuous and mechanically sound, and so that when exposed to the conditions encountered in the environment of intended use and in cleaning and bactericidal treatment,

the rubber and rubber-like material, hard (vulcanized) rubber or the plastic material does not separate from the base material. The final bond and residual adhesive, if used, shall conform to the criteria in C.1.6.

D.4

Pumps that are to be mechanically cleaned shall be designed so that all product contact surfaces of the pump, and all non-removable appurtenances thereto can be mechanically cleaned and are readily accessible for inspection.

D.4.1

All product contact surfaces not designed to be mechanically cleaned shall be easily accessible for cleaning and inspection either when in an assembled position or when removed. Removable parts shall be readily demountable.

D.5

There shall be no threads on product contact surfaces.

D.6

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

D.7

All internal angles of 135 degrees or less on product contact surfaces shall have minimum radii of 1/4 inch (6 mm), except that:

D.7.1

Where for space or functional reasons, such as intricately machined or molded parts, it is impossible to have a radius of 1/4 inch (6 mm), smaller radii may be used. In no case shall such radii be less than 1/32 inch (1 mm).

D.7.2

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

D.7.3

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

D.7.4

When the diaphragm is in its neutral position the angle formed between the diaphragm and the wall of the chamber at the clamping point on the product side shall be not less than 90 degrees.

D.7.5

Wher the diaphragm is in its neutral position the angle formed between the diaphragm and the rod attachment, at the clamping point on the product side, shall be not less than 90 degrees. This requirement pertaining to the clamping point is not applicable if the rod attachment is completely encapsulated by the diaphragm material.

D.7.6

The clamping point(s) on the diaphragm shall be designed so that there is effective liquid sealing at the clamping point regardless of the pumping stroke position of the diaphragm.

D.8

Inlet and outlet connections shall conform with the applicable provisions of the 3-A Sanitary Standards for Fittings, Number 08-17, rev. Parts I and II.

D.9

The chamber on the non-product side of the diaphragm pump shall be provided with a means of detecting a leak in the diaphragm. A detection system capable of sensing the presence of liquid shall be installed in both non-product chambers of the pump. The presence of any liquid may be caused by a ruptured diaphragm.

D.9.1

The manufacturer shall provide the leak detection system which will make the pump stop whenever liquid is sensed on the nonproduct side of the diaphragm.

D.9.2
The leak detection apparatus must be easily removable from the pump and be able to be tested independently. One test method is to submerge the detector probe(s) in a conductive fluid such as water to determine that the pump does stop.

D.10
The pump must be drainable when disassembled for manual cleaning and/or inspection.

D.11
The means of supporting pumps shall be one of the following:

D.11.1
With legs. Legs shall be adjustable, smooth with rounded ends, and have no exposed threads. Legs made of hollow stock shall be sealed. Legs shall be of sufficient length to provide a clearance between the lowest part of the base, pump, motor or drive and the floor of no less than:

D.11.1.1
4 inches (10 cm) on pumps with legs designed to be permanently mounted or fixed to the floor or pumps having a horizontal base area of more than 1 sq. ft. (0.09 sq.m) or;

D.11.1.2
2 inches (5 cm) on pumps having a horizontal base area of not more than 1 sq. ft. (0.09 sq. m) and not designed to be fixed to the floor.

D.11.2
Mounted on a wall or column. If the pump is to be sealed to a wall or column, the base shall be such that it may be sealed to the mounting surface.

D.12
Any guard(s) required by a safety standard that will not permit accessibility for cleaning and inspection shall be designed so that it (they) can be removed without the use of tools.

D.13
Non-product contact surfaces shall be smooth, free of pockets and crevices and be readily cleanable and those to be coated shall be effectively prepared for coating.

APPENDIX

E

STAINLESS STEEL MATERIALS

Stainless steel conforming to the applicable composition ranges established by AISI*1 for wrought products, or by ACI*2 for cast products, should be considered in compliance with the requirements of Section C.1 herein. Where welding is involved the carbon content of the stainless steel should not exceed 0.08%. The first reference cited in C.1 sets forth the chemical ranges and limits of acceptable stainless steels of the 300 series. Cast grades of stainless steel corresponding to types 303, 304, and 316 are designated CF-16F, CF-8, and CF-8M, respectively. These cast grades are covered by ASTM*3 specifications A351/A351M, A743/A743M and A744/A744M.

F

PRODUCT CONTACT SURFACE FINISH

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

These standards are effective September 9, 1990.

*3 Available from ASTM, 1916 Race St., Philadelphia, PA 19103-1187 (215-299-5400).

3-A SANITARY STANDARDS
FOR CROSSFLOW MEMBRANE MODULES

Number 45-00

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

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

A

SCOPE

A.1

These standards cover the sanitary aspects of crossflow membrane modules for use with ultrafiltration, diafiltration, microfiltration and reverse osmosis systems for processing milk and milk products.

A.2

In order to conform with these 3-A Sanitary Standards, membrane modules shall comply with the following design, material, and fabrication criteria.

B

DEFINITIONS

B.1

General

B.1.1

Product: Shall mean milk, milk products or their fractions which are fractionated, concentrated or otherwise processed in this equipment and are to be used for human food. Either or both permeate or retentate are products.

B.1.2

Feed: Shall mean that portion of the product that is about to enter the element. It may include recycled permeate, concentrate or retentate.

B.1.3

Permeate: Shall mean that portion of the product which has passed through the membrane during processing.

B.1.4

Retentate: Shall mean that portion of the product which does not pass through the membrane during processing.

B.1.5

Concentrate: Shall mean that portion of the retentate that has left the system for disposition as final product or for recycling.

B.1.6

Membrane: Shall mean a selectively permeable barrier which can separate a multi-component stream into fractions. This membrane may be polymeric, organic, inorganic or mineral.

B.1.6.1

Asymmetric Membrane: Shall mean a membrane with an integral graded structure having a relatively consolidated surface skin underlain by a progressively more open spongy base.

B.1.6.2

Composite Membrane: Shall mean a membrane which consists of several superposed chemically or physically different layers. (Usually a composite membrane has a thin active surface membrane of one material affixed to an asymmetric supporting membrane of another material.)

B.1.7

Membrane Support Material: Shall mean

porous material used for supporting the membrane.

B.1.8

Feed Channel Spacer: Shall mean the open mesh screen used to maintain spacing between the membranes in elements and to define the channels through which retentate flows.

B.1.9

Permeate Carrier: Shall mean the porous material used for conducting permeate away from the membrane to a collection point in the membrane element. The permeate carrier may be identical with the membrane support material.

B.1.10

Bypass Flow Restrictor: Shall mean a device to direct feed material through the membrane elements' retentate flow channels while allowing a controlled amount to bypass these channels.

B.1.11

Module: Shall mean that part of the membrane equipment that contains the membrane elements, element connectors, and external shrouds or housing. The module interfaces with the system pipelines carrying products to and from it.

B.1.11.1

Boundaries: The boundaries of the membrane module are defined as the connections between:

a. The feed manifold and the feed line(s) to the module.
b. The retentate collection manifold and the retentate line(s) from the membrane module.
c. The permeate collection manifold and the permeate line(s) from the membrane module.

B.1.12

Membrane Element: Shall mean that part of the module which contains the membrane and is replaceable. (The element may be identical with the module and may contain the membrane support material and the permeate carrier.) There are six configurations of elements. These are:

a. Tubular
b. Spiral wound
c. Plate and frame
d. Parallel leaf
e. Hollow fiber
f. Monolithic ceramic

In these different configurations, the membrane support material may be part of the replaceable element or part of the module structure.

B.1.13

External Shroud: Shall mean the impermeable shell which forms the exterior structure of the module. It may provide mechanical strength to resist internal operating pressure and may serve as a permeate collection vessel except for spiral modules where it serves as a feed conduit.

B.1.14

Membrane Element Seal(s): Shall mean that part of the module which is designed to prevent flow between the feed and retentate channel spaces and the permeate space.

B.1.15

Feed Channel Space: Shall mean that flow channel within the module where product is introduced to the membrane element(s) for the purpose of concentration, fractionation or other processing.

B.1.16

Retentate Channel Space: Shall mean that flow channel within the module where products that do not flow through the membrane are discharged from the membrane element(s).

B.1.17

Permeate Channel Space: Shall mean that part of the module where the permeate is collected as it flows from the membrane element(s).

B.1.18

Permeate Connector: Shall mean that part of the module used for making a sanitary connection to the permeate collection line or manifold at the boundary of the module.

B.1.19

Feed Connector: Shall mean that part of the module used for making a sanitary connection to the feed line(s) or manifold at the boundary of the module.

B.1.20
Retentate Connector: Shall mean that part of the module used for making a sanitary connection to the retentate line(s) or manifold at the boundary of the module.

B.1.21
Cross Flow: Shall mean the retentate flows in a direction parallel to the membrane surface.

B.1.22
Through Flow: Shall mean entrance of fluid at one end of a passage and its removal at the opposite end so that the flowing fluid passes without dead areas through the intervening space.

B.1.23
System: Shall mean all mechanical hardware, pumps, pipelines, instrumentation and the membrane module(s).

B.1.24
Membrane Process Equipment: Shall mean equipment in which products are fractionated, concentrated or otherwise processed by a membrane.

B.1.25
Manifold: Shall mean that part of the system to which connections are made to bring product, permeate, or cleaning solution to and from the module.

B.2
SURFACES

B.2.1
Product Contact Surface: Shall mean all surfaces that are exposed to the product or any of its fractions (whether feed, concentrate, retentate, or permeate) and surfaces from which liquid may drain, drop, or be drawn into the products.

B.2.2
Non-Product Contact Surface: Shall mean all other exposed surfaces.

B.3
CLEANING

B.3.1
Mechanical Cleaning or Mechanically Cleaned: Shall denote cleaning, solely by circulation and/or flowing chemical and/or enzyme cleaning solutions and water rinses onto, over, and/or through the surfaces to be cleaned, by mechanical means.

B.4
TUBULAR MODULE

B.4.1
Tubular Module: Shall mean a module whose membrane elements carry retentate in individual, separated, rigid tubes of about 0.2 inch or larger inside diameter. These tubes may be single or multiple elements within an external shroud. (See Appendix F.1.)

B.4.2
"U" Bend: Shall mean that device attached to the end of a tubular element used to reverse the direction of retentate flow and direct it into another tubular element.

B.4.3
Ferrule: Shall mean the fitting(s) attached to the end of a tubular element used for making sanitary connection to a "U" Bend or manifold.

B.4.4
Membrane Array: Shall mean a parallel array of one or more hollow single tubular or multi-channel tubular membrane elements contained within the module's external shroud.

B.4.5
Header: Shall mean the device at the end of a multitubular element that holds the tubes in fixed array and into which they are sealed. Headers may be potted or cast in place, molded, or machined.

B.4.6
Grommet: Shall mean the elastomeric part used to seal tubes into headers. It acts as a membrane element seal.

B.4.7
Expander: Shall mean that device which when inserted into the end of the tube expands it against the grommet and the grommet against the tube sheet to effect a seal.

B.4.8
Membrane Element Support Tube: Shall mean that part of the module which closely supports the membrane element. This tube may be made of a porous composite or stainless steel.

B.4.9
Module End Plate: Shall mean part of

a multi-tube into which the membrane element support tubes are fitted. (Single tube elements may have an individual connector like a ferrule.)

B.4.10

Header Cap: Shall mean that device fitted to the end of a module, used to direct the flow-path of the feed and retentate through the tubular membrane elements in the module. The header cap may:

a. Direct the flow-path through all the tubular elements in parallel; or
b. Connect all the tubular elements in series by means of internally-molded U-bends; or
c. Separate the flow into two or more parallel paths each consisting of two or more tubular elements connected in series by means of internally-molded U-bends.

B.4.11

Supported Metallic Oxide Membrane Module: Shall mean a tubular module whose elements are formed from a rigid porous support on which has been deposited a metallic oxide coating to form the membrane. (See Appendix F.1.3.)

B.4.11.1

End Tubular Plate: Shall mean the drilled plate which holds the membrane elements in position and provides the surface to support and seal the membrane element gasket and counter plate.

B.4.11.2

Counter Plate: Shall mean the bored plate used to compress the membrane element gasket and to conduct retentate flows to the inlet of membrane elements.

B.4.11.3

Inner Spacer: Shall mean the device used to hold the membrane elements in the correct position in the interior of the module.

B.5

Spiral Wound Module

B.5.1

Spiral Wound Module: Shall mean a module element is formed of leaves of membrane, membrane support, feed channel spacer, and permeate carrier wound in spiral fashion around a central permeate collection tube. (See Appendix F.2.)

B.5.2

Anti-Telescope Device (ATD): Shall mean a support for spiral type elements to prevent their layers from sliding past each other when the element is in operation.

B.5.3

Element Connector or Interconnector: Shall mean the device used within modules to connect together membrane elements. In some embodiments, the element connector may be incorporated into the anti-telescoping device.

B.5.4

Permeate Collection Tube: Shall mean a perforated tube usually centrally located in a spiral membrane element into which permeate is conducted from the permeate carrier. The permeate collection tube conducts permeate out of the element.

B.5.5

Connector/Interconnector Seals: Shall mean the device for forming a seal between the module connector and the permeate collection tube.

B.5.6

End Cap: Shall mean the cover at the end of the external shroud which connects with the permeate collection tube.

B.5.7

Glue Seams: Shall mean the areas at each edge of a leaf to which adhesive is applied to bind the materials together and form a seal. (Note that each leaf generally has two end glue seams and one axial glue seam so named because of their relative locations in the finished element.)

B.5.8

Leaf: Shall mean the sandwich of membrane, membrane support material, permeate carrier and feed channel spacer that are multiply laid up and wound around the permeate collection tube to form a spiral element.

B.6

Plate and Frame Module

B.6.1

Plate and Frame Module: Shall mean a module formed of multiple sandwiches of flat membrane elements held together by an external supporting frame. (See Appendix F.3.)

B.6.2

Module of Plate and Frame Design: Shall mean that part of the membrane processing system that contains the membrane elements of plate and frame design. The module consists of:

a. Membrane elements.
b. Supporting frame.
c. Permeate collection manifold.

The module interfaces with the system pipelines carrying product to and from it.

B.6.3

Membrane Support Plate: Shall mean that part of the membrane element which provides mechanical support for the membrane. The membrane support plate receives the permeate from the membranes and delivers it to the permeate collection manifold.

B.6.4

Lock Rings: Shall mean that part of the membrane element which can hold the membrane support plate and the two attached membranes together and form a barrier between the permeate and the retentate.

B.6.5

Spacer Plate: Shall mean that part of the membrane element which provides the necessary space to create the circulation channels across the membrane. The spacer plate separates two adjacent membrane support plates with membranes and lock rings.

B.6.6

Section Plate: Shall mean that part of the membrane element that makes it possible to divide the module into sections.

B.6.7

Supporting Frames: Shall mean that part of the module which internally or externally holds all the membrane elements within the module pressed together and provides the necessary support. The supporting frame consists of:

a. End flanges.
b. Connecting bolt(s).
c. Supporting legs.

B.6.7.1

End Flanges: Shall mean those parts of the supporting frame which hold together all the membrane elements within the module and provide the inlet connection from the feed line(s) to the module and the outlet connection from the module to the retentate line(s). The end flanges may include a flow distributing ring.

B.6.7.2

Connecting Bolt(s): Shall mean that part(s) of the supporting frame which connects the end flanges and holds together the stack of membrane elements.

B.6.7.3

Supporting Legs: Shall mean that part of the supporting frame which provides means for support of the whole module.

B.6.8

Permeate Collection Manifold: Shall mean that part of the membrane module that receives the permeate from the membrane element. The manifold can be an integral part of the membrane element or be connected to this by flexible hose.

B.7

Parallel Leaf Module

B.7.1

Parallel Leaf Module: Shall mean a module formed of multiple membrane elements whose membrane has been permanently bonded to a rigid support plate. (See Appendix F.4.)

B.7.2

Membrane Cartridge: Shall mean a multiple of membrane elements joined to form a unit to be inserted into a membrane housing.

B.7.3

Permeate Fitting: Shall mean a device for communicating permeate from the membrane cartridge to the permeate tubing. It may hold and seal the membrane cartridge *in situ.*

B.7.4

Membrane Element Retaining Clamp: Shall

mean a device for holding together a multiple of membrane elements (membrane element stack). The retaining clamp consists of two rigid nonporous plates, one on each side of the membrane element stack, and a tie rod that holds the two rigid plates together.

B.8

Hollow Fiber Module

B.8.1

Hollow Fiber Module: Shall mean a module whose membrane elements are formed of a multiplicity of flexible tubules generally less than 0.2 inches in inside diameter and potted or otherwise bound together into a common header. (See Appendix, F.5.)

B.8.2

A module of hollow fiber design shall consist of the following components:

a. Membrane cartridge.
b. Process manifold adapter assembly.
c. Permeate adapter assembly.

B.8.3

Membrane Cartridge: Shall mean a parallel array of hollow fiber membrane elements which are housed in a plastic or metallic cartridge assembly and fixed at both ends via an adhesive tubesheet. The hollow fiber membrane element is a self supporting structure. Therefore, in this configuration, the membrane element and support are an integral part of the membrane cartridge.

B.8.4

Process Manifold Adapter Assembly: Shall mean that part of the membrane module that connects the membrane cartridge to the system pipelines that carry product to and from the cartridge. This assembly consists of a manifold adapter, V-band clamp and a gasket.

B.8.5

Permeate Adapter Assembly: Shall mean that part of the membrane module that connects the permeate outlets of each membrane cartridge to the permeate collection manifold. This assembly consists of a permeate adapter, V-band clamp and gasket.

B.8.6

Membrane Sheath: Shall mean that part of the membrane cartridge which provides mechanical support to the hollow fiber membrane elements.

B.8.7

Tube Sheet: Shall mean the thermoset adhesive compound that is used to seal the hollow fiber membrane elements into the membrane housing.

B.9

Monolithic Ceramic Modules

B.9.1

Monolithic Ceramic Module: Shall mean a module that contains membrane elements wherein the membrane and the support are ceramic bonded structures which are in turn joined by ceramic bonds such that the joined membrane and support are monolithic in nature. (See Appendix F.6.)

B.9.2

Ceramic Bond: Shall mean the joining of ceramic materials by heat to produce fusion or sintering between particles.

B.9.3

Ceramic Membrane Support: Shall mean a ceramic porous base structure used to support a thinner and finer more uniformly graded porous structure. A membrane element may contain one or more supports all joined by ceramic bonds.

B.9.4

Membrane Element Retainer: Shall mean that part of the module which is designed to retain in place the membrane element seals and membrane element(s).

B.9.5

Membrane Element Fixed Retainer: Shall mean a retainer which is a part of the shroud.

B.9.6

Membrane Element Removable Retainer: Shall mean a retainer which is secured to the external shroud by mechanical means and may be removed for membrane element seal or membrane element cleaning or replacement.

B.9.7

Membrane Element Array: Shall mean a parallel array of one or more single tubes or multichannel membrane elements contained within the module shroud.

C

MATERIALS

C.1

All membrane product contact surfaces shall be:

a. Constructed of materials meeting the Title 21, Part 177 of the Code of Federal Regulations, or
b. Generally recognized as safe (GRAS) or
c. Otherwise approved by the Food and Drug Administration for food contact.

Users may rely on vendor certification that proprietary materials meet these requirements.

C.2

All product contact surfaces except the membrane shall be:

C.2.1

Plastic or plastic-like materials complying with applicable provisions of 3-A Sanitary Standards for Multiple Use Plastic Materials, Number 20-15, or

C.2.2

Stainless steel of the AISI 300 series*1 or the corresponding ACI*2 types. (See Appendix G.) or types which under conditions of intended use are at least as corrosion-resistant as stainless steel of the foregoing types and are non-toxic and non-absorbent, except that;

C.2.2.1

Rubber and rubber-like materials may be used for gaskets, seals, flexible product connectors, and O-Rings.

C.2.2.2

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

C.2.2.3

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

C.2.2.4

Fiberglass reinforced composites may be used where required for strength such as for membrane element support tubes.

C.2.2.5

Adhesive and potting materials in product contact surfaces including edge contact shall meet the requirements of Title 21, Part 175.105 or part 175.300 of the Code of Federal Regulations and be inert under conditions of operation, cleaning and sanitizing.

C.2.2.6

Composite methods of construction may be used to produce elements with ceramic materials for supports different than the materials used for the membrane. Such composites shall retain the ceramic bond properties between multiple supporting layers.

C.2.2.6.1

Ceramic materials selected shall be such that the membrane ceramic bonds attach the membrane to the support with sufficient mechanical integrity that it does not peel, chip or spall under processing or cleaning and

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

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

sanitizing conditions.

C.3

All materials used shall be inert, non-toxic, insoluble in the product and in cleaning and sanitizing solutions. They shall be resistant to scratching, scoring, and distortion when exposed to the conditions of intended use and of cleaning and sanitizing.

C.4

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

D

FABRICATION

D.1

General

D.1.1

The module shall be constructed such that the element can be mechanically cleaned on both retentate and permeate sides.

D.1.2

Membrane elements designed and constructed to fit into a shroud shall be without dead spaces so that they and it can be mechanically cleaned by a through flow of cleaning and sanitizing solutions.

D.1.3

The design and fabrication of the membrane element seals and retainers shall take into consideration the combined effects of differential thermal expansions, between the shroud, if any, and the elements, hydraulic shock and thermal shock such that the membrane elements are free of excessive compressive or tensile forces. The membrane element seals or supports, as the case may be, shall be designed in such a manner as to firmly support the membrane elements but allow for elastic axial and lateral movements to prevent undue stress and strains which could lead to failure of the membrane.

D.1.4

The membrane shall be firmly attached to its support material or have sufficient mechanical integrity that it does not peel, spall or chip.

D.1.5

Grommets or seals against the membrane surface must be made against impermeable support materials or alternatively against porous materials that can be mechanically cleaned or demonstrated to be effectively sealed.

D.1.6

Surfaces

D.1.6.1

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

D.1.6.2

Permanent metallic joints in product contact surfaces shall be continuously welded, except that tubes may be expanded and rolled into tube sheets. Welded areas on product contact surfaces shall be at least as smooth as a No. 4 ground finish on stainless steel sheets free of imperfections such as pits, folds, and crevices. When tubes are expanded and rolled into tube sheets, the resulting joint shall be completely rigid and without pockets or crevices. Alternatively metallic joints, if used, shall be in accord with the 3-A Accepted Practices for Permanently Installed Product and Solution Pipelines and Cleaning Systems, Number 605-03.

D.1.6.3

Appurtenances having product contact surfaces shall be easily removable for cleaning and inspection, or shall be mechanically cleanable.

D.1.6.4

Membrane modules shall be designed for chemical and mechanical cleaning and sanitizing of all product

contact surfaces.

D.1.6.5
There shall be no exposed threads on product contact surfaces.

D.1.6.6
Non-product contact surfaces shall be smooth, free of pockets and crevices and be readily cleanable and those to be coated shall be properly prepared for coating.

D.1.6.7
When used, fiberglass shall be completely encapsulated with no exposed fibers with a polymeric coating meeting the requirements of Title 21, Parts 175 or 177 of the Code of Federal Regulations.

D.1.7
Connections

D.1.7.1
Product connections to manifolds shall meet 3-A Sanitary Standards for Fittings, Number 08-17 except that these connections shall be made in a sanitary manner with rigid and/or flexible connectors provided the materials comply with the applicable provisions of 3-A Sanitary Standards for Multiple Use Plastic Materials, Number 20-15.

D.1.7.2
Flexible permeate tubes are permitted and shall have connections that are crevice free. Internal diameter may be selected to suit mechanical requirements.

D.1.7.3
Hose clamps shall be easily disassembled and assembled.

D.1.8
Gaskets and Seals

D.1.8.1
Gaskets having a product contact surface shall be removable or permanently bonded to the surface. Any gasket groove or gasket retaining groove except in the bonded area shall be no deeper than its width and shall not exceed 1/4 inch in depth or be less than 1/4 inch wide except those for standard O-Rings smaller than 1/4 inch.

D.1.8.2
Bonded rubber and rubber-like gaskets and bonded plastic gaskets shall be bonded in such a manner that the bond is continuous and mechanically sound and when exposed to the conditions encountered in the environment of intended use and in cleaning and bactericidal treatment, the rubber and rubber-like material or the plastic material does not separate from the base material to which it is bonded.

D.1.8.3
Grooves in gaskets shall be no deeper than their width and the minimum radius of any internal angle shall not be less than 1/8 inch unless the gasket is readily removable and reversible for cleaning.

D.1.8.4
Gasket grooves or gasket retaining grooves in product contact surfaces for removable gaskets shall not exceed 1/4 inch in depth and, except those for standard O-Rings smaller than 1/4 inch, shall be at least 1/4 inch wide.

D.1.8.5
Element seals that are potted, poured, or otherwise cast in place shall have joints that are fully filled such that there are no voids pits or cavities.

D.1.8.6
Element seals of the grommet type shall be one piece construction and shall firmly fit the mating surfaces such that there are no crevices or voids.

D.1.9
Radii

D.1.9.1
Internal angles on product contact surfaces shall have minimum radii of 1/16 inch, except:

D.1.9.1.1
Gasket recesses and grooves in which all sharp corners shall be avoided.

D.1.9.1.2
The minimum radii in gasket grooves or gasket retaining grooves other than those for bonded gaskets or for standard 1/4 inch and smaller O-Rings shall be not less than 1/8 inch.

D.1.9.1.3
The minimum radii in grooves for

standard 1/4 inch O-Rings shall be not less than 3/32 inch and for standard 1/8 inch O-Rings shall be not less than 1/32 inch. In either case the internal product contact surface must be readily available for cleaning and inspection.

D.1.9.1.4
For essential functional reasons, smaller internal angles or radii may be used provided the product contact surfaces are demonstrated to be mechanically cleanable.

D.2
Tubular Modules

D.2.1
The element shall fit into its shroud without dead spaces so that it can be completely mechanically cleaned by through flow of cleaning solutions or placed in the shroud so that the exterior can be flooded or sprayed with cleaning solution to achieve effective cleaning.

D.2.2
Ferrules that are potted, swaged or otherwise attached to tubes must have joints fully filled so that there are no voids.

D.3
Spiral Wound Modules

D.3.1
Glue seams in spiral elements shall be free of indentations or protrusions that may interfere with cleaning and shall be of sufficiently uniform width not to impede permeate flow.

D.3.2
The cut surfaces of the element shall be completely within the glue area.

D.3.3
Elements shall be tightly wound and have interior flow channels that are uniform in height.

D.3.4
Elements shall be equipped with a bypassing flow restrictor to allow a portion of the feed stream to flow through the annulus between the element and its external shroud to eliminate an annular dead-end condition and to keep that area clean.

D.3.5
The membrane support material and the permeate carrier material are porous. Visual inspection of an element from time to time after cleaning shall be necessary to confirm that cleaning and sanitation are effective.

D.3.6
Shrouds for spiral elements shall be fabricated of stainless steel or plastic. All joints shall be free from flaws and voids and flush with adjoining surfaces.

D.3.7
The anti-telescope device and module inter-connectors shall be designed in such a way that element surfaces can be mechanically cleaned and no dead-end areas are created.

D.3.8
Inter-connector seals shall be tight with no open crevices and shall be made against impervious surfaces.

D.4
Plate and Frame Modules

D.4.1
Membrane surface shall be smooth, flat and devoid of wrinkles.

D.4.2
The membrane, support plates, and spacer plates shall be tightly stacked and have a uniform flow in the retentate flow channels.

D.4.3
Elastomeric seals, locking rings and gaskets shall be of sanitary design with no open crevices and made against impervious surfaces or demonstrated to be effectively sealed.

D.4.4
End-flange(s), spacer, section, and support plates, permeate manifolds, and lock rings shall be fabricated of stainless steel or plastic.

D.4.5
The membrane support plates may be porous. Visual inspection of the plates from time to time, after cleaning, shall be necessary to ensure cleaning and sanitation procedures are effective.

D.4.6
The permeate outlet shall be

positioned in such a way that when assembled, air is not entrapped in the plate.

D.5

Parallel Leaf

D.5.1

The membrane (of the membrane element) shall be firmly attached to the membrane support plate with even and continuous leak-proof bonds of sufficient mechanical integrity to remain free of voids, peel backs or delaminations. The transition from protruding support plate surface to membrane surface shall be smooth.

D.5.2

Membrane surface shall be smooth, flat and devoid of wrinkles.

D.5.3

Membrane cartridges shall be tightly stacked and have uniform retentate flow channels.

D.5.4

When bypassing flow restrictors are employed, they shall allow a portion of the feed stream to flow through the annulus between the membrane cartridge and the membrane housing to keep that area clean.

D.5.5

Elastomeric seals and gaskets should be of sanitary design with no open crevices, and made against impervious surfaces, or alternatively, against porous materials that can be mechanically cleaned or demonstrated to be effectively sealed.

D.5.6

Housings and membrane element retaining clamps shall be fabricated of stainless steel or plastic.

D.5.7

The membrane support material and the membrane element permeate carrier material are porous. Visual inspection of an element from time to time, after cleaning, shall be necessary to assure cleaning and sanitation procedures are effective.

D.6

Hollow Fiber Modules

D.6.1

The manifold adapter assembly shall utilize sanitary type gasket designs and stainless steel clamps at both the membrane cartridge and system feedline interface connections.

D.6.2

The permeate adapter assembly shall utilize sanitary type gasket designs and stainless steel clamps at both the cartridge permeate outlet and permeate collection manifold interface connections.

D.6.3

The surface of the epoxy or thermoset adhesive tube sheet shall be smooth and free of pits, voids or crevices.

D.6.4

Membrane cartridge housings shall be fabricated of plastic or stainless steel.

D.7

Monolithic Ceramic Modules

D.7.1

Ceramic membrane elements shall be a monolithic construction incorporating both the support and the membrane into a one-piece element resistant to delamination, peeling, chipping or spalling of the membrane.

E

INSTALLATION, OPERATION AND CLEANING

E.1

Membrane modules shall be installed, operated and mechanically cleaned in a membrane processing system meeting the requirements of the 3-A Accepted Practice for the Sanitary Construction, Installation, and Cleaning of Membrane Processing Systems for Milk and Milk Products, Number 610–00.

APPENDIX

F

MODULE DESCRIPTION

F.1

Tubular Modules

Tubular modules may be made of single tubes, multiple tubes and/or arrays of tubes. In general, tubular modules are cylindrical with the tubes sealed at each end into an external shroud. The feed product usually flows inside the tubes with the external shroud acting as a

permeate collection vessel. In some elements headers are used to join together multiple tubes in parallel as in a shell and tube heat exchanger. U-bends are used to join modules together in series.

F.1.1.1

Large Diameter Tubes These tubes are usually one inch in diameter and approximately ten feet long. A stainless steel ferrule at each end of the tube connects to a U-bend to join a number of tubes in series. These tubes are placed in a cabinet which contains inlet and outlet manifolds for the product to be processed. Permeate drips from the tubes and collects in the bottom of the cabinet which serves as an external shroud. Permeate is collected and pumped away for disposal or use. Cabinets are often equipped with spray nozzles to help clean and sanitize the exterior of tubes. Figure F.1.1 illustrates a large diameter tube and cabinet. The tube itself is formed from a membrane placed on a porous composite membrane support material.

F.1.1.2

Small Diameter Tubes These tubes are usually about one-half inch in diameter and are formed together into elements of multiple tubes by gluing or potting the ends together. There are several configurations.

a. Exposed Outer Surface - This design is similar in concept to the one inch tube. There is no closely fitted external shroud. The tubes are glued in stainless steel manifolds in cabinets. A composite material is used for membrane support. See Figure F.1.2.

b. Closely Supported - In this configuration the membrane tubes are placed into closely fitting stainless steel support tubes which may in some cases also serve the function of external shroud and permeate collection vessel. Stainless steel headers are customarily used at each end to bring product to and from the tubes. In some configurations the headers also have internal flow channels that collect permeate from the annular space between the membrane tube and its supporting stainless steel tube. In others the supporting stainless tube is perforated so that permeate collects within a separate external shroud. See Figure F.1.3.

c. Potted - Here a bundle of tubes are potted together and sealed into an external shroud that has inlet and outlet fittings for the product. The tubes are self supporting with the shroud serving as the permeate collection vessel. See Figure F.1.5.

F.1.3

Supported Metallic Oxide

F.1.3.1

The supported metallic oxide module consists of a multitude of tubular membrane elements. Membrane elements are assembled in parallel bundle tubes in a pressure shroud. An end tubular plate at both ends of the shroud holds each membrane element. A membrane element gasket at each end of the module provides sealing of all ends of membrane elements and between retentate and permeate side. Counter plates are used to press gaskets and for conducting retentate flow to the membrane elements. One inner spacer holds membrane elements spaced. The shroud is equipped with connection as two retentate inlet or outlet and two permeate outlets.

F.1.3.2

The fluid to be processed enters the module through the retentate inlet. It flows as cross flow through the tubular membrane element. Permeate

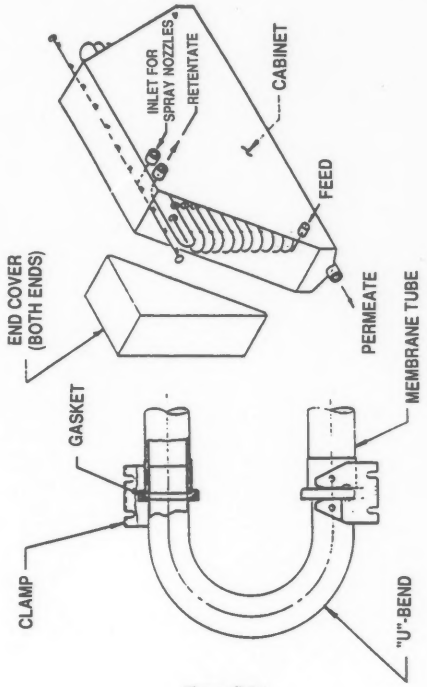


Figure F.1.1

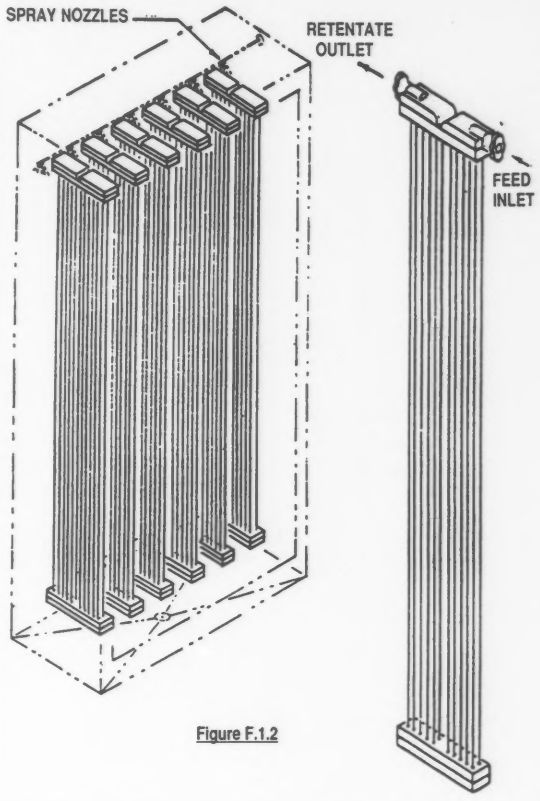
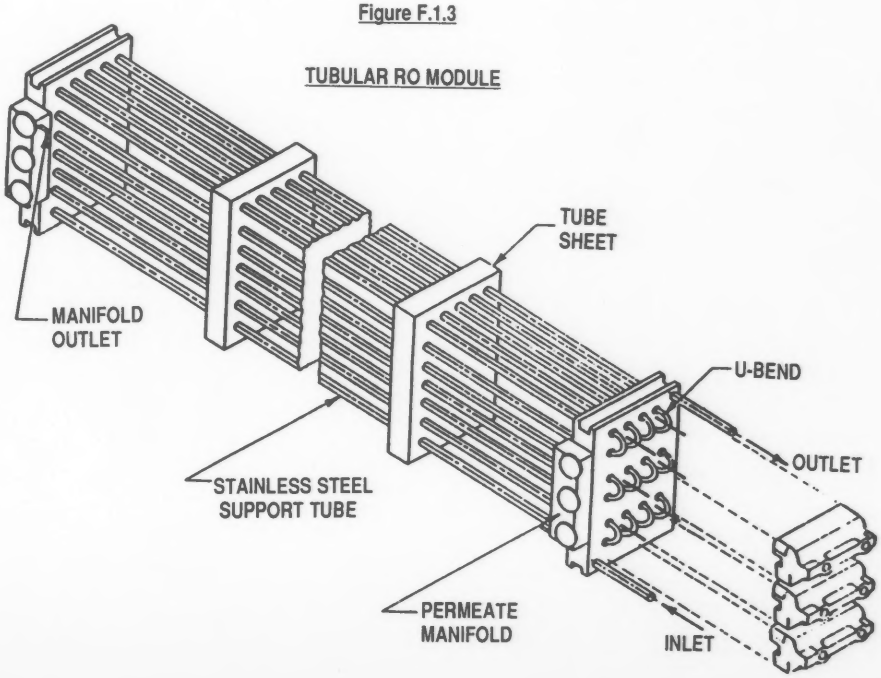


Figure F.1.2

Figure F.1.3

TUBULAR RO MODULE



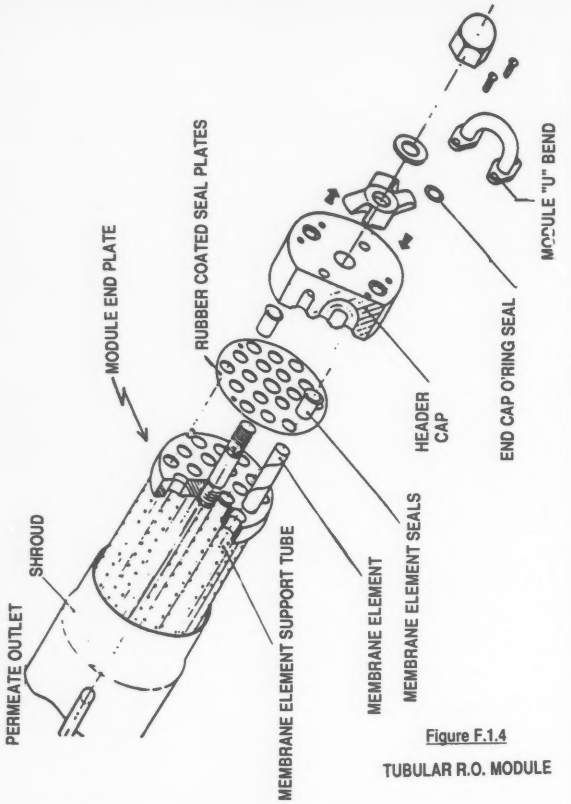


Figure F.1.4

TUBULAR R.O. MODULE

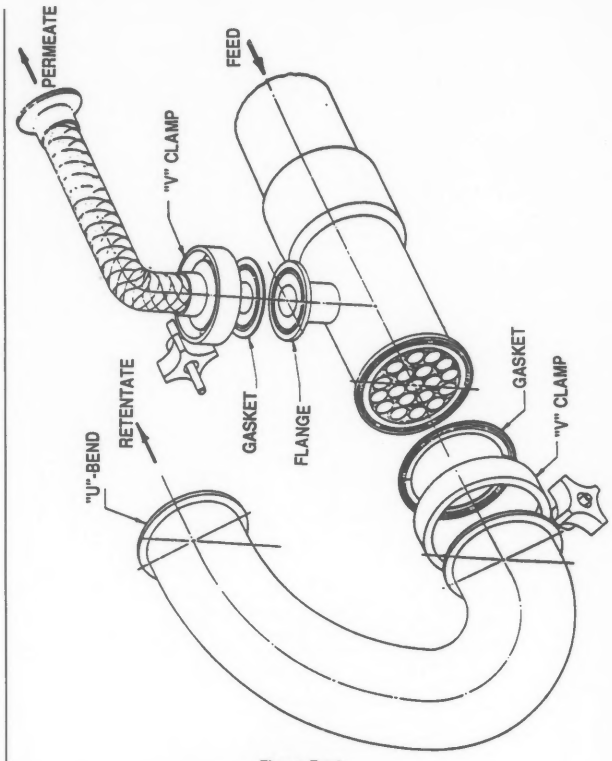


Figure F.1.5

SUPPORTED METALLIC OXIDE MODULE
ULTRA AND MICROFILTRATION

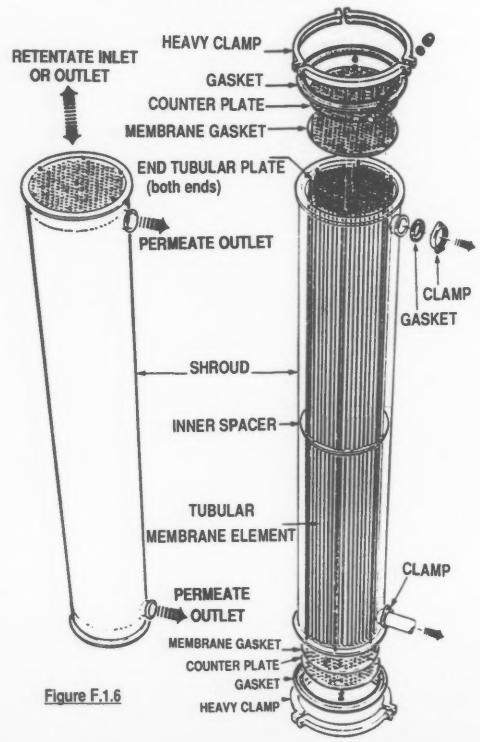
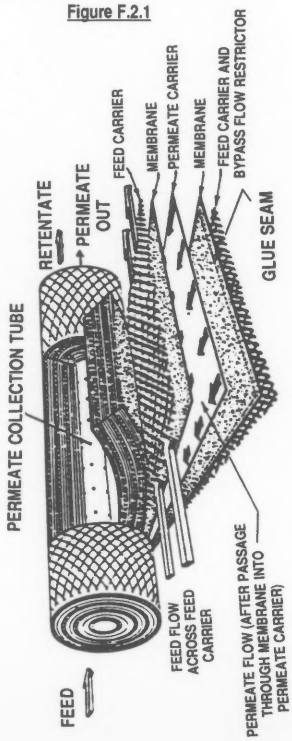


Figure F.1.6

SPIRAL WOUND MEMBRANE MODULE

Figure F.2.1



is conducted away from the membranes by supports to permeate vessel, then to the outlet.

F.1.3.3
Figure F.1.6 shows assembly of membrane elements in the shroud and associated parts.

F.2
Spiral Wound Modules

F.2.1
Spiral wound elements have multiple leaves of alternating membrane, feed carrier and permeate carrier wound around perforated central permeate collection tube. Figure F.2.1 is a schematic illustration of the assembly. The fluid being processed flows axially parallel to the permeate tube in between sheets of membrane held apart by the feed channel spacer. Permeate collects in the permeate carrier and flows in that carrier in a spiral fashion inwardly to the permeate collection tube.

F.2.2
Spiral elements are usually connected together in groups of two or three at the permeate tube. These elements fit into an external shroud that contains all necessary inlet and outlet ports.

F.2.3
An anti-telescoping device (ATD) helps each element to resist the flow forces during operation. These anti-telescope devices (ATD's) may also be connectors for the modules.

F.2.4
Figure F.2.2 shows how elements fit into the external shroud and its associated hardware. This assembly of elements, connectors, anti-telescope devices, shroud and associated hardware forms the membrane module.

F.3
Plate and Frame Modules

F.3.1
The plate and frame module consists of a multitude of membrane elements assembled (stacked) and held together by means of the supporting frame. (Figures F.3.1.1, F.3.1.2, F.3.1.3, F.3.1.4 and F.3.1.5.)

F.3.2
The geometry of the membrane support plate is such as to form retentate flow channels between the membranes. A variant is to have the retentate flow channels formed in a spacer plate inserted between the support plates with membranes.

F.3.3
The sealing between the elements or to the end flanges can be made either with an elastomeric ring or with a seal lip formed at the perimeter of the support plate or spacer plate.

F.3.4
The module can be divided into sections of membrane elements by means of section plates (Figures F.3.1.2 and F.3.1.4).

F.3.5
Each membrane support plate has a permeate outlet which is connected to the permeate manifold. The permeate manifold can be an integral part of the membrane element or be connected by flexible hoses. (Figure F.3.1.1.)

F.4
Parallel Leaf Modules

F.4.1
The parallel leaf membrane element consists of a membrane permanently joined to a rigid flat support plate that provides integrity of geometry and facilitates permeate transport to a collection port (Figure F.4.1). A multitude of membrane elements are assembled (stacked) and sealed to each other with an elastomeric ring at the permeate collection port so as to conduct permeate from each membrane element. The membrane element stack is held together with a retaining clamp consisting of two rigid non-porous plates, one on each side of the membrane element stack, and a tie-rod that holds the two rigid plates together at their center, and protruding through the permeate collection ports so as to provide a common permeate collection port for the membrane element stack

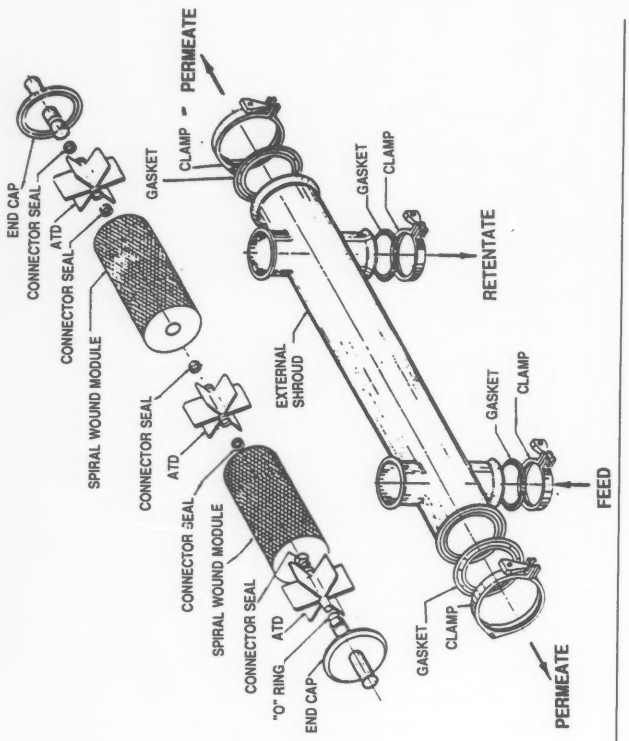


Figure F.2.2

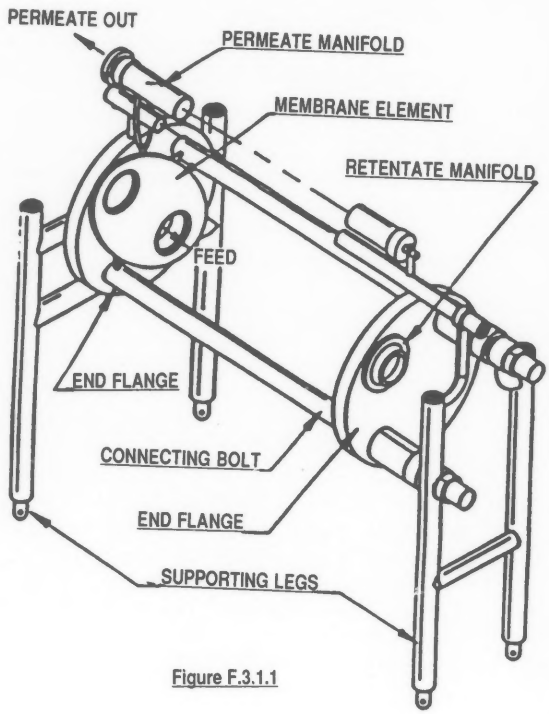


Figure F.3.1.1

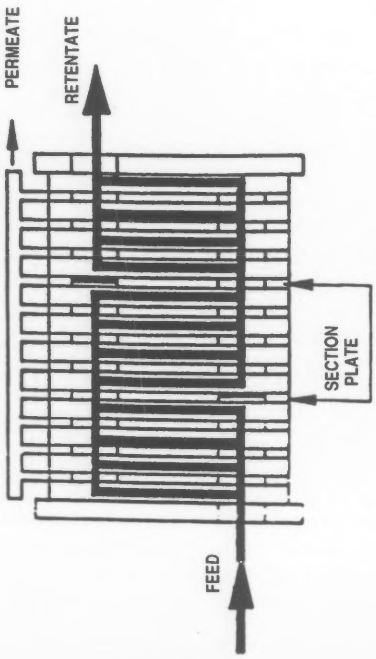


Figure F.3.1.2

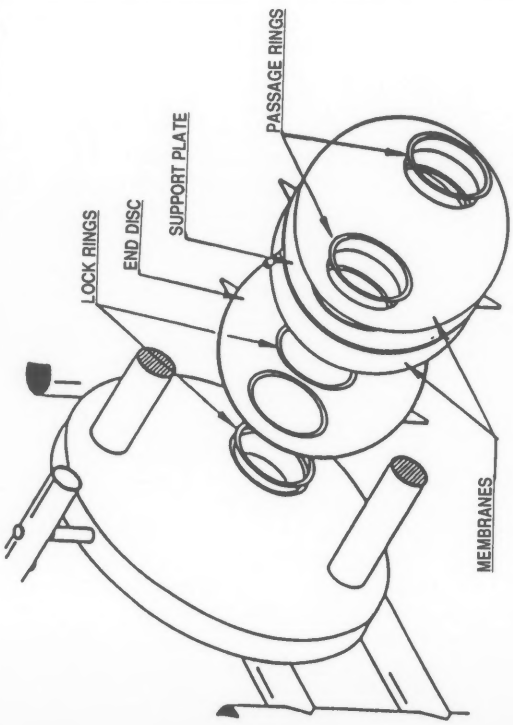


Figure F.3.1.3

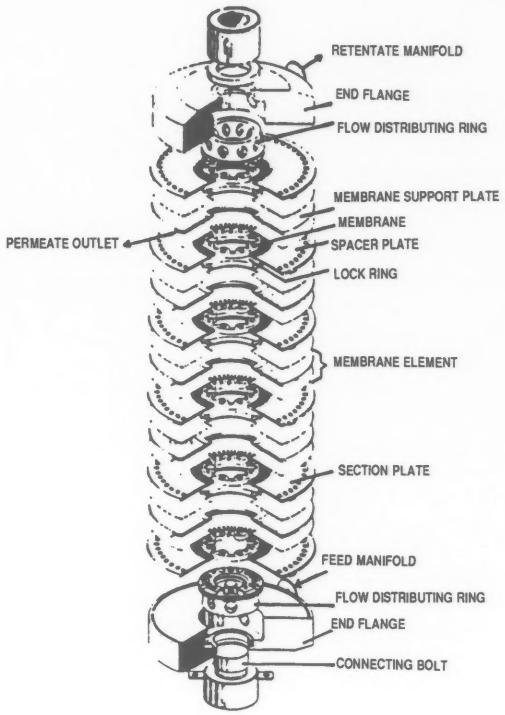


Figure F.3.1.4

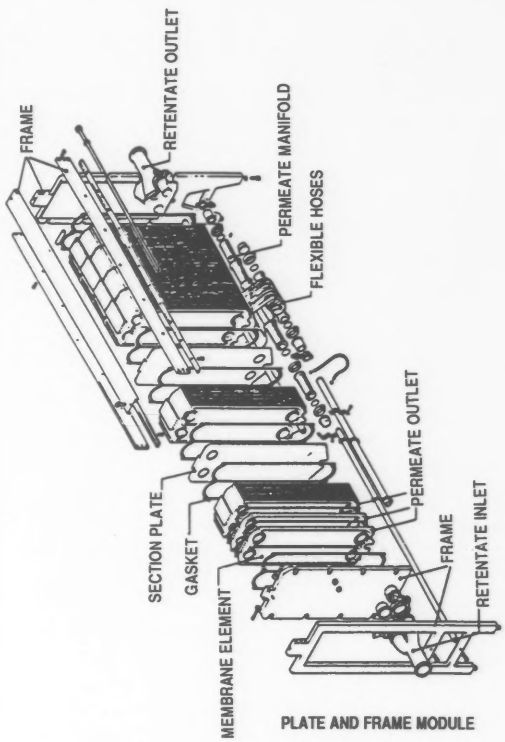


Figure F.3.1.5

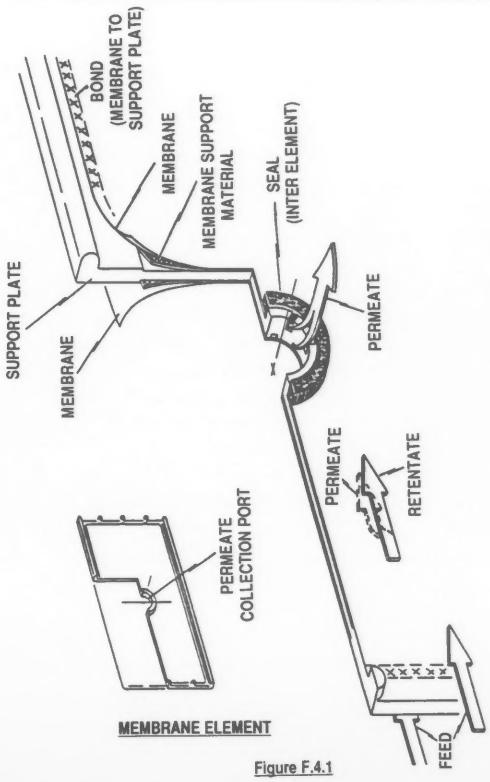


Figure F.4.1

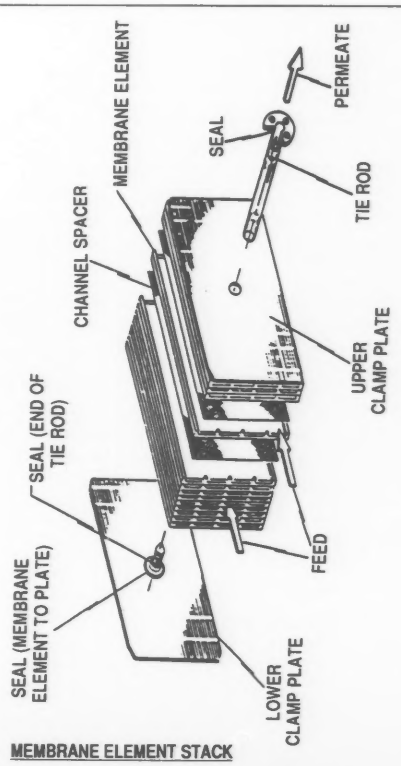


Figure F.4.2

(Figure F.4.2). The geometry of the membrane elements is such as to form retentate flow channels in between the membrane elements. A variant is to have retentate flow channels formed with the insertion of a channel spacer, such as a monofilament mesh of a size selected to maintain the desired flow channel height.

F.4.2

Several of these assemblies, or "membrane cartridges", (each consisting of a multitude of membrane elements, inter-element elastomeric seals, and retaining clamp) are inserted, end to end, in a close fitting pressure vessel (shroud) equipped with a feed connection, a retentate connection, and permeate connections for each membrane cartridge. Each cartridge is mechanically held and sealed in place with a permeate fitting. Frequently a bypassing flow restrictor is inserted upstream of each membrane cartridge for the purpose of increasing/directing feed flow through the cartridge flow channels. A permeate manifolding system, including anti-flow-reversal valves for each cartridge, collects permeate from each cartridge containing pressure vessel with feed and retentate connections, together with the permeate manifold system, constitute the membrane module (Figure F.4.3).

F.4.3

Pressurized feed enters the membrane module through the feed connection, flows through the membrane element retentate flow channels (over the membrane), and exits through the retentate connection. Permeate is forced through the permeate fittings into the permeate manifold.

F.5

Hollow Fiber Modules

F.5.1

Hollow fiber membrane elements are self supporting membrane tube structures that do not require porous support material for mechanical strength. The perm-selective membrane skin on the inside of the fiber and the porous fiber wall are a homogeneous polymer matrix and therefore, act as the pressure vessel. As such, the hollow fiber membrane is cleaned by back-flushing the membrane with cleaning solutions that are recommended by the manufacturer. See 3-A Accepted Practice for the Sanitary Construction, Installation, and Cleaning of Membrane Processing Systems for Milk and Milk Products, Number 610-00. Figure F.5.1 is a schematic illustration of a hollow fiber membrane module.

F.5.2

A bundle of parallel hollow fiber membrane elements is inserted into a protective membrane sheath which is then sealed into a hydraulically symmetrical shell and tube cartridge by bonding the ends of the fibers in an epoxy resin tube sheet.

F.5.3

The fluid being processed flows through the cartridge manifold adapter assembly and enters the lumen or center of the fiber and flows longitudinally down the fiber with the permeate passing radially through the fiber wall and collecting in the "low pressure" or shell side chamber of the membrane cartridge. The retentate exits the other end of the cartridge and is directed to the system retentate/feed lines while the permeate flows out of the permeate outlets of the cartridge through the permeate adapter assembly into the permeate collection manifold. This membrane cartridge, process manifold and permeate adapter assemblies form the membrane module.

F.6

Monolithic Ceramic Membrane Modules

F.6.1

The monolithic ceramic membrane modules consist of a membrane array of one or more parallel single tubular elements or multi-channel tubular elements or tubular elements

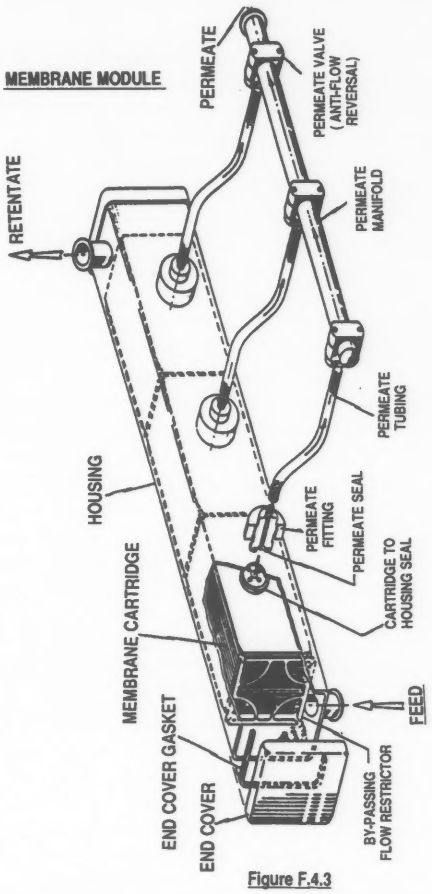


Figure F.4.3

Figure F.5.1

MONOLITHIC CERAMIC MODULE
ASSEMBLY OF SEVERAL MULTICHANNEL ELEMENTS

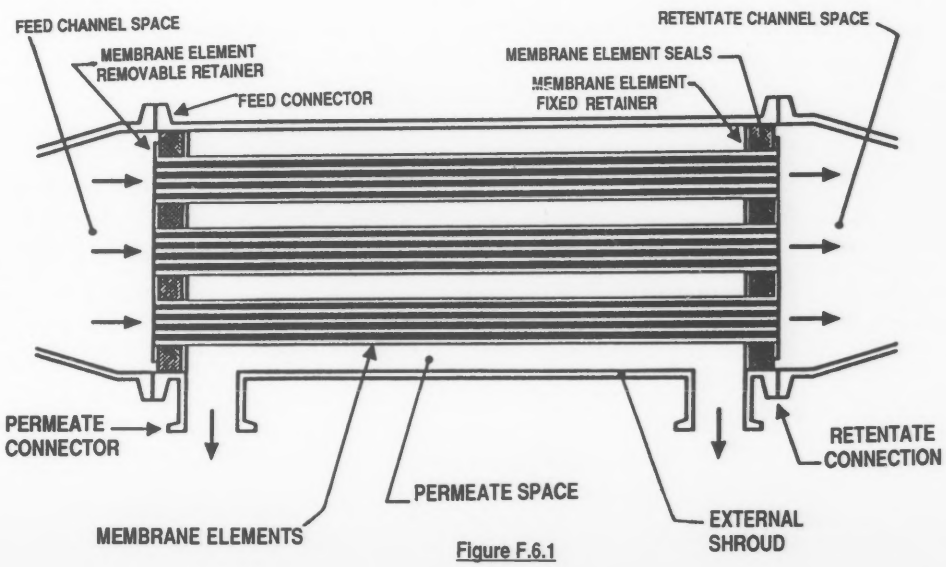


Figure F.6.1

in a bundled arrangement in the shroud. The shroud is used to protect the membrane elements and divide the module into feed, retentate and permeate channels and spaces.

F.6.2

The membrane elements are self-supporting structures with the membranes on the inside of the flow channels. The outside of the element is the porous support for the membrane and provides mechanical integrity and protection for the membranes. The ends of the membrane elements are generally sealed with a very fine ceramic bonded layer of the same material as used for the membrane but of a greater thickness and a finer pore structure. In alternate designs a self-curing or catalyzed sealant may be used to fill the support structures and seal the membranes to the feed and retentate channel spaces and the permeate spaces.

F.6.3

Membrane elements are supported within the shroud by either single element grommets or seals, which may be either O-Rings or gaskets, or monolithic precast or cast-in-place rubber-like, plastic-like or epoxy material to form a membrane bundle or a membrane array within the shroud. Fixed retainers may be used to secure the bundle or array firmly to the shroud and removable retainers may be used to secure the element seals, bundle seals, or array seals, as the case may be, to the elements.

F.6.4

The geometry of the module is such as to form a channel space to feed products to the membrane elements, a channel space at the discharge of the membrane elements to collect the retentate and provide a flow path to connect to boundary retentate lines, and a permeate space surrounding the outside of the membrane elements to collect the permeate and channel it to one or more permeate connectors at the module boundary lines.

F.6.5

Figure F.6.1 shows the arrangement of a monolithic ceramic assembly of several multichannel elements. Figure F.6.2 shows an alternate design of a monolithic ceramic module element fixturing for one or more multichannel elements. Figure F.6.3 shows the principal of the multichannel element. The details of this assembly may vary depending on the design of the elements as single tubular or multichannel and the type of membrane element seals required to support a cast-in-place or pre-cast bundle, or the membrane array-type designs with grommet seals.

G

STAINLESS STEEL MATERIALS

Stainless steel conforming to the applicable composition ranges established by AISI for wrought products, or by ACI for cast products, should be considered in compliance with the requirements of Section C.1 herein. Where welding is involved the carbon content of the stainless steel should not exceed 0.08 percent. The first reference cited in C.1 sets forth the chemical ranges and limits of acceptable stainless steels of the 300 series. Cast grades of stainless steel corresponding to types 303, 304 and 316, are designated CF-16F, CF-8, and CF-8M respectively. These cast grades are covered by ASTM*3 specifications A351/A351M, A743/A743M and A744/A744M.

H

PRODUCT CONTACT SURFACE FINISH

Surface finish equivalent to 150 grit or better as obtained with silicon carbide properly applied on stainless steel sheets is considered in compliance with the requirements of Section D.1.6.1 herein.

These standards are effective September 8, 1990.

*3 Available from ASTM, 1916 Race St., Philadelphia, PA 19103-1187 (215-299-5400).

MONOLITHIC CERAMIC MODULE
MEMBRANE ELEMENT FIXTURING FOR ONE OR MORE MULTICHANNEL ELEMENTS

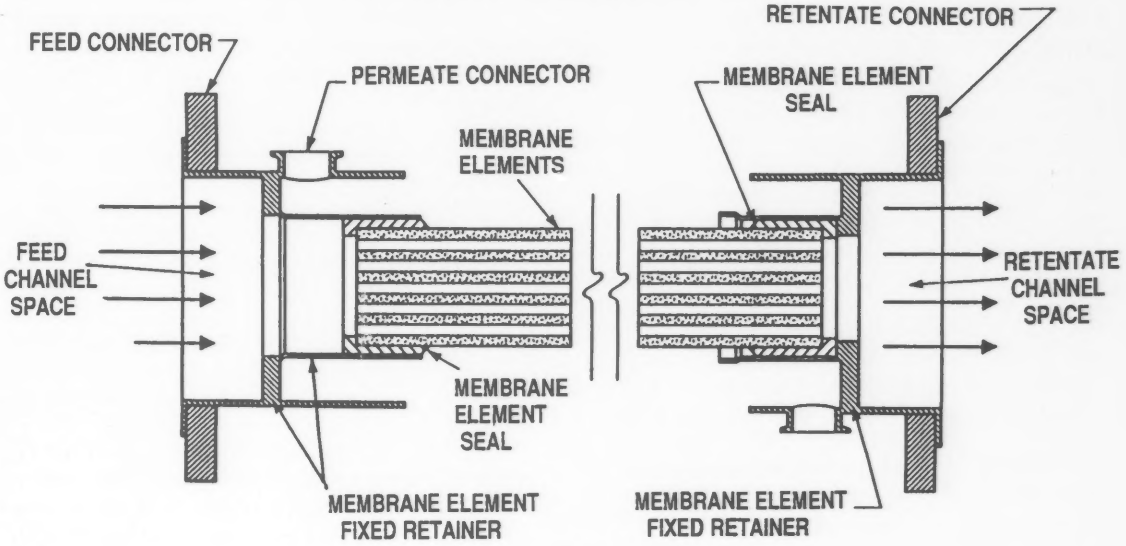


Figure F.6.2

MONOLITHIC MEMBRANE MODULE
PRINCIPLE OF THE MULTICHANNEL ELEMENT

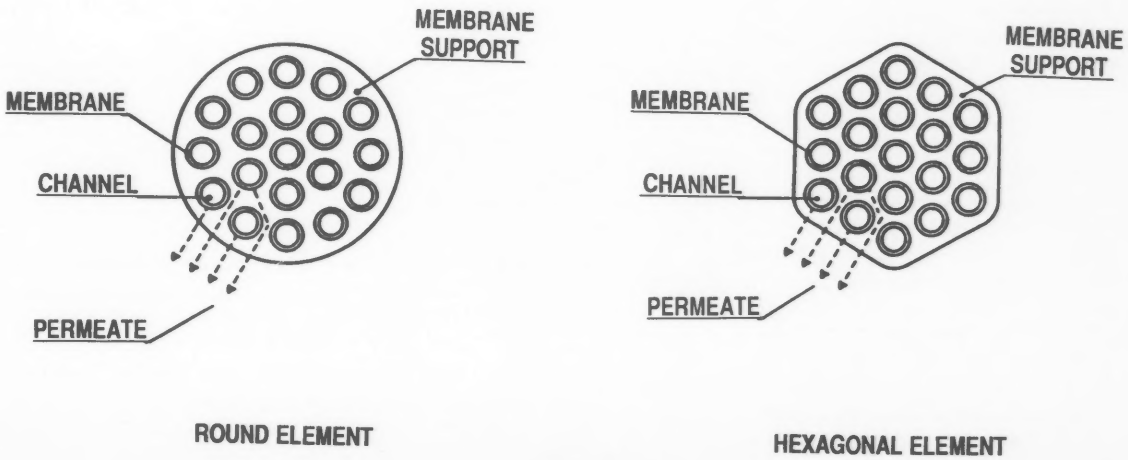


Figure F.6.3

Coming Events

1990

JUNE

•**4, Pesticide Applicator Certification Seminar**, Okumura Biological Institute, Clarion Hotel, Sacramento, CA. For more information contact George Okumura, 6669 14th Street, Sacramento, CA 95831 (916)421-8963.

•**4-5, HACCP** to be held in Chicago, Illinois. For more information or registration materials, contact the American Association of Cereal Chemists, 3340 Pilot Knob Road, St. Paul, MN 55121, (612)454-7250 FAX (612)454-0766.

•**4-5, Starch: Structure, Properties, and Food Uses** to be held in Chorleywood, United Kingdom. For more information or registration materials, contact the American Association of Cereal Chemists, 3340 Pilot Knob Road, St. Paul, MN 55121, (612)454-7250 FAX (612)454-0766.

•**4-6, American Frozen Food Institute's Seventh Annual Distribution Conference** will be held at the Opryland Hotel in Nashville, TN. The title of this conference is "The Future of Frozen Food Distribution: Are You Ready for the 1990's?" For more information or registration materials, contact AFFI, 1764 Old Meadow Lane, Suite 350, McLean, VA 22102; (703)821-0770.

•**5, Worker Safety Compliance Seminar 1990, Chemical, Pesticides and Fumigants in the Workplace,** Okumura Biological Institute, Clarion Hotel, Sacramento, CA. For more information contact George Okumura, 6669 14th Street, Sacramento, CA 95831 (916)421-8963.

•**5-6, Texas Association of Milk, Food & Environmental Sanitarians Annual Meeting,** held at the Howard Johnson-South Plaza, Austin, Texas. For more information contact Janie Park, Secretary, P.O. Box 2362, Cedar Park, TX 78613-2363, (512)458-7281.

•**11, Kitchen Management** Seminar in Portland, Maine at the Sheraton Tara Hotel in South Portland. Cosponsored by The Educational Foundation of the NRA and the Maine Restaurant Association. Contact: (800)765-2122.

•**12, Kitchen Management** Seminar in Manchester, New Hampshire at the Center of New Hampshire Holiday Inn. Cosponsored by The Educational Foundation of NRA and the New Hampshire Hospitality Association. Contact (800)765-2122.

•**18, Banquet Management** Seminar in Cleveland, Ohio at the Sheraton City Centre (formerly Bond Court Hotel). Cosponsored by The Educational Foundation of the NRA and the Ohio Restaurant Association. Contact: (800)765-2122.

•**18, Kitchen Management** Seminar in Los Angeles, California at the Hyatt Wilshire, Los Angeles. Cosponsored by The Educational Foundation of the NRA and the California Restaurant Association. Contact: (800)765-2122.

•**18-19, Dough Rheology and Baked Products Texture** to be held in Short Hills, New Jersey. For more information or registration materials, contact the American Association of Cereal Chemists, 3340 Pilot Knob Road, St. Paul, MN 55121, (612)454-7250 FAX (612)454-0766.

•**19, Banquet Management** Seminar in Philadelphia, Pennsylvania at the Sheraton Valley Forge Hotel. Cosponsored by The Educational Foundation of the NRA and the Pennsylvania Restaurant Association. Contact: (800)765-2122.

•**19, Kitchen Management** Seminar in San Francisco, California at the Sheraton Airport Hotel in Burlingame. Cosponsored by The Educational Foundation of the NRA and the California Restaurant Association. Contact: (800)765-2122.

•**20, Kitchen Management** Seminar in Sacramento, California at the Radisson Hotel. Cosponsored by The Educational Foundation of the NRA and the California Restaurant Association. Contact: (800)765-2122.

•**21-22, Third International Colloquium on Centrifugal Partition Chromatography** to be held at the Dunfey's Hotel, San Mateo, California. For more information contact Sanki Laboratories, Inc., 106 Folcroft East Business Park, Sharon Hill, PA 19079 (215)583-2010, FAX (215)583-2018 or Sanki Engineering Limited, 2-16-10 Imazato, Nagaokakyo, Kyoto 617, Japan (075)951-9321 or FAX (075)951-9329.

JULY

•**6-7, International Symposium on Rapid Methods and Automation in Microbiology: Ten Years of Excellence.** Contact Dr. Daniel Y.C. Fung, Director, 207 Call Hall, Kansas State University, Manhattan, KS 66506, (913)532-5654, FAX (913)532-7059.

•**6-13, International Workshop on Rapid Methods and Automation in Microbiology: Ten Years of Excellence.** Contact Dr. Daniel Y.C. Fung, Director, 207 Call Hall, Kansas State University, Manhattan, KS 66506. (913)532-5654, FAX (913)532-7059.

16-18, American School Food Service Association 44th Annual Conference to be held at the New Orleans Convention Center, New Orleans, Louisiana. For more information call (703)739-3900 or (800)877-8822.

AUGUST

•**5-8, IAMFES 77th Annual Meeting**, Woodfield Hilton Towers, Arlington Heights, IL. For more information, contact Steven K. Halstead, IAMFES, Inc., 502 E. Lincoln Way, Ames, IA 50010 (800)369-6337.

•**6-7, Pesticide Applicator Certification Seminar**, Okumura Biological Institute, Holiday Inn, Elk Grove Village, IL. Contact George Okumura, 6669 14th Street, Sacramento, CA 95831 (916)421-8963.

•**7-8, Dietary Managers Association Meeting** to be held at the Hyatt Orlando, Orlando, Florida. For more information call (708)932-1444 or (800)323-1908.

•**7-11, 2nd Latin-American Congress of Biotechnology** to be held in LaHabana, Havana, Cuba. For more information contact the Organizing Committee, P.O. Box 6162, Havana, Cuba. Telex: 512330 ing gen cu, 511072 cubacib. Telephone: 21-8039, 20-1400, 20-1402, 20-1408, 21-8466, 21-8164, 21-8008. FAX: 53-7-218070.

•**8-9, Advance Pesticide Technology for the Food Industry Seminar**, Okumura Biological Institute, Holiday Inn, Elk Grove Village, IL. For more information contact George Okumura, 6669 14th Street, Sacramento, CA 95831 (916)421-8963.

•**15-18, FOOD PACIFIC, 1990** will be held at Vancouver's domed stadium, B.C. Place. Those wishing to attend may obtain further information by contacting: B.C. Food Exhibitions Ltd., 190-10651 Shellbridge Way, Richmond, B.C., Canada V6X 2W8 (604)660-2288.

•**26-31, Eighth International Biodeterioration and Biodegradation Symposium**. University of Windsor, Ontario, Canada. For more information contact Mary M. Hawkins, Corresponding Secretary, 10657 Galaxie, Ferndale, MI 48220-2133, (313)544-0042.

•**27, Pesticide Applicator Certification Seminar**, Okumura Biological Institute, Clarion Hotel, Sacramento, CA. For more information contact George Okumura, 6669 14th Street, Sacramento, CA 95831 (916)421-8963.

SEPTEMBER

•**10-13, 104th Annual AOAC International Meeting & Exposition**, to be held at the Clarion Hotel, New Orleans, Louisiana. For more information contact: Margaret Ridgell, AOAC, Suite 400, 2200 Wilson Blvd., Arlington, VA 22201-3301 (703)522-3032.

•**13-14, Minnesota Sanitarians Association, Inc.** Annual Conference will start at 1:00 p.m. on September 13 at the Earle Brown Center, University of Minnesota. Annual meeting will start at 4:30 p.m. on September 13 with the Awards Banquet at 6:00 p.m. at the Holiday Inn, Shoreview. For further information call Roy E. Ginn at (612)785-0484.

•**13-14, Annual Wisconsin Laboratory Association's Educational Conference** will be held in Brookfield, WI. The Conference will be held at the Mariott Convention Center. For more information please contact Mr. Malin Benicek, Sanofi Bio Ingredients, 620 Progress Avenue, Waukesha, WI 53186.

•**18-20, New York State Association of Milk and Food Sanitarians Annual Meeting**, at the Sheraton Inn-Syracuse, Liverpool, NY. For more information contact Paul Dersam, 27 Sullivan Rd., Alden, NY 14004, (716)937-3432.

•**19-20, Wisconsin Association of Milk and Food Sanitarians Annual Meeting**, Pioneer Inn, Oshkosh, WI. For more information contact Neil Vassau (608)267-3504.

•**26-27, Joint Annual Convention of the South Dakota State Dairy Association and Dairy Fieldmen's Association** to be held at the Holiday Inn, Brookings, SD. For information contact Dr. John Parsons, Dairy Science Department, SDSU, Box 2104, Brookings, SD 57007 (605)688-4116.

•**26-28, Kansas Association of Sanitarians Annual Meeting**, Red Coach Inn, Salina, KS. For more information contact John Davis, 1900 East 19th, Wichita, KS 67214, (316)268-8351.

OCTOBER

•**7-12, Twenty-Third International Dairy Congress**, sponsored by the International Dairy Federation, and **Exposition 1990**, will be held at the Montreal Convention Centre, Montreal, Canada. For further information, contact: Richard Stern, Executive Director, International Dairy Congress, 1990, P.O. Box 2143, Station D. Ottawa, Ontario, Canada K1P 5W3 (613)238-4116.

•**15-16, Pests Associated with Food Industry and Environmental Sanitation Seminar**, Okumura Biological Institute, Holiday Inn, Elk Grove Village, IL. For more information contact George Okumura, 6669 14th Street, Sacramento, CA 95831 (916)421-8963.

•**17-18, Advanced Course on Pest Recognition and Food Industry Problems**, Okumura Biological Institute, Holiday Inn, Elk Grove Village, IL. For more information contact George Okumura, 6669 14th Street, Sacramento, CA 95831 (916)421-8963.

•**17-18, North Central Cheese Industries Association Annual Conference**, will be held at the South Dakota State University, Brookings, SD. For more information contact E.A. Zottola, Executive-Secretary, NCCIA, P. O. Box 8113, St. Paul, MN 55108.

NOVEMBER

•**6-8, International Cheese Technology Exposition** will be held in Milwaukee, Wisconsin. For further information contact: USCMA/WEMA, P.O. Box 2133, Madison, WI 53701 (608)255-2027.

•**28, Ontario Food Protection Association Annual Meeting**, will be held at the Airport Hilton Hotel, Toronto, Ontario. The title of the all-day symposium is "FOOD PROTECTION: HOT TOPICS FOR THE '90's". For more information, please contact program convenors: Garth Sundeen (416)239-8411 or FAX (416)239-2416 or Patrick Kwan (416)671-5080 or FAX (416)671-5176.

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

From the Ames Office . . .

By
Steven K. Halstead
IAMFES
Executive Manager

In February, I had the pleasure of attending the 3rd Annual Meeting of the Georgia Association of Food and Environmental Sanitarians. It was exciting to see the level of support and the quality of programming this "young" affiliate was able to put together. I congratulate the group on its ability to make use of local resources. Between the Centers for Disease Control, the USDA, University of Georgia and the host of local consultants, they were able to pull together a dynamite program.

One item on the Agenda really caught my attention. It was a report from the Georgia Environmental Health Association on their efforts to license Georgia Sanitarians. It brought back memories.

When I worked for the Iowa Funeral Directors Association and the Iowa Dental Association, legislative activity was a big part of my job. It was a love/hate relationship. I loved being "over on the hill," watching the maneuvering and political infighting. I loved the sense of power that simply permeated the place. But I hated the lack of efficiency. It was not uncommon to wait for two hours just to spend 5 minutes with a Senator. Or to work hard to convince a Representative that our side was right and then have him absent when the vote came to the floor.

Like I said, it was love/hate! Hurry up/wait! Excitement/boredom!

I learned there that while money talks, it doesn't buy votes. Votes buy votes. All the money in the world won't move a bill if the citizenry isn't behind it. The clever, successful lobbyists were those who knew how to focus public attention on their issues.

Some of their efforts were silly and inane, but they got the TV cameras rolling and that's what it took. One time we wanted a bill that would require the owner's name or social security number to be inscribed on dentures. We were getting nowhere because it was hard for legislative to see the need. A box of dentures placed in the rotunda convinced them that they do look alike and our bill had great meaning to denture wearers who were in health care facilities. The bill passed both houses unanimously!

You want to get Sanitarians licensed? Have an outbreak of *Listeria* or *Salmonella!*

I also learned that you have to know what your opposition is. For example, if the legislature is being told by the league of counties that licensing sanitarians is going to cost them money, you can bet that you are going to have a battle on your hands.

At this point, you have to work with the opposition to seek a compromise that will help both sides. While the league wants to save its members money, it also doesn't want to be blamed for an outbreak of food poisoning. See, both sides want the same thing. Now you can get together to reach an agreement that will meet the needs of both sides.

I guarantee that if you don't do it before hand, you will do it later when the legislature says "compromise or the bill is dead." Then you may be boxed in and have to settle for something less than you want.

Do I miss being involved Legislatively? Clearly at least a little bit. Maybe this is just one more way IAMFES can help its members and affiliates. We can't fight the battles for you, but we can sure give ideas on how to win those battles.

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

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105	118	131	144	157	170	183	196	209	222	235	248	261	274	287	300	313	326	339	352
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107	120	133	146	159	172	185	198	211	224	237	250	263	276	289	302	315	328	341	354
108	121	134	147	160	173	186	199	212	225	238	251	264	277	290	303	316	329	342	355
109	122	135	148	161	174	187	200	213	226	239	252	265	278	291	304	317	330	343	356
110	123	136	149	162	175	188	201	214	227	240	253	266	279	292	305	318	331	344	357
111	124	137	150	163	176	189	202	215	228	241	254	267	280	293	306	319	332	345	358
112	125	138	151	164	177	190	203	216	229	242	255	268	281	294	307	320	333	346	359
113	126	139	152	165	178	191	204	217	230	243	256	269	282	295	308	321	334	347	360

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112	125	138	151	164	177	190	203	216	229	242	255	268	281	294	307	320	333	346	359
113	126	139	152	165	178	191	204	217	230	243	256	269	282	295	308	321	334	347	360

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Meeting & Hotel Registration Forms available in this issue

FOUR DIAMOND AWARD

Fact Sheet

We're Easy to Find

From the South: (or southeast, including O'Hare). Take the Northwest Tollway (I-90) toward Rockford. Exit at 53 North, take 53 for 2 miles. Exit at Euclid East and you're there!

From the North: take I-94 south to Willow Road, which becomes Palatine Road. Take Palatine Road to Route 53. Take 53 South, exit at Euclid East and you're there!

From the West: take the Northwest Tollway (I-90) toward Chicago, Exit at 53 North, take 53 for 2 miles. Exit at Euclid East and you're there!

From the East: take Lake Avenue West, which becomes Euclid Avenue, and leads directly to us.

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Guest Accommodations:

Over 40,000 square feet of meeting and function rooms to accommodate every business and social need. 421 spacious guest rooms, including the "Towers" and Suites. The Sports complex and Recreation Areas represent the most complete service in the area. Conference Center 1 boasts the most advanced conferencing facilities the area has to offer. With 19 conference rooms, private boardrooms, an executive dining room, a lobby lounge with house and credit card phones, personal computer hook-ups, complete audio/visual equipment and rear screen projection rooms, the center is ideal for any business function.

Area Attractions:

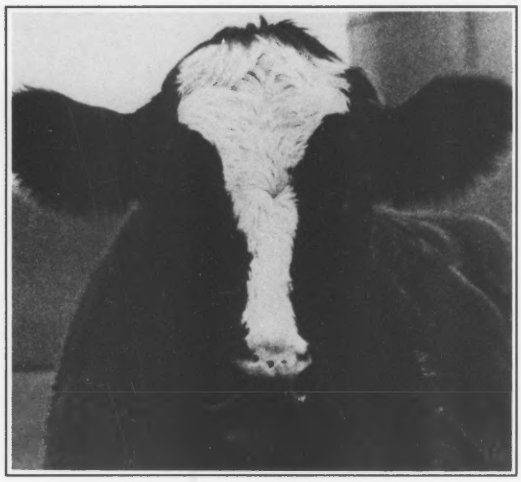
Adjacent to Arlington International Racecourse. Five minutes from Woodfield Mall, Second City Comedy Club, and Ditka's Nightclub (at the Racecourse). Easy access to major Expressways. Free Scheduled Shuttle Service in area. 15 minutes from O'Hare Airport. A variety of dining and entertainment atmospheres.

Dining and Cocktails:

Delaney & Murphy: A steak house, where you'll find an atmosphere of warmth and an extensive menu featuring the finest charbroiled prime steaks, fresh seafood and poultry.

Brasserie: A charming, open-air cafe, offering excellent cuisine and gracious service. The Brasserie is perfect for light meals, snacks or just a cup of coffee. Overlooking the main loby it's the ideal place to people-watch.

The Ritz: The Ritz is the WOODFIELD HILTON AND *Towers* new entertainment lounge, with live music and dancing. The drinks are generous; the conversation, captivating; the mood - irresistible.



This is the cow
that caught the bug,
that was treated by penicillin
(and ampicillin and erythromycin
and sulfamethazine etc.)
that spoiled the milk,
that contaminated the silo,
that shut down the plant,
that lost $100,000.
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