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Dairy and Food Sanitation

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

Goat Milk Production in Scotland

Video Tape Training

ACDPI Announces Award Winners

EDB Report

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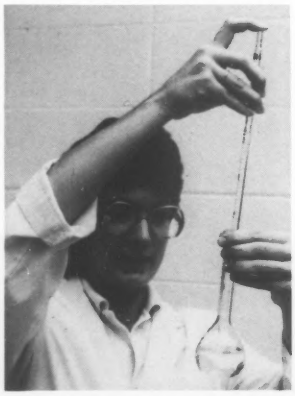

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Dairy and Food Sanitation

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In Scotland as in the United States there has been a considerable increase in recent years in the production and sale of goats' milk. As virtually none of this milk is heat treated before sale and no specific legislation exists concerning hygienic production methods or standards, the growth in retail sales has been accompanied by increased concern of Environmental Health Officers and others responsible for consumer protection. Investigations have been carried out in the North and West of Scotland to assess the bacteriological quality of goats' milk and to examine the main factors affecting it. The results of tests to determine the incidence of udder pathogens, levels of somatic cell counts and the extent of bacterial contamination occurring between goat and consumer are presented.

HYGIENIC ASPECTS OF GOAT MILK PRODUCTION IN SCOTLAND

A. C. HUNTER* and ELIZABETH G. CRUICKSHANK**

As has been the case in many other areas throughout the world, both the dairy goat population and the consumption of goat milk in Scotland have increased in recent years. There are however few large herds in the country, most goatkeepers have less than a dozen milking goats. Much of this milk is kept for home use, for feeding young stock and small animals and for making yoghurt, cheese and other products. Yet, substantial quantities are sold either liquid or frozen, direct from the goatkeeper premises or through retail outlets such as health food shops or supermarkets. In contrast to cow milk, almost all of which must now be heat-treated before being retailed, goat milk is seldom pasteurized and no legislation exists which specifically controls the hygienic conditions under which it is produced. Some guidance has however been made available to Scottish goatkeepers in the form of a Code of Practice recently issued by the Department of Agriculture and Fisheries for Scotland (*5*).

As a result of strict bacteriological standards (*3*) which existed for the sale of untreated cow milk prior to the introduction of compulsory pasteurization regulations and also due to the financial penalty schemes currently operated by the UK Milk Marketing Boards, the production of milk in Scotland has long been considered to be of a very high standard. Examples of the hygienic quality which is expected are shown in Tables 1 and 2.

**North of Scotland College of Agriculture, 581 King Street, Aberdeen.*
***West of Scotland Agricultural College, Auchincruive, Ayr.*

TABLE 1. *Statutory bacterial count standards for raw milk retailed in Scotland from 1965 to 1983.*

Grade	Maximum permitted bacterial count/ml
Standard	50,000
Premium	15,000

TABLE 2. *Financial penalty schemes operated by Milk Marketing Boards in Scotland.*

Board	Bacterial counts/ml	Penalties at 1.1.84
Scottish Milk Marketing Board	<15,000	+0.1 ppl premium
	15,000-75,000	nil
	75,000-100,000	-0.1 ppl
	100,000-150,000	-0.3 ppl
	>150,000	-0.7 ppl
Aberdeen and District Milk Marketing Board	<50,000	nil
	50,000-100,000	-0.243 ppl
	100,000-150,000	-1.215 ppl
	>150,000	-2.430 ppl
North of Scotland Milk Marketing Board	similar scheme to be introduced in 1984	

In contrast, little control is exerted over the hygienic quality of goat milk and, although several local authorities carry out bacteriological tests on milk sold in shops, little is known about the quality of milk retailed from the goatkeepers premises. In an attempt to obtain such information the two authors conducted separate investigations within their own College areas, the combined results of these projects being presented in this paper.

METHODS

A total of 483 milk samples drawn aseptically from individual halves of dairy goats in various areas in the North Scotland were examined for total bacterial counts and coliform organisms (*2*) and also mastitis pathogens and somatic cell counts (*4*). In addition, 29 goatkeepers co-operated in the assessment of the hygienic standards of their production methods. A total of 75 items of milking and milk handling equipment, mostly sterilized with either hot water or sodium hypochlorite, were rinsed with 500 ml quantities of quarter-strength Ringer's solution (*2*) on which bacterial counts and coliform tests were subsequently carried out. On each of the 29 producers' premises milk samples were taken at various stages of production to assess the effect of poorly sterilized utensils on the bacteriological quality of the milk.

In the South-West of Scotland, bacterial counts and coliform tests were carried out on 37 retail packages of liquid milk, 26 obtained direct from goatkeepers and 11 from shops. Tests were also done on 77 packages of frozen milk, 18 from goatkeepers and 59 from shops. A further 40 samples of frozen milk were obtained from goatkeepers in the North of Scotland and a detailed examination of the surviving microflora was undertaken as part of a student project (*1*).

To assess the effect of storage temperature, three 100 ml aliquots from a quantity of clean, freshly produced goat milk were stored at 4°C, 10°C and ambient temperature (19°C-22°C) respectively for 8 days. The bacterial count of each sample was recorded at 24 hr intervals throughout the storage period.

RESULTS

Milk samples direct from goats

Of the 483 samples examined, 121 (25%) showed evidence of udder infection. The organisms isolated were coagulase-negative staphylococci (21%), coagulase-positive staphylococci (3%) and streptococci (1%). *Escherichia coli* was isolated from one sample from a goat showing symptoms of clinical mastitis but *Streptococcus agalactiae* was not detected in any of the samples. The effect of such infections on the total bacterial counts of the samples is shown in Table 3. Udder infections were reflected also in the levels of somatic cells in the samples. The distribution of cell counts of uninfected samples and of samples infected with coagulase-negative and coagulase-positive staphylococci is shown in Table 4.

Hygienic condition of milking equipment

Items of equipment tested included milking pails, filters and sieves, an assortment of storage vessels and, where used, milking machine clusters, long milk tubes and buckets. These utensils were made of a variety of materials including plastic, glass, aluminum, stoneware and stainless steel. The results of tests on rinses are expressed in bacterial counts per square metre and are shown in Table 5.

Milk samples from utensils during production

A total of 77 milk samples were taken from milk pails, sieves or filters, storage vessels and milking machines during production. The distribution of bacterial counts of these samples is shown in Table 6.

TABLE 3. *Distribution of total bacterial counts of infected and non-infected samples.*

Infection Status	Bacterial counts/ml					
	$<10^1$	10^1-10^2	10^2-10^3	10^3-10^4	10^4-10^5	$>10^5$
	No (%)	No (%)	No (%)	No (%)	No (%)	No (%)
Infected	1 (0.8)	10 (8.3)	13 (10.7)	68 (56.2)	18 (14.9)	11 (9.1)
Non-infected	129 (35.6)	159 (43.9)	61 (16.8)	13 (3.6)	- (-)	- (-)

Packaged milk

Bacterial counts were carried out on samples of milk packaged in cartons or sachets for sale either liquid or frozen. The results of these tests are shown in Table 7.

Effect of storage temperature

The original bacterial counts of the milk used in this experiment was 800/ml. The increases in bacterial counts of the three sub-samples during the period of storage are shown in Figure 1. The maximum levels of count which were permitted for Standard and Premimum Grade cow milk are indicated for reference.

Coliform tests

It was of interest to note that only in the case of one animal showing symptoms of clinical mastitis were coliform organisms detected in the samples taken directly from the goats. Coliform organisms were also detected in a number of rinses and milk samples where there was evidence of inefficient cleaning of equipment but the numbers present were insufficient to constitute a serious problem in terms of keeping quality unless storage conditions were unsatisfactory.

DISCUSSION

Compared with the extensive literature which exists concerning the microbiological problems associated with cow milk, relatively little has been published on the hygienic aspects of producing goat milk. A certain amount of work has been done on the incidence of mastitis pathogens and levels of somatic cell counts, some

TABLE 4. *Distribution of somatic cell counts of infected and non-infected samples.*

Infection Status	Somatic cell counts ($\times 10^3$/ml)			
	<500	500-1000	1000-2000	>2000
	No (%)	No (%)	No (%)	No (%)
Infected: coagulase negative staphylococci	18 (17.8)	28 (27.7)	25 (24.8)	30 (29.7)
coagulase positive staphylococci	1 (6.7)	2 (13.3)	1 (6.7)	11 (73.3)
Non-infected	77 (21.3)	90 (24.9)	79 (21.8)	116 (32.0)

TABLE 5. *Distribution of bacterial counts of rinses of milking utensils.*

Utensils (No)	Bacterial count/m^2			
	$<10^5$	10^5-5×10^5	5×10^5-5×10^6	$>5\times10^6$
	No (%)	No (%)	No (%)	No (%)
Milking pails (24)	11 (45.8)	4 (16.6)	5 (20.8)	4 (16.6)
Sieves/filters (22)	9 (40.9)	1 (4.5)	7 (31.8)	5 (22.7)
Storage vessels (20)	11 (55.0)	4 (20.0)	2 (10.0)	3 (15.0)
Milking machine parts (9)	4 (44.4)	2 (22.2)	3 (33.3)	- (-)

TABLE 6. *Distribution of bacterial counts of milk samples at various stages of production.*

Source (No)	Bacterial count/ml			
	$<10^3$	10^3-10^4	10^4-5×10^4	$>5\times10^4$
	No (%)	No (%)	No (%)	No (%)
Milking pails (28)	14 (50.0)	14 (50.0)	- (-)	- (-)
Sieves/filters (10)	3 (30.0)	4 (40.0)	3 (30.0)	- (-)
Storage vessels (36)	13 (36.1)	14 (38.9)	5 (13.9)	4 (11.1)
Milking machines (3)	1 (33.3)	2 (66.7)	- (-)	- (-)

TABLE 7. *Bacterial counts of liquid and frozen packaged milk obtained direct from goatkeepers or from retail outlets.*

Samples (No)	Bacterial count/ml			
	$<10^3$	10^3-10^4	10^4-5×10^4	$>5\times10^4$
	No (%)	No (%)	No (%)	No (%)
Direct from goatkeepers:				
liquid (26)	9 (34.6)	10 (38.5)	3 (11.5)	4 (15.4)
frozen (58)	19 (32.8)	28 (48.3)	5 (8.6)	6 (10.3)
From retail outlets:				
liquid (11)	- (-)	2 (18.2)	1 (9.1)	8 (72.7)
frozen (59)	- (-)	17 (28.8)	15 (25.4)	27 (45.8)

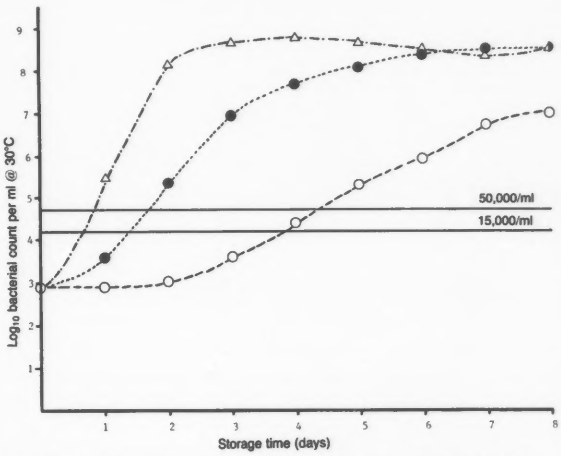

Figure 1. *Bacterial counts of goat milk during storage at 4°C (○---○), 10°C (●---●) and ambient temperature in the range 19°C-22°C (Δ-·-·-Δ).*

of the main contributions in this field having been reviewed recently by one of the authors (*7*). Little information is available however on the bacterial content of the milk at various stages of production and the results presented here attempt to illustrate typical sources and factors affecting levels of contamination from the time the milk leaves the goat until it is retailed.

No matter how much care is taken with the sterilization of utensils, milking technique or subsequent storage, contamination can still arise from organisms within an infected udder. One quarter of all samples taken aseptically from the goats in this study were infected to some extent but over 80% of these were due to coagulase negative staphylococci, organisms generally thought to be either non-pathogenic or of low pathogenicity. They have from time to time been isolated from halves showing indications of sub-clinical mastitis, such as elevated somatic cell counts, but they are not considered to be a serious health risk. Coagulase positive staphylococci on the other hand present a more serious problem but they occurred in only 3% of the infected samples.

The effect of such infections on total bacterial counts is extremely variable but over 80% of infected samples had counts of more than 1000/ml compared with 80% of uninfected samples having counts less than 100/ml. Counts in excess of 100,000/ml were found in 8.3% of infected samples while only 3.6% of the uninfected samples had counts of over 1000/ml. It is clear therefore that milk from infected animals could readily fail to comply with statutory bacteriological tests even though produced under the most stringent hygienic conditions.

The results of somatic cell counts on these samples agree with other published evidence to the effect that levels of somatic cells in goat milk are generally higher than in cow milk. And that although udder infections result in increased counts, existing standards for cow milk should not be adopted without modification for the grading of goat milk (*7*).

In assessing the efficiency of sterilizing milking utensils, the difficulty in relating bacterial counts of rinses to milk quality is widely recognized. However, in our interpretation of the results of tests on rinses consideration was given to the opinion of Cuthbert (*6*) that "cleaning methods consistently producing rinse counts of less than 50,000/ft^2 (approx 500,000/m^2) will cause little trouble". On this basis 83% of pails and other vessels used for hand-milking, all the milking machines and 85% of storage vessels were considered to be in a satisfactory condition. Of the filters and sieves tested, 23% were in an unsatisfactory bacteriological condition, a number of these being visibly in a poor state of repair.

All of the milk samples taken from the milking utensils before filtering had bacterial counts of less than 10,000/ml, half of these being below 1000/ml. Of these samples in the range 1000-10000/ml, almost 80% were from goats with udder infections.

The effect of filtering on the bacterial content was, as could be expected, extremely variable. The counts of two samples filtered through a sieve with a rinse count well in excess of 5 million/m^2 rose from 4,900/ml to 17,000/ml and from 1,600/ml to 20,000/ml. Of four samples in the 1000-10,000/ml range, three were from infected udders and the other had passed through a sieve with a rinse count of 7 million/m^2.

Of a further 36 samples which were obtained from storage vessels, 23 had counts in excess of 1000/ml. Examination of individual results suggested that of these, more than half were associated with infected udders and about the same number with poorly sanitized equipment. In at least 7 cases both factors were involved.

The effect of such contamination on the milk will depend to a large extent on the temperature of storage. The effect of storing samples of cleanly produced liquid milk at three different temperatures is clearly shown in Figure 1. When stored in a refrigerator at 4°C the bacterial count, initially at 800/ml remained below 15,000/ml for almost 4 days. At a temperature of 10°C, the count exceeded 100,000/ml within 2 days. Storage at ambient temperature resulted in a rise to almost 300,000/ml in 24 hours. If this rate of increase in bacterial numbers occurs in clean milk, the result of storage, other than in a refrigerator, of milk produced under unhygienic conditions is likely to be an extremely short shelf-life. Compared with cow milk, goat milk tends to be purchased at less frequent intervals and a longer shelf-life is often expected.

Freezing of goat milk has usually proved to be a satisfactory way of ensuring an even supply throughout the year of an otherwise seasonal product. Where milk is produced under clean conditions and frozen immediately to a temperature around -20°C, few problems seem to arise. The surviving microflora of frozen goat milk and the factors likely to influence the numbers and types of organisms have recently been studied by Agnello (*1*) who concluded that the quality of such milk depended mainly

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Video Tape Training -

The Future is Now

DR. ROBERT B. GRAVANI

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Traditionally, sanitation training has been accomplished through inperson lectures, supplemented by the use of overhead transparencies, slides, filmstrips and films. Field trips to food processing operations, warehouses, retail stores and food service facilities also served to impart practical knowledge to the audience. Today, the technology has progressed to where video can be effectively used to convey concepts, issues and realism to training programs. Available in a wide variety of formats, this "new" medium allows for tremendous flexibility in sanitation or industry training programs. Not only can scientific subjects be covered, but important issues such as inspector attitude, employee awareness and crisis management can be effectively taught. Interactive video utilizing both video and computer technologies can be used for teaching complicated and/or comprehensive material.

Educational and training programs in food protection are instructional processes designed to facilitate learning and to modify human behavior. This is usually accomplished by providing a systematic program for the acquisition of knowledge, skills, rules, concepts or attributes that result in improved performance (*10,14*). In order to assure that the instructional message(s) will be received, retained and assimilated by the audience, educators and trainers must utilize principles involved in learning as they plan training programs (*10,11,12,13,14*).

The spoken word is the most popular form of communication; oral communication in lecture format has been used as the primary vehicle for transmitting information in education and training (*7*). However, when a speaker is trying to teach a complex subject or convey an important concept, explanations are seldom adequate to allow the audience to understand and remember the important details. This is because the listener's impression comes from verbal symbols alone and these symbols may be misinterpreted or misunderstood (*1,7*). As a result, the intended message is not conveyed to the audience. Many studies (*7*) have shown that the lecture is not the most effective technique for transmitting information; there are significant differences in the amount of information acquired by individuals exposed to oral instruction (*7*). These differences are due to a variety of reasons including the educational background, mental abilities and social experiences of the learners.

The inadequacy of oral instruction may be compensated for by the use of visual aids. Visual aids including drawings, diagrams, charts, posters, signs, photographs, films, slides, filmstrips, overhead transparencies, television, video, interactive video, programmed instruction and computer assisted instruction have all been used to enhance the learning process. Thus, the verbal symbol, when reinforced by visuals is strengthened, and the listener gains a better understanding of the concepts being discussed (*1,7*). This strategy has been used to complement both oral and written instruction and to stimulate and facilitate learning.

Unfortunately, the mere use of visuals is not a guarantee that the learning process will be enhanced. Some visual aids may be more effective than others in facilitating learning in different situations (*7*). Properly designed and effectively used visuals should provide the stimuli needed by the learners to achieve a specific educational or training objective (*7,12*). When this occurs, effective learning will result, and training programs will be successful.

One visual aid that has been underutilized in the training of food protection personnel has been video. This exciting technology will be evaluated as a training tool and its current uses and problems will be discussed.

Video as a Training Tool

The use of video or private, non broadcast television is rapidly expanding and is widely used to communicate with the train personnel in a variety of organizations. Most people have been exposed to television for information and entertainment and usually find effectively produced video programs an appealing form of training (*9,13*). The advantages of video training are shown below:

Advantages

- Displays actual scenes.
- Has strong personal and emotional appeal.
- Repeats information for reinforcement.
- Generates interest and excitement.
- Has excellent visual qualities.

Since its beginning in the late '60's and early '70's when it was used to record lectures, video has evolved

into a versatile training tool. Business and industry now account for well over 50% of all video usage, while education accounts for approximately 25-30%, government 10% and health and medical organizations about 10% (*6*).

Business and Industry

Business and manufacturing industries are among the heaviest users of video. They utilize this mediuim in training, employee communications and for public information. The training function is expanding very rapidly and has been estimated to be growing at a rate of 30 to 50% each year (*9*). A heterogenous and better educated work force, multiple facilities in geographically diverse areas of the United States and foreign countries, new technical information, job skills and a need for improved communications have caused this surge of interest in video programming.

A large number of employees are hired and promoted each year who work in complex and specific jobs. Manufacturers must thus provide instructional programs to teach a wide range of skills -- from specific tasks in the plant to sophisticated data processing or management skills for executives. Although instruction usually involves traditional lecture format and on-the-job training, a great deal can be taught through the use of group or individualized video programs (*9*). Video has also been used within corporations as a communications device to keep employees informed about new policies, practices, and changes within the company. Some organizations even use, video to recognize promotions and distribute personal news about employees. This helps to personalize large organizations and also stimulate and improve employee spirit (*9*).

Public information is often transmitted via video programs. Companies produce video programs and show them at the point of product purchase, where specific information about a product is shared with consumers.

Government

Government departments and agencies often use video as an instructional and communication medium. The Department of Defense is one of the largest and most sophisticated users of video (*9*). They use video in military training and can standardize procedures on bases all over the world. The military is also actively involved in the research and development of new and more sophisticated video technologies.

Government agencies use video to communicate new information to field personnel all over the United States. A recent example is a video tape produced by the U.S. Food and Drug Administration on tamper-resistant packaging devices for certain over-the-counter human drug and cosmetic products. The video program, utilizing several FDA packaging experts explained the new regulations and showed examples of the tamper-resistant devices. Multiple copies of the video tape were sent to field offices where they were shown to FDA personnel, as well as state and local regulatory officials.

Education

Education institutions use video in a variety of innovative ways. From showing complex scientific phenomena under a microscope to using video as a research tool, educational institutions have brought realism into the classroom, to research laboratories and to diverse extension audiences in the field. Video brings real-life examples and experiences into the learning process and provides situations that would otherwise not be available to students.

Several video tapes that have been developed at Cornell University, in cooperation with the New York State Department of Agriculture and Markets, Division of Food Inspection Services are now being shown to food protection professionals throughout the United States (*13*). These role-played tapes, filmed on location, address a variety of inspectional considerations including inspector attitude and conduct, human relations skills and agency policies and procedures. These programs are used to complement other training activities and have been well received by industry and regulatory audiences.

Health and Medical Organizations

These organizations use video extensively in the continuing education of professionals as well as for educating patients about medical matters and procedures.

Video has emerged as an effective communication and training tool. The annual expenditures for non-broadcast video surpassed the $1.5 billion mark in 1980. It has been estimated they will double in size and reach over $3.6 billion by 1984 (*5*).

This steady expansion has been brought about by a number of social, technical and economic factors (*2,6,9*) including the:

- desire to improve communication and training;
- need to improve and standardize instruction;
- need for continuing education of professionals;
- need for on-line education and training for non-professionals;
- need to reach geographically dispersed companies and government agencies;
- need to deal with the rising costs of quality training programs;
- need to address the diminishing impact of written communications;
- need to cut travel expenses.

Due to its ability to reproduce and display sound, motion and color, that results in realism, video motivates learners and is an effective communication tool. Video also allows individuals to learn at their own pace; this medium provides the viewer with the flexibility to stop, replay a segment or slow down a program. Interactive, or microprocessor controlled video allows viewers to "interact" with the program and respond to specific questions. This form of self-paced instruction provides two way communication and personlizes training situations (*8,13*). The repetition of messages and demonstration of techniques that would normally be time consuming and inefficient if repeated by a skilled professional can easily be accomplished with video technology.

Video is also cost effective. Considering the expenses involved in training employees, including travel and the hiring of training consultants, video programs can save time and money, since the same program can be used many times (*6,9,13*). They can also be used in conjunction with instructors and can reduce the time of training.

Use of Video

In order to determine the use and applications of video, one research group surveyed a variety of organizations in 1973, 1977 and 1980 (*3,4,5*). In their most recent survey of about 300 organizations that use video, Brush & Brush (*5*) found that over 70% of the respondents used video for training in basic skills and specific jobs. Video was also used in employee orientation and supervisory training by over 60% of the organizations surveyed. Table 1 indicates the variety of uses of video determined in the survey.

In addition, the respondents shared information on the format used for program distribution and the length of viewing time for their programs. The majority of organizations (86.5%) distribute their programs on video cassettes with 69.4% of them using the 3/4" format (*5*). Most organizations surveyed are now using 3/4" video cassettes for production but, because of costs, are moving to ½" video cassettes for distribution.

The production of short video programs was found to be preferred by most of the organizations surveyed (*5*). Table 2 summarizes the results on the average running time for programs.

Three-quarters of the users produced programs in the 10 to 20 minute category -- most of these programs were shot on location. About 83.5% of the survey respondents shot on location. Brush and Brush (*5*) also found that slightly more than half of the respondents (54.4%) showed their video programs four or more times.

Some other interesting observations determined by the Brush survey (*5*) relate to the number of viewing locations in which video programs are shown. The information is found in Table 3.

The data reveals that a large percentage of manufacturers, nonindustrial organizations and government agencies show their video programs from 21 to 50 viewing locations.

Finally, the Brush survey (*5*) addressed the question of how video programs were being viewed. This unique information is shown in Table 4.

More than half the programs were viewed in small groups at the organization's headquarters and almost two-thirds were viewed with a supervisor or trainer present in field locations. So, it appears that most video programs are used as part of other training activities. In the future, use of programs by individuals and personnel involved in self-paced instruction will probably increase (*5*).

Although video is not a panacea that can solve all communication, education and training problems, the information discussed above clearly indicates that video is a viable training tool. The data also show that this medium is currently being effectively used by business, industry, education, government and health and medical organizations.

What are some of the problems with video? While video is being used by a great many organizations

TABLE 1. *Current Video Applications in Order of Use*[1].

Video Application	% Of Total Respondents
Basic Skill Training	72.7
Specific Job Training	70.6
Employee Orientation	63.5
Supervisory Training	62.3
Employee Information	59.2
Management Communications	56.1
Management Development	54.9
Sales Training	50.9
Safety/Health	50.6
Employee Benefits	49.4
New Product Demonstration/Introduction	47.2
Sales Meetings	32.5
Community Relations	31.3
Proficiency Upgrading	31.3
Annual Reports/Meetings	27.9
News Programs (Regularly Scheduled)	27.6
Point-of-Sale Programs	21.8
Economic Information/Education	17.8
Labor/Government Relations	13.8
Security Analyst Presentations	8.6

[1]Information from 326 respondents.

SOURCE: Brush, J. M. and D. P. Brush. 1981. Private Television Communications: Into the Eighties. International Television Association, Berkeley Heights, NJ. 204p.

TABLE 2. *Average Running Length of Video Programs*[1].

Average Length[2]	% Of Total Respondents
Less than 10 minutes	54.1
10 to 20 minutes	74.9
20 to 30 minutes	61.8
30 to 45 minutes	26.0
45 to 60 minutes	23.5
60 minutes or more	12.8

[1]Information from 327 respondents.

[2]More than one answer may apply for each respondent.

SOURCE: Brush, J. M. and D. P. Brush. 1981. Private Television Communications: Into the Eighties. International Television Association, Berkeley Heights, NJ. 204p.

TABLE 3. *Number of Locations in Which Video Programs Were Viewed.*

# of Locations	Mfrs. (127)[1]	Non-Ind. (146)[1]	Hth/Med. (26)[1]	Gov't. (18)[1]	Other (8)[1]	% of Total (325)[1]
1	5.5%	4.8%	3.8%	5.6%	-	4.9%
2-3	3.9	3.4	26.9	5.6	12.5	5.8
4-6	7.1	2.1	15.4	22.2	-	6.2
7-10	11.8	8.2	11.5	-	-	9.2
11-20	14.2	17.8	7.7	22.2	-	15.4
21-50	18.9	22.6	3.8	27.7	12.5	19.7
51-100	18.1	17.8	3.9	11.1	25.0	16.6
101-250	11.0	11.0	3.9	-	37.5	10.5
Over 250	9.5	12.3	23.1	5.6	12.5	11.7
TOTAL	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

[1]Number of organizations responding to the survey in each category.

SOURCE: Brush, J. M. and D. P. Brush. 1981. Private Television Communications: Into the Eighties. International Television Association, Berkeley Heights, NJ. 204p.

TABLE 4. *How Video Programs are Viewed*[1].

How Program is Viewed[2]	% Of Total
Individually, at viewer's discretion.	38.8
Individually placed instruction in field locations or headquarters.	26.1
Small group session at headquarters.	55.9
In field locations with group supervisor and/or trainer leading session.	64.0
At point-of-sale with sales representative present.	12.1
In customer's locations with no representative present.	6.2
At government, community and/or other outside audience meeting.	8.7
Don't know--send to field for use as they see fit.	13.7

[1]Information from 322 respondents.

[2]More than one answer may apply for each respondent.

SOURCE: Brush, J. M. and D. P. Brush. 1981. Private Television Communications: Into the Eighties. International Television Association, Berkeley Heights, NJ. 204p.

and has achieved tremendous success, there are still some problems that can occur (*2,6,13*). They are:

- *Improper Selection of Video Application*

  When educating and training people, it must be recognized that there is no one method of instruction or one type of visual aid that will be appropriate in every situation. This is why educators and trainers use a combination of strategies and techniques as well as a wide variety of visual aids to complement the eudcation process. Not every instructional situation lends itself to video programming. The needs of each training situation should be carefully evaluated and specific training goals formulated *before* any production work is undertaken.

- *Inadequate Program Design*

  Instructional programming can certainly affect the outcome of any training program. It should be stressed that a thorough program design must be carried out for each training situation considered. A typical program design sequence is shown in Figure 1. There must be a needs assessment, followed by the development of specific training goals. After this, the capabilities and attitudes of the learners must be determined and the characteristics of the information should be evaluated. When all of these analyses are completed, then a specific training format, with appropriate script and visuals can be developed, tested and implemented.

- *The Complexity of Video*

  Often people have greater expectations of video than can be achieved. Top management involvement, adequate equipment and facilities, skilled and creative video professionals and subject matter experts are all needed to produce high quality video productions. Without all of this input, video programming may not be an effective instructional tool.

- *Problem Solving*

  In order to modify human behavior and solve problems, people within an organization must be willing to verbalize and share problems. In this way, a solid program design can be formulated and an appropriate training program can be used to solve the problem.

- *Top management Involvement*

  Top management in corporations, educational institutions, and government agencies need to be committed to and involved in training. Since video programming requires a great deal of time and effort, top managment should provide input and expertise to these programs.

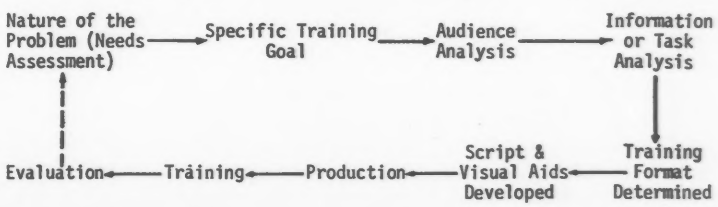

Figure 1. *Program Design.*

- *Cost Effectiveness*

  Video training needs to be cost effective to survive in any organization. Many considerations are involved, but with adequate and proper program design, video can achieve training goals and be cost effective too.

Video equipment and facilities are currently being used by a tremendous number of organizations in a wide variety of ways. The challenge is to stimulate administrators in the food industry, university food science departments and regulatory agencies to develop high quality video programs for professionals and non professionals in food protection. There is a definite need for this information, the technology is available, the expertise is present, and the only obstacles are the time, energy and expense involved in incorporating this medium into food protection training programs. The future looks very good for new and innovative education and training programs in the field of food protection. Video programming can indeed be used as an effective training tool in this important area.

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Hunter and Cruickshank, *con't. from p. 215*

on production conditions, time and storage temperature between production and freezing and also the method of thawing.

Coliform tests are useful indicators of hygienic production conditions. Although the levels of such bacteria did not give much cause for concern in milk samples taken direct from the goats, from milking utensils or from retail packs obtained from the producers' premises, almost half of the samples obtained from retail outlets had detectable amounts of coliform organisms in 0.001 ml quantities of milk. Absence of coliforms in this quantity of milk is regarded as an acceptable level in Scotland where, until last year, the Coliform Test was a statutory requirement.

CONCLUSIONS

As a result of the work described above it would appear that goat milk production in Scotland is of an acceptable standard in spite of the fact that advice on hygienic production techniques, although readily available through Agricultural Colleges and other bodies, has neither been widely publicized nor requested.

The main problems appear to be (i) a high incidence of udders infected with coagulase negative staphylococci resulting in elevated bacterial counts, (ii) lack of adequate control of conditions of storage of packaged milk after it leaves the producers' premises and to a lesser extent, (iii) inadequate sterilization of milk handling equipment.

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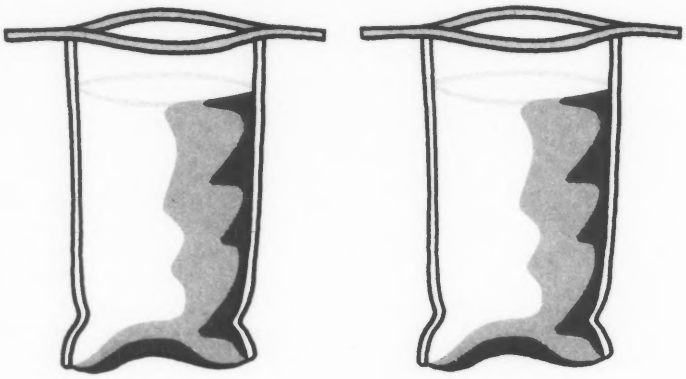
Notice To IAMFES Members

Due notice is hereby given that the following proposed changes to the IAMFES Constitution and Bylaws are to be discussed at the Annual Meeting of the Association in Edmonton, Alberta, Canada, August 5-9, 1984. The following constitute the substantive changes that will be discussed:

A. Constitution
   1. Article II--Editorial changes of the Objectives.
   2. Article III--Add the class Student members.
   3. Article IV
      a. Reduce the number of officers from 5 to 4, eliminating the Second Vice President.
      b. Reduce the number of persons on the Executive Board to 6 (instead of 8). The Board would be composed of the 4 officers, the immediate Past President and the Chairperson of the Affiliate Council.
      c. The Senior Past President would no longer be a member of the Affiliate Council.
   4. Article VI
      a. The number required for a quorum to conduct business would be increased from 25 to 50.
      b. Special meetings of the Association could be called by the Executive Board with 60 days notice in the Journal.
      c. A quorum of the Executive Board would be 4 instead of 5.
   5. Article VII--The Executive Secretary would be named the Executive Manager.

B. Bylaws
   1. Article I
      a. Section 1 - Includes persons engaged in environmental inspection among the types of persons allowed membership.
      b. Section 2 - Associates the authority of the Executive Board to set dues with achieving the objectives of the Association. Provides for notification of members of amounts of dues.
      c. Section 4 - Provides that Student Members pay one-half the dues of Regular Members, e.g. $14 if they elect to receive *Dairy and Food Sanitation*. Allows Student Members to attend business meetings and to speak but not to vote.
      d. Section 5 - Changes the responsibility for ensuring that applicants for membership are eligible from the Membership Committee to the Executive Board.
      e. Section 9 - Makes official the practice of authorizing the Executive Manager to bill IAMFES Members for both Affiliate and IAMFES dues. Also, provides that members will receive an annual subscription to the Official Publication of the Association.
   2. Article II
      a. Adds to duties of the single Vice President the responsibility to study the organization and operation of committees.
      b. Makes editorial changes in the section on duties of the Secretary-Treasurer and Executive Manager to clarify that the Executive Manager has all duties except keeping minutes of meetings.
      c. Specifies that the Chairperson of the Affiliate Council will serve on the Executive Board (Already accepted as an amendment).
      d. Includes duties of the Secretary of the Affiliate Council.
   3. Article III--Specifically authorizes the hiring of an Executive Manager by the Executive Board.
   4. Article V (formerly IV)
      a. Section 1 - Changes the name of the Publication Committee to Journal Management Committee and authorizes appointment of a separate committee for each journal (practice already in use). Specifies the composition of this (these) committee(s) and makes the Executive Manager the Managing Editor of the publication(s).
      b. Section 1A - Provides that the Chairperson of the Local Arrangements Committee be a member of the Program Committee.
      c. Section 2 - Provides that the Nominating Committee be representative of geographical and membership groups, that a date be published by which names of nominees for office be submitted by IAMFES members, that biographical sketches be published by April 1 and that ballots be distributed by the Executive Manager.
      d. Section 4 - Provides that appointments to committees be made by the President-Elect prior to the Annual Meeting.
   5. Article VII (formerly VI)--Provides that Dairy and Food Sanitation shall be the official publication and the Journal of Food Protection shall be the scientific publication.



Finally, a 6-minute milk antibiotic assay.

One of these sample bags is filled with fresh, wholesome milk. The other, with milk contaminated by antibiotics.

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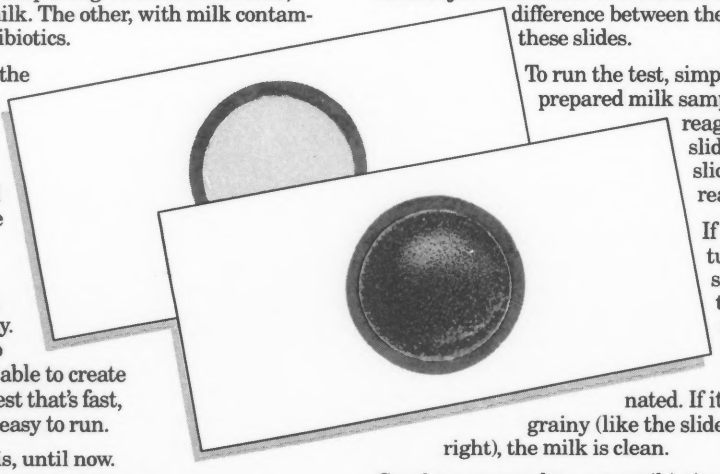

To run the test, simply mix a prepared milk sample and reagents on a slide. Rock the slide, then read.

If the mixture looks smooth (like the slide on the left), the milk is contaminated. If it looks grainy (like the slide on the right), the milk is clean.

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News and Events

Dairy Science Conference Set

The latest in the scientific aspects of dairying--from production to processing--will be presented when the American Dairy Science Association meets June 24-27 at Texas A&M University in College Station, Texas.

The conference is open to anyone interested, and the up-to-date information will have application for producers as well as researchers, Extension specialists, and industry professionals, said Dr. Gary Lane, Extension dairy specialist in the University of Kentucky College of Agriculture, who is the chairman of ADSA's production division.

About 1,500 people associated with the dairy industry are expected to attend, Lane said. More than 400 papers outlining research findings will be presented.

"There will also be several symposia on dairy production in which top speakers will give invited presentations on certain timely topics," he said.

A symposium likely to draw considerable interest is one on "the dairy cow of the future." It will explore biological requirements for economic efficiency, with emphasis on genetic improvement and breeding decisions, nutritional requirements and lowering feed costs, enhanced reproduction, and animal health and management.

Other symposia topics include these:

--Dairy cattle reproductive management. R. S. Youngquist, an invited speaker from the University of Missouri, will discuss clinical approaches to solving reproductive problems. This session also will feature an integrated approach to and a futuristic look at reproductive management.

--Species variation in mammary gland function. Two invited speakers, Isabel Forsyth and Raymond Dils, both of Reading, England, will talk about the variation between species in the endocrine control of mammary growth and function and the comparative aspects of milk fat synthesis.

--Heterosis and crossbreeding. Richard Willham of Iowa State University will talk about the theory of heterosis. Other speakers will discuss heterosis and crossbreeding among temperate cattle and crossbreeding in tropical areas with emphasis on milk, health and fitness.

--Environmental effects on cow health and performance. Mastitis, stray voltage, reducing heat stress, and environmental effects on reproduction will be discussed.

--Forage and mineral utilization by the lactating cow. These sessions will cover sodium and potassium, calcium and phosphorus, chlorine, forage quality and particle size, prediction of energy value, and intake and forage-concentrate interactions.

Other sessions of general interest will be on evaluation of Extension educational programs and the future of the DHIA system. Dairy producers, federal and state dairy specialists, and representatives from equipment manufacturers will discuss DHIA educational programs, research needs, quality certification, DHIA boards, and farm computers.

"This symposium will deal with how the roles of the Cooperative Extension Service and industry are changing as times change, and as more responsibility for records shifts to dairy farmers," said Lane.

For more information about the ADSA meeting, or to register, contact C. J. Cruse, ADSA Executive Secretary, 309 W. Clark Street, Champaign, IL 61820.

RDA's and Nutrition

Nutrition-conscious grocery shoppers often read product labels to determine the RDA's -- or Recommended Dietary Allowances -- of various nutrients contained in the food they buy.

But shoppers should understand that RDA's don't tell the entire nutrition story, says Marilyn Haggard, a Texas A&M University Agricultural Extension Service foods and nutrition specialist.

RDA's represent averages that do not necessarily reflect a person's individual nutrient needs, she says.

Nutrition requirements differ with age, sex, body size and physiological state, explains the specialist. So the National Academy of Sciences National Research Council established RDA's which are adequate to meet the nutritional needs of practically all healthy persons according to their age and sex.

To figure out the precise amount of nutrients each family member needs using RDA's requires juggling a lot of numbers.

What consumers see on a food product label is actually the USRDA, which is set at the highest RDA for all the different sex and age groups, Haggard says. The amount of a nutrient in a food is stated as a percentage of the USRDA on the label.

The Food and Drug Administration adopted the USRDA as a means of providing a single standard for food labeling, she adds. By using the highest RDA for all groups, the USRDA system tries to insure adequate nutrient intake for the entire population.

Selecting food products with the highest percentage of USRDA nutrients is not always the best criteria for buying foods, says the nutritionist.

During the day, most people eat several foods which contain a particular nutrient. So it may not be necessary to get most or all of that nutrient from one product -- especially if it costs significantly more than similar products containing a smaller percentage of the nutrient.

Some people also incorrectly assume they are well fed just because they are consuming 100 percent of the USRDA as listed on food product labels, says Haggard. But there are other nutrients essential for health in addition to those required by the nutrition labeling regulations.

RDA labeling is required for products which have nutrients added or about which nutrition claims are made. The information must include listings for protein, carbohydrates, fat, vitamin A, vitamin C, thiamin, riboflavin, niacin, calcium and iron. The manufacturer may, but is not required to, list other nutrients.

The RDA's listed on food products can be a useful guideline for shoppers, says the specialist, but they do not insure good nutrition.

The best way to make sure you are getting needed nutrients is to eat a balanced diet, advises Haggard. Select foods from the four major food groups of meat, poultry and fish; breads and cereals; fruits and vegetables; and dairy products each day.

New Report Identifies EDB Health Risks

Of EDB sources, the urban atmosphere probably poses the greatest threat to human health in the nation, according to a recent study. The report also cites reproductive effects of EDB and warns that combined effects with other common drugs or chemicals may heighten health risks.

The report, *EDB: A Guide for Decision Makers*, was compiled by Envirologic Data, an independent firm of health specialists, including a physician and toxicologist staff that specializes in evaluating the risks of environmental hazards to human health.

To compile the EDB report, the company used 11 world-wide, computerized databases. Some 300 documents cited in the report, and 200 additional sources of information, were evaluated to determine the health hazard of the chemical in many categories including: acute toxicity, cancer induction, birth defects, genetic alteration and reproductive effects.

Analysis of data yielded a risk assessment in each category on a rating scale from 0 (no hazard) to 3 (relatively high potency or certainty of hazard). "We found the highest risk in the areas of cancer causation and reproductive effects," said Envirologic Data Director of Environmental Toxicology, Robert A. Michaels, Ph.D. "A low number, however, does not mean that the chemical is safe in that category. It may be due simply to lack of information."

Dr. Michaels said the most unexpected result of the analysis was the finding that from 77 to 88 percent of the total EDB exposure comes from the atmosphere. "Studies of similar compounds suggest that about 80 percent of inhaled EDB is absorbed by the body compared to about 75 percent when the chemical is ingested."

Atmospheric EDB comes from leaded gasoline, in which it is used to prevent lead deposits. The sources in order of importance are gasoline pumps, crankcase blow-by and exhaust fumes, Dr. Michaels said.

Several studies in cattle revealed lower sperm counts and changes in sperm structure after EDB exposure. "The effects were marked, although transient," Dr. Michaels said.

The computer search also provided information showing that certain chemicals, if present in the body, could combine with EDB to increase its health risk.

Envirologic Data normally performs risk assessments for such clients as government agencies, manufacturers and law firms, Michaels said. The EDB report is the first available to the public. It includes a history of the chemical, examination of sources and routes of exposure, a quantitative analysis of health effects, a state-by-state survey of regulations and listing of some 300 literature sources analyzed.

Advance copies have been requested by such organizations as the Environmental Protection Agency, the U.S. Department of Labor, users and manufacturers of EDB, and one foreign government.

Pearl Receives Macy Award

Robert C. Pearl, Extension Food Technologist, Department of Food Science and Technology, University of California, Davis, is the 1984 recipient of the Harold Macy Food Science and Technology Award, presented by the Minnesota section of the Institute of Food Technologists. The award has been presented annually since 1981, to recognize an outstanding example of food technology transfer or cooperation between scientists in any two of the following settings: academia, government, and private industry.

Mr. Pearl was cited particularly for pioneering food technology transfer between university researchers and industry. His technology transfer has focused on the California fruit and vegetable industry, where he is not only responsible for transferring research information to the food processing industry, but also for identifying problems in this industry for academic investigators. Mr. Pearl's recent work with the tomato industry in California is an excellent example of his thorough knowledge of the scientific literature and effectiveness in transferring information. The safety of process tomatoes depends on the pH remaining below 4.6 so that *Clostridium botulinum* is not a potential hazard. This was a particular problem in the 1982 harvest. Through his leadership, the scientific information was reviewed with processors in the

tomato industry and researchers. The result of this activity helped assure the safety of processed tomato products. The confidence of both the industry and the academic community in Robert Pearl's knowledge and his effective communication were important components in this achievement.

Robert Pearl is the chairman of the University of California Freezing Industry Advisory Committee. This committee transfers information between University researchers and industry specialists. Faculty at the University of California credit Robert Pearl with stimulating new research which benefits the frozen food industry. Since 1979 he has been the Institute's representative to the Council for Agricultural Science and Technology and was elected Fellow of the Institute of Technologists in 1980.

Anderson Joins Harold Wainess & Associates

Kenneth A. Anderson is now associated with Harold Wainess & Associates. Previously he was with the Illinois Department of Public Health where he developed considerable expertise in the sanitation of single service container and closure plants, evaluation of food equipment for FDA and USDA, and a thorough knowledge of processing and pasteurizing plants and dairy farms.

Diverse Capabilities in Flexible Packaging Division

A new full-color brochure from the Flexible Packaging Division of Reynolds Metals Company illustrates the division's total capabilities, ranging from the continuous roll casting of aluminum foil feedstock, to foil rolling and converting using the latest industry technology, to printing in as many as eight colors.

The brochure also describes the division's ability to provide shrink and stretch plastic films to meet specific customer requirements.

Other highlights include information on Reynolds "Flex-Can" retortable pouch and the division's Flexible Packaging Technology Center--equipped with the latest in analytical and developmental facilities.

According to Yale M. Brandt, general manager of the division, "Our capabilities as a supplier of quality aluminum foil and related flexible packaging materials span a number of categories, including foods and beverages to medical supplies and textiles.

"We are also a major supplier of functional and innovative products and containers to the important foodservice market."

For more information, write to Flexible Packaging Division, Reynolds Metals Company, P.O. Box 27003, Richmond, VA 23261.

ACDPI Announces Award Winners

H. E. Butt Grocery Co., San Antonio, Texas, was recipient of the prestigious Neil C. Angevine Superior Quality Award at the recent 1984 ACDPI Annual Meeting/Klinic/National Cultured Products Evaluation Sessions in Dallas, Texas. This award--consisting of a revolving trophy and permanent plaque--is presented to the processor for highest cumulative score for yogurt, buttermilk, sour cream, and cottage cheese.

Pictured (L to R) are: Bill Born, Dean Foods Co. and Dr. Ron Richter, Texas A&M University (Product Evaluation Coordinators); Bill Ezell, Purity Dairies, Inc. (ACDPI Board Vice Chairman); Maurice Rouchon, H.E.B. Food Stores; Earl Connolly, Fantasy Flavors, Inc. (Product Evaluation Coordinator); James Roberson, H.E.B. Food Stores; Glenn Witte, MIF (ACDPI President/Treasurer); Dr. C. Bronson Lane, Dairy and Food Nutrition Council of Florida (ACDPI Vice President/Secretary); Jeff Edwards, The Kroger Co. (ACDPI Board Chairman).

Purity Dairies, Inc., Nashville, Tennessee; Marigold Foods, Rochester, Minnesota; United Dairy Inc., Martins Ferry, Ohio, were also cited for cultured foods quality excellence.

Winner of the 1984 Research Award sponsored by Nor-Lica International was Dr. William Sandine, Professor of Food Science, Oregon State University.

The 1984 conclave drew over 250 delegates from the U.S., Canada, and various European countries.

H. E. Butt Grocery Co. Receives Superior Quality Award.

National Sanitation Foundation Announces New Publication

A new booklet entitled "Facts About NSF" has just been released. It presents a current profile of the organization, its services and programs, and describes the organization's purpose, objectives, and philosophy.

The brochure details the structure of the organization and identifies the types of analytical and physical evaluation and inspection services that are available. NSF Listing, Certification, and Assessment Services are briefly described. The scope of educational and training opportunities are also presented.

A listing of regional offices, key officers and staff, the Board of Trustees, and the Council of Public Health Consultants is provided.

For a free copy of the new booklet, write to National Sanitation Foundation, P.O. Box 1468, Ann Arbor, MI 48106, or phone 313-769-8010.

Food Science Facts
For The Sanitarian

Robert B. Gravani
Cornell University
Ithaca, NY

SALMONELLOSIS -- *SALMONELLA* FOOD POISONING

Salmonellosis is a term used to describe the illness resulting from the ingestion of *Salmonella* bacteria. There are about 2,000 closely related types of Salmonellae that cause food poisoning in humans. The Center for Disease Control reported that *Salmonella* was responsible for approximately 24% of the confirmed foodborne disease outbreaks between 1975-1979. With all things being considered, the economic loss in the United States due to *Salmonella* has been estimated at $300 million annually!

HABITAT

Salmonellae are very common in nature and are found wherever there are humans and animals. These bacteria frequently occur in the intestinal tracts and fecal matter of humans and animals, raw meats such as beef, pork, chicken, eggs and egg products. Other sources of Salmonellae are food handlers, pets (especially dogs, cats, birds, turtles and fish), rodents, and insects such as flies and cockroaches.

FOODS INVOLVED

Foods that have frequently been involved in *Salmonella* outbreaks include meat and meat products such as meat pies, hash, sausage, ham, bacon and chili; poultry and poultry products; milk and milk products; egg products such as custards, cream cakes and egg nog.

While many foods provide an environment that will allow Salmonellae to grow, proper care in the processing, preparation, handling and storage of these foods will reduce the chances of a *Salmonella* outbreak.

THE DISEASE

In order to come down with Salmonellosis, a person needs to consume food that contains a large number of living bacteria. The Salmonellae then enter the digestive tract, grow in the small intestine and cause inflammation resulting in gastroenteritis.

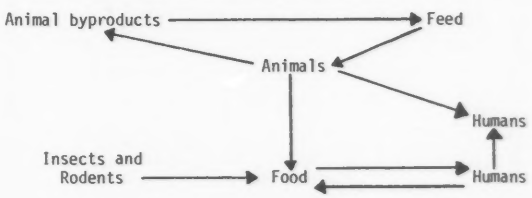
Salmonellosis is considered an infection since large numbers of bacteria are needed to cause the disease; no toxin is produced by these bacteria.

The symptoms of *Salmonella* food poisoning usually appear about 12-36 hours after eating the contaminated food. A sudden onset of abdominal pain, diarrhea, nausea, vomiting, chills and fever are common symptoms, while dehydration, headache and prostration may also occur. The severity and duration of the symptoms depend on the type of *Salmonella* present, the amount of food eaten, and the susceptibility of the person involved.

The illness usually lasts from 2 to 6 days, and deaths are uncommon except in the very young, very old, or persons who are already weakened by illness.

TRANSMISSION OF THE DISEASE

Salmonella can be transmitted in a variety of ways. Since these bacteria occur in the intestinal tract of animals and humans, they are shed in fecal matter and a cycle of infection is always present. This cycle of infection is summarized in the diagram below:



A "typical" way that Salmonellosis occurs is outlined as follows:

1) There is Salmonellae contamination of animal feed on the farms;
2) Animals that eat the feed become infected;
3) Manure builds up on pens and in transport vehicles;
4) The contamination spreads to a processing plant;

5) Inadequate processing temperatures, temperature abuses, cross contamination, and/or improper storage of the product occurs;
6) Time passes and the organisms grow in the food; and
7) The food containing large numbers of living Salmonellae is consumed and Salmonellosis occurs.

The growth of Salmonellae in foods does not produce any noticeable changes in the appearance, smell or nature of the product. Only laboratory testing can determine whether *Salmonella* are present in the food.

PREVENTION AND CONTROL

The prevention of Salmonellosis can be achieved when management and employees work together to:

1) *Prevent Contamination*

* Keep raw foods away from processed foods--avoid cross contamination;
* Practice good personal hygiene;
* Wash hands thoroughly after going to the toilet and after handling raw food;
* Thoroughly clean and sanitize all equipment, utensils and food contact surfaces;
* Keep establishments free of animals, insects, rodents, and birds;
* Avoid cross connections and sewage backflow; and
* Avoid recontamination of cooked products.

2) *Inhibit Growth*

* Hold foods below 45°F or above 140°F;
* Don't allow foods to remain at room temperature for long periods of time; and
* Cool foods quickly.

3) *Kill Microorganisms*

* Salmonellae are not very heat resistant and can easily be destroyed by proper heating treatments.
* Heating to an internal temperature of 150°F for 12 minutes or other approved processes that allow adequate temperature for a sufficient time to destroy Salmonellae should be used.

By understanding the nature of these bacteria and by following principles of good sanitation, Salmonellosis can be prevented.

Dairy Quality

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

METHODS USED FOR MONITORING THE MICROBIOLOGICAL QUALITY OF RAW MILK

PART II - Recently Proposed Methods of Raw Milk Microbiological Evaluation

The last Dairy Quality Update discussed the Standard Plate Count (SPC), Lab Pasteurized Count (LPC), Direct Microscopic Count (DMC) and dye reduction methods as a means of evaluating raw milk quality. The Newsletter pointed out the advantages and disadvantages of these methods and indicated that these methods do not totally reflect the microbiological quality of raw milk or the conditions of production on the farm.

Last month's Newsletter also noted that the Psychrotrophic Bacteria Count (PBC) may be the best method of reflecting the microbiological quality of raw milk and the conditions of production. High numbers of psychrotrophic bacteria in raw milk supplies can result in serious quality defects in finished products, primarily due to heat stable enzymes, development of off-flavors by psychrotrophic bacteria, and the presence of thermoduric psychrotrophic bacteria that can lead to quality defects after pasteurization. Since psychrotrophic bacteria are normally not found as udder flora, the sources of psychrotrophic organisms usually include product contact surfaces, water and other environmental sources. Therefore, the PBC, in addition to being an effective method of determining raw milk quality, may also better reflect the conditions of production on the farm.

While the PBC may be the most accurate method of determining raw milk quality, it is time-consuming and costly. Determining the PBC requires ten days of incubation at 7C; therefore, considerable research has been conducted to determine rapid and more cost-effective methods. Three approaches have been used to resolve this problem:

1) Use of selective media to inhibit gram positive bacteria and promote growth of gram negative organisms. These methods include the use of inhibitory substances such as surfactants, dyes and antibiotics.

2) Methods such as Oxidase Positive Count, electrical impedance and automated pyruvate.

3) Methods (4, 9, 11) concerning elevated incubation temperatures for milk samples and/or plating media plates. These methods include primarily use of Preliminary Incubation (PI) and Microscopic Colony Counts (MCC).

The use of selective media for enumeration of gram negative bacteria have been evaluated by Smith and Witter (10). These scientists found that crystal violet at 2 mg/l and neotetrazolium chloride at 2 mg/l was most effective in inhibiting gram positive bacteria and not affecting the growth of gram negative bacteria.

Cady (1) found that automated impedance measurement can be an effective means of screening milk for microbial content. Also, Marshall and Harmon (7) found that Automated Pyruvate Methods can be effective for evaluating Grade A milk. The electrical impedance method involves noting the time required to bring about electrical changes in media due to microbial metabolism and growth. The Automated Pyruvate Method measures the change in pyruvic acid in milk due to microbial metabolism. Both of these methods require relatively high numbers of psychrotrophic organisms (10,000/ml) as well as some substantial equipment investments.

Hankin and Dillman (2) proposed analyzing for *Pseudomonas* species (a common gram negative bacteria found in raw milk) by flooding SPC plates with a solution of alpha naphthol and para aminodimethylaniline oxylate. The colonies containing the enzyme cytochrome oxidase appear blue in color. This is a characteristic of the *Pseudomonas* species.

Two methods used to indirectly measure the number of psychrotrophic organisms in milk are Preliminary Incubation (PI) and Microscopic Colony Count (MCC). The PI (preliminary incubation of samples at 55F for 18 hours) has been recommended by Johns (4, 5) and other researchers (11) as a useful method in determining the psychrotrophic content of raw milk. Microscopic Colony Count has been proposed by Juffs and Babel (6). This method involves mixing milk and media at 45C and placing on a glass slide. After solidification, the slides are incubated at either 7C (48 or 72 hours) or 21C (13.5 or 16.5 hours). The slides are then dried and stained, and the colonies counted under a low power microscope.

Other elevated incubation methods have been proposed by Oliveria and Parmalee (8). These methods include in-

cubation of plates at 21C for 25 hours. These researchers found an extremely high correlation (r=0.992) when these counts were compared to standard PBC.

Since proteolytic bacteria (usually gram negative psychrotrophs) can lead to quality defects in pasteurized fluid milk, a method such as the Hulls test (3) may be a useful tool. White et al (11) found this test to be useful in determining samples of milk that would develop bitter flavors with storage.

There is little doubt that determining the amount of psychrotrophic bacteria in raw milk supplies can best reflect the microbiological quality and the conditions of production. Unfortunately, the PBC is costly and time consuming. The rapid methods proposed above for enumeration of psychrotrophic bacteria and methods such as the Hulls test (3) to determine proteolytic activity of bacteria in raw milk supplies can be useful in the determination of raw milk microbiological quality. These tests have been implemented by some dairy labs as part of the quality assurance program. If you wish to investigate any methods in more detail, Capsule Laboratories suggests consulting the references cited below and implementing one or more as appropriate.

Because researchers have found that neither the standard nor the proposed evaluation methods totally reflect the microbiological quality of raw milk or the conditions of production on the farm, there is a necessity for continued farm inspections.

1. Cady, P., et al. 1978. Automated Impedance Measurements for Rapid Screening of Milk Microbial Content. J. Food Protection. 41:277-283.
2. Hankin, L., and W. F. Dillman. 1968. A Rapid Test to find "Potentially" Psychrophilic Organisms in Pasteurized Dairy Products. J. Milk Food Technol. 31:141-145.
3. Hull, M. E. 1947. Studies on Milk Proteins, II. Colorimetric Determinations of the Protial Hydrolysis of Proteins in Milk. J. Dairy Science. 30:881.
4. Johns, C. K. 1975. Use of Counts After Preliminary Incubation to Improve Raw Milk Quality for a Denver Plant. J. Milk Food Technol. 38:481-482.
5. Johns, C. K. 1971. Bacteriological Testing of Milk for Regulatory Purposes - Usefulness of Current Procedures and Recommendation for Change II Bacteriological Testing of Raw Milk for Regulatory Purposes. J. Milk Food Technol. 34:173.
6. Juffs, H. S., and F. J. Babel. 1975. Rapid Enumeration of Psychrotrophic Bacteria in Raw Milk by the Microscopic Colony Count. J. Milk Food Technol. 38:333-336.
7. Marshall, R. T., and C. C. Harmon. 1978. The Automated Pyruvate Method as a Quality Test for Grade A Milk. J. Food Protection. 41:168-177.
8. Oliveria, J. S., and C. E. Parmelee. 1976. Rapid Enumeration of Psychrotrophic Bacteria in Raw and Pasteurized Milk. J. Milk Food Technol. 39:269-272.
9. Punch, J. D., and J. C. Olson, Jr. 1964. Comparison Between Standard Methods Procedure And a Surface Plate Method for Estimating Psychrophilic Bacteria in Milk. J. Milk Food Technol. 27:43-47.
10. Smith, T. L., and L. D. Witter. 1979. Evaluation of Inhibitors for Rapid Enumeration of Psychrotrophic Bacteria. J. Food Protection. 42:158-160.
11. White, C. H., et al. 1978. Evaluation of Raw Milk Quality Tests. J. Food Protection. 39:269-272.

Kansas Conference Highlights

The 1983 Kansas Association of Sanitarians Annual Conference was held at the Red Coach Inn in McPherson, Kansas on October 5, 6, and 7. The conference had, for the first time, a 3 hour class offered on the last day which could be taken for CEU's. Approximately 70% of the people at the conference attended the class on "Learning Styles." It was definitely a "learning" experience for all members. The conference also brought back the use of displays. These had been discontinued for some time, but members felt they should be included again.

Sanitarian of the Year Award was presented to Steve Paige, Director of Disease Prevention and Control, at the annual banquet. Special Service Awards were presented to John Mitchell, Bureau of Waste Management, for outstanding work as the secretary/treasurer of K.A.S.; Denise Goodin, Bureau of Adult & Childcare Licensing, for time and effort in establishing and maintaining the organization's continuing education program; and Otto Ossana, Food, Drug, & Lodging Section, for doing an excellent job in the field, inspecting.

The 1984 Annual Conference of the Kansas Association of Sanitarians will be held October 3, 4, and 5, at the Red Coach Inn, 2111 E. Kansas, McPherson, KS 67460.

Fifth Annual Joint Educational Conference

The Fifth Annual Joint Educational Conference of the Wisconsin Association of Milk and Food Sanitarians, the Wisconsin Environmental Health Association, the Wisconsin Dairy Technology Society and the Wisconsin Association of Dairy Plant Field Representatives will be held at the Elizabeth Inn at Plover (Stevens Point), Wisconsin, on Wednesday, September 12 and Thursday, September 13, 1984. *PLEASE NOTE THAT THE LOCATION HAS BEEN CHANGED FROM THAT ANNOUNCED EARLIER.*

The theme for this year's conference is "Achieving More With Less."

For additional information about the conference, contact Ron Buege, West Allis Health Department, 7120 West National Avenue, West Allis, Wisconsin 53214. 414-476-3770.

Spring Meeting of OAMFES

The Ohio Association of Milk, Food and Environmental Sanitarians Spring Meeting was held in Columbus, Ohio, on April 4, 1984, with seventy-seven (77) in attendance. The participants were primarily from local health departments throughout the States.

Official Affiliate Business included a motion regarding the name change for IAMFES. OAMFES voted to retain the current name - International Association of Milk, Food and Environmental Sanitarians, Inc.

Non-members of IAMFES were encouraged to join and receive one or both copies of the publications. Participants were also encouraged to attend the IAMFES Annual Meeting in Edmonton, Alberta, Canada.

OAMFES Fall Meeting is scheduled for October 3, 1984, at Columbus, Ohio.

IAMFES Secretary-Treasurer Wins Outstanding Sanitarian Award

Leon Townsend, IAMFES Secretary-Treasurer, was awarded the 1983 Kentucky Outstanding Sanitarian Award by the Kentucky Association of Milk, Food and Environmental Sanitarians at its 1983 Fieldman and Sanitarian Educational Conference in Louisville, Kentucky.

Leon began his public health career in 1958 and has held several positions both on the local health department and state health department levels in Kentucky. For the past seven (7) years he has served as Manager, Milk Control Branch, Department for Health Services. Over the years he has served International on several committees. He is presently serving on the Executive Board of the National Conference of Interstate Milk Shipments.

Leon Townsend Receives Kentucky Sanitarians Award.

New Members

Leonard E. Zematis
Eastern Milk Producers Coop.
Syracuse, NY

Leonard Ingrando
Crowley Foods, Inc.
Binghamton, NY

Cornelius Poppe
Univ. of Guelph
Guelph, Ontario, Canada

Bob Camp
Sandpoint, ID

Dr. Darwin H. Pilkington
North Carolina State Univ.
Raleigh, NC

Michael Kirkwood
State House of Corr. & Br. Prison
Marquette, MI

William T. Ingram
Whitestone, NY

Elmer George
NYS Dept. Ag. & Mkts.
Albany, NY

Norman H. Hanson
PSI Analytical Services Div.
Houston, TX

Dr. Edward R. Richter
T. J. Lipton, Inc.
Englewood Cliffs, NJ

Elza Brachman
Emmaus, PA

Maria Margarita Gomez
Univ. of Minnesota
St. Paul, MN

Philip Elliott
Armour Research Center
Scottsdale, AZ

Kun Young Park
Pusan National Univ.
Pusan, Korea

David R. Osborn
Westmar Co., Inc.
Seattle, WA

Frank Murphy, Dir.
Environmental Health Div.
Mt. Clemens, MI

Theodore J. Jefferson, J.D., R.S.
Port Arthur City Health Dept.
Port Arthur, TX

Douglas Wilkins
University of Florida
Gainesville, FL

Dr. Harry L. Wildasin
Lexington, MA

Chuck Becker
Driftwood Dairy
El Monte, CA

Charlotte Appl, Microbiologist
The Paniplus Co.
Olathe, KS

Gregory J. Alho
Duluth, MN

J. P. Connolly
Becker Milk Co., Ltd.
Scarborough, Ontario, Canada

Jack Eden
Seattle, WA

Barbara H. Velzy
University of Vermont
Burlington, VT

Dr. L. A. Shelef
Wayne State Univ.
Detroit, MI

Dermot T. Carey, QC Manager
Express Foods, Inc.
Fairfax, VT

Dennis Thayer
Woodbridge, NJ

Tim Bond
Grace Restaurant Co.
Costa Mesa, CA

George Stanko
Duffy-Mott Co.
Williamson, NY

Frank Settineri
Summit, NJ

Thomas P. Koskamp
Independence, IA

Dale Termunde
Winfield, IL

Stephen Pierson
County of San Bernardino
Upland, CA

James Bender
Crowley Foods
Binghamton, NY

Lee A. Jensen
University of Vermont
Burlington, VT

Greg Hanson
St. Cloud, MN

Arthur C. Freehling
Cabot, PA

Jose Luis Vidaurreta
Jet International
Miami, FL

Steve Ferreira
Safeway Milk Plant
San Leandro, CA

The 3-A Sanitary Standards For Non-Coil Type Batch Pasteurizers For Milk and Milk Products

Number 24-01

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. Batch pasteurizer specifications heretofore or hereafter developed which so differ in design, material and 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 sanitary aspects of non-coil type batch pasteurizers used to pasteurize milk, fluid milk products, or frozen dessert mixes, including those appurtenances necessary to meet pasteurization requirements. Batch pastuerizers may be either of the atmospheric or closed type. The latter may be operated at pressures from below to above that of the atmosphere.

A.2

In order to conform with these 3-A Sanitary Standards, non-coil type batch pasteurizers shall comply with the following design, material and fabrication criteria.

B. *DEFINITIONS*

B.1

Product: Shall mean milk, fluid milk products and frozen dessert mixes.

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

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

B.4

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

B.5

Breast: Shall mean that portion of the metal used to join the lining to the shell.

B.6

Bridge: Shall mean a cover on an open top type tank which is open on both sides and is permanently attached to the lining on opposite sides of the tank. It may be used to support a removable or nonremovable main cover(s) and accessories.

B.7

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

Product contact surfaces, including the breast, 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-absorbant, except that:

[1]*The data for this series are contained in the following reference: AISI Steel products Manual, Stainless & Heat Resisting Steels, December 1974, Table 2-1, pp. 18-19. Available from: American Iron & Steel Institute, 1000 16th St. NW, Washington, DC.*

[2]*Steel Founders' Society of America, Cast Metals Federation Bldg., 455 State St., Des Plaines, IL 60016.*

C.1.1.

Rubber and rubber-like materials may be used for measuring devices (except measuring sticks), slinger or drip shields, agitator seals on vacuum and/or pressure pasteurizers, agitator guides, protective caps for openings (other than manhole) and/or sanitary fittings, scraper blades, bonded or removable gaskets, seals and parts having the same functional purposes.

C.1.2

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

C.1.3

Plastic materials may be used for bearings, measuring devices (except measuring sticks), slinger or drip shields, agitator seals on vacuum and/or pressure pasteurizers, agitator guides, protective caps for openings (other than manhole) and/or sanitary fittings, sight and light ports, scraper blades, bonded or removable gaskets, seals and parts having the same functional purposes.

C.1.4

Plastic materials when used for the above specified applications shall comply with the applicable provisions of the 3-A Sanitary Standards for Multiple-Use Plastic Materials, used as Product Contact Surfaces for Dairy Equipment, as Amended, Number 20-13.

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 encountered in the environment 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

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

C.1.8

Glass may be used in sight and/or light openings and when used shall be of a clear heat resistant type.

C.1.9

Single service sanitary type gaskets may be used on parts which must be disassembled for cleaning.

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-absorbant, 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

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

D.3

Appurtenances having product contact surfaces shall be easily removable for cleaning, or shall be readily cleanable in place.

D.4

Pasteurizers having an inside height of more than 96 inches shall be provided with means for mechanical cleaning.

D.5

Pasteurizers that are to be mechanically cleaned shall be designed so that the product contact surfaces of the pasteurizer, including the product contact surfaces of the opening for a vertical mechanical agitator, and all non-removable appurtenances thereto can be mechanically cleaned and are accessible for inspection.

D.6

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.7

Gaskets:

D.7.1

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

D.7.2

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.7.3

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

D.8

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.9

Radii

Internal angles of 135° or less on product contact surfaces shall have radii of not less than 1/2 inch, except that:

D.9.1

Minimum radii for fillets of welds in product contact surfaces may be 1/8 inch where the thickness of one or both parts joined is less than 3/16 inch.

D.9.2

The radii in agitator shaft bottom support or guide and in gasket grooves or gasket retaining grooves for removable gaskets, except those for standard 1/4 inch and smaller O-rings, shall be not less than 1/8 inch.

D.9.3

The 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.

D.9.4

The radii of covers and agitator assemblies shall be not less than 1/4 inch.

D.10

The lining shall remain in a relatively fixed position within the shell or body of the pasteurizer and shall be so constructed that it does not sag, buckle or become distorted in normal use. The bottom of the lining shall have a minimum pitch of 3/8 inch per foot toward the outlet.

D.11

There shall be no threads on product contact surfaces.

D.12

Shell

All seams and openings in the shell shall be effectively sealed against the entrance of moisture and extraneous material.

D.13

Sanitary fittings and connections shall conform to the applicable provisions of (1) the 3-A Sanitary Standards for Fittings Used on Milk and Milk Products Equipment and Used in Sanitary Lines Conducting Milk and Milk Products, Number 08-17, Rev. and/or (2) the 3-A Sanitary Standards for Polished Metal Tubing for Dairy Products, Number 33-00, except that materials conforming to C.1.1 or C.1.3 may be used for caps of sanitary design for the protection of terminal ends of sanitary tubes, fittings or vents.

D.14

The breast shall be integral with or welded to the lining and shall be sloped so that drainage is away from the lining. The junction of the breast and the shell shall be continuously welded.

D.15

Covers:

D.15.1

Main covers for Atmospheric Type Pasteurizers

Main covers (1) shall be of a type which can be opened and maintained in an open position, (2) shall be sufficiently rigid to prevent buckling, (3) shall be self-draining in the closed position, (4) shall be provided with an adequate, conveniently located and durable handle(s) of sanitary design, which is welded in place or formed into the cover materials, (5) shall have downward flanges not less than 3/8 inch along all edges and (6) shall be close fitting. The design shall be such that when raising the cover(s), any liquid on the top will not enter the pasteurizer. When the cover(s) is in its fully opened position, the drops of condensate formed on the underside of the cover(s) shall not drain into the pasteurizer.

D.15.2

Bridges and Fixed Covers for Atmospheric Type Pasteurizers

Bridges and fixed covers shall pitch to the outside edge(s) of the pasteurizer for complete drainage, and shall have a raised flange not less than 3/8 inch in height where the edge(s) meet the main cover(s). Bridges and fixed covers shall be integral or continuously welded to the lining and shall be installed so the underside is accessible for cleaning and inspection without completely entering the pasteurizer.

D.15.3

Manhole Covers for Closed Type Pasteurizers

Covers for manholes in side walls and/or ends shall be either of the inside or outside swing type. If the cover swings inside, it shall also swing outside, away from the opening. Threads or ball joints employed to attach the manhole cover(s) and its appendages shall not be located within the lining.

Covers for manholes in the top of the pasteurizers shall be of the outside swing type.

D.16

Openings:

D.16.1

Openings in the lining or in fixed covers or bridges, or main covers of atmospheric type pasteurizers,

except those for agitators, openings with permanently attached sanitary pipeline fittings, and thermometers that remain in place while the product is in the pasteurizers, shall be provided with removable covers, which are designed to make close contact with the upper edges of the opening or cover surface, and when in the main cover the removable cover(s) shall remain in position when the main cover is in an open position.

D.16.2

The edges of openings in the top enclosure, main cover, or bridge shall extend upward at least 3/8 inch or be fitted with a permanently installed sanitary pipeline fitting. Openings that extend outward, generally horizontal, shall be fitted with a permanently installed sanitary pipeline fitting.

D.16.3

Agitator openings: Agitator shaft openings through the bridge or top enclosure shall have a minimum diameter of one inch on pasteurizers which require removal of the agitator shaft for cleaning, or be of a diameter that will provide a one inch minimum annular cleaning space between the agitator shaft and the inside surface of the flanged opening on pasteurizers which do not require removal of the agitator for cleaning.

D.16.4

An umbrella or drip shield of sanitary design that can be raised or readily dismantled, to permit cleaning of all its surfaces, shall be provided to protect against the entrance of contaminants into the pasteurizer through the annular space around the agitator shaft.

D.16.5

Manhole opening: The inside dimensions of a manhole opening shall not be less than 15×20 inches oval, 12×27 inches elliptical, or 18 inches diameter, except that pasteurizers with a capacity of 300 gallons or less may have top opening manholes having a diameter of not less than 16 inches.

D.16.6

A hand grip shall be mounted externally on the pasteurizer near the manhole in order to afford easy access to the pasteurizer interior.

D.16.7

Sight and light openings: Sight and light openings, when provided, shall be in the top enclosure and shall be of such design and construction that the inner surfaces drain inwardly and the glass or plastic may be removed for cleaning. If the pasteurizer is designed for mechanical cleaning, the inner surface of the glass or plastic shall be relatively flush with the inner surface of the lining. The inside diameter of the opening(s) into the lining shall be not less than 3 3/4 inches.

D.16.8

Air space heater opening: An air space heater opening(s) shall be provided in a batch pasteurizer.

D.16.9

Instrument Connections

Connections or openings shall be located in the top enclosure, cover, bridge, or through a sidewall. Thermometer wells may be used. Connections shall conform to the applicable fitting or connection defined in the 3-A Sanitary Standards for Instrument Fittings and Connections Used on Milk and Milk Products Equipment, Number 09-07.

D.16.9.1

Connections and/or openings which will accommodate indicating, recording and air space thermometers shall be provided on batch pasteurizers. When installed through the sidewall of a batch pasteurizer, the location shall be such that the thermometer(s) is easily readable. Thermometer connections and/or openings shall be located so that the thermometer is not influenced by the heating or cooling medium.

D.17

Outlet and Outlet Valve:

D.17.1

The inside diameter of the outlet passage of pasteurizers shall not be less than the nominal inside diameter of a 1-1/2 inch (1.402 inch) 3-A Sanitary Fittings. The outlet shall be in a position that will provide complete drainage of the pasteurizer. The top of the terminal end of the outlet passage shall be lower than the lowest point of the lining. The outlet and the outlet valve shall be so designed that either a single service or a multiple use gasket can be used.

D.17.2

The outlet valve for a pasteurizer shall comply with applicable provisions for outlet leak protection plug valves for batch pasteurizers found in Subsection E.9 in the 3-A Sanitary Standards for Sanitary Fittings, Number 08-17, Rev. The outlet valve shall be removable for cleaning. The outlet valve shall be considered removable when secured by not more than four hex nuts.

D.17.3

The outlet valve, outlet including the flare, if flared, shall comply with the applicable provisions for outlet leak-protector plug valves for batch pasteurizers found in subsection E.9 in the 3-A Sanitary Standards for Fittings Used on Milk and Milk Products Equipment and Used on Sanitary Lines Conducting Milk and Milk Products, Number 08-17, Rev. (See drawings numbers 3A-100-20, 3A-100-21 and 3A-100-29 in the 3-A Standard for Sanitary Fittings, Number 08-17, Rev., for illustrations).

D.20

Agitators:

Agitators, if not designed for mechanical cleaning, shall be readily accessible for manual cleaning and inspection, either in an asembled position or when removed. A seal for the agitator shaft, if provided, shall be of a packless type, sanitary in design and

durable with all parts readily accessible for cleaning. A sanitary seal for the agitator shaft shall be provided for a side or bottom entering agitator.

D.20.1

The means for agitation shall be one of the following:

D.20.1.1

Top entering, non-removable type:

There shall be a space of not less than ½ inch between the nonremovable agitator and the bottom of the lining, unless the agitator is mounted on a hinged-type cover. A bottom guide, if used, (1) shall be welded to the lining, (2) shall not interfere with drainage of the pasteurizer, (3) shall have radii of not less than 1/8 inch on internal angles and (4) there shall be adequate clearance to allow the guide, guide support and the portion of the agitator shaft in the guide to be effectively cleaned by mechanical cleaning. The agitator shaft shall not have a bottom cavity. When the opening in the lining and the top mounted agitator is located outside the control areas, a positive rotary sanitary seal shall be required.

D.20.1.2

Top entering, removable or demountable type:

This type of agitator shall be provided with an easily accessible, readily demountable coupling of either a sanitary type located within the lining or a coupling located outside of the lining provided that it is above the shield provided to protect the annular space around the shaft. All product contact surfaces of the agitator shall be visible when the agitator is removed. A bottom guide support, if used, shall be welded to the lining, shall not interfere with the drainage of the pasteurizer, and shall have radii of not less than 1/8 inch on internal angles. When the agitator shaft has a guide cavity, the diameter of the cavity shall be greater than the depth. The agitator and guide shall be easily demountable for cleaning of the guide, guide support and any shaft cavity.

D.20.1.3

Side or bottom entering type:

This type of agitator and shaft and its complete seal shall be readily demountable for manual cleaning. Non-removable parts having product contact surfaces shall be designed so that the product contact surfaces are readily cleanable from the inside of the pasteurizer.

D.20.2

Agitator Driving Mechanism Mounting

The driving mechanism shall be securely mounted in a position that will provide a minimum distance of 4 inches measured from the driving mechanism housing excluding bosses and mounting bosses to the nearest surface of the pasteurizer, and in such a manner that all surfaces of the pasteurizer under or adjacent to the driving mechanism shall be readily accessible for cleaning and inspection.

D.20.3

Means for agitation shall be provided that will result in uniformity of composition and temperature throughout the product to the extent that the simultaneous temperature difference between the warmest and coldest product in the pasteurizer will not exceed 1°F at any time during the holding period. This shall be deemed to be satisfied if the agitator is so designed as to sweep the product current effectively through all zones occupied by the product, including the outlet, flare, and the outlet passage through the shell.

D.21

All Space Heating

Means shall be provided in pasteurizers to keep the atmosphere above the product at a temperature of not less than 5°F higher than the product temperature during the heating period, and not less than 5°F higher than the required minimum temperature of pasteurization during the holding period. (See Appendix, Section H).

The air space heater(s) shall be mounted within the space between the top enclosure, cover or bridge of the pasteurizer and the level of the product when the pasteurizer is filled to its rated capacity. The air space heater(s) shall be easily demountable for cleaning. The air space heater(s) shall be installed through the cover, bridge, or top enclosure of the pasteurizer, and sanitary fittings conforming to the applicable provisions of the 3-A Sanitary Standards for Fittings Used in Milk and Milk Products Equipment and Sanitary Lines Conducting Milk and Milk Products, Number 08-17, Rev. shall be used.

D.22

Pressure or Level Sensor

A pressure or level sensor, if provided, shall comply with the applicable provisions of the 3-A Sanitary Standards for Pressure and Level Sensing Devices, Number 37-00. If the pasteurizer in which it will be used is designed for mechanical cleaning, the product contact surface of the device shall be relatively flush with the inner surface of the pasteurizer.

D.23

Supports

The means of supporting a pasteurizer shall be one of the following:

D.23.1

With legs: Adjustable legs shall be of sufficient number and strength and so spaced that the filled pasteurizer will be adequately supported. Legs shall be smooth with rounded ends and have no exposed threads. Legs made of hollow stock shall be sealed. Legs shall be of a length that will provide a clearance (1) between the floor and the bottom of the pasteurizer or (2) between the floor and the lowest point of the agitator or the agitator drive on pasteurizers having bottom entering agitators, of at least 6 inches if the pasteurizer is 72 inches or less

in diameter or width or at least 8 inches if the pasteurizer is more than 72 inches in diameter or width.

D.23.2

Mounted on a Slab or Island: The base of the pasteurizer shall be such that it may be sealed to the mounting surface (See Appendix, Section G). Cone bottom pasteurizers and pasteurizers with bottom mounted agitators shall not be mounted on slabs or islands.

D.24

Guards:

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

D.25

Non-Product Contact Surfaces:

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.

D.26

Information Plate:

Pasteurizers shall have an information plate permanently affixed by the manufacturer in juxtaposition to the name plate giving the following applicable information or the information should appear on the name plate:

D.26.1

If the vessel is a pasteurizer at the time of manufacture.

D.26.2

The maximum operating pressure and/or vacuum under which a closed type pasteurizer may be safely operated.

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 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 A-296-68 and A351-70.

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.

G. *SLABS OR ISLANDS*

When the pasteurizer is designed to be installed on a slab or island, the dimensions of the slab or island should be such that the base of the pasteurizer will extend beyond the slab or island at least one inch in all horizontal directions. The slab or island should be of sufficient height so that the bottom of all product connections are not less than 4 inches above the floor. The surface of the slab or island should be coated with a thick layer of waterproof mastic materials, which will harden without cracking. The junction of the pasteurizer base and the slab or island should be sealed.

H. *AIR SPACE HEATING*

Steam for Product Contact: Culinary steam should be provided for air space heaters. The method of producing steam of culinary quality will be found in the 3-A Accepted Practice for Culinary Steam, Number 609-00.

I. *THERMOMETERS*

The ranges and degree of accuracy listed apply to milk and milk products and those in brackets only to frozen desserts mix.

(1) *Indicating Thermometers for Batch Pasteurizers:*

(a) Type - Mercury actuated, direct-reading, contained in a corrosion-resistant case which protects against breakage and permits easy observation of column and scale; reference line etched on tube at 145°F. [155°F. for frozen dessert mix], with other markings permissible; filling above mercury, nitrogen, or equally suitable gas.

(b) Magnification of Mercury Column - To apparent width of not less than 0.0625 of an inch.

(c) Scale - Should have a span of not less than 25 Fahrenheit degrees (14 Celsius degrees) including the pasteurization temperature plus and minus 5°F (3°C); graduated in 1°F (0.5°C) divisions with not more than 16 Fahrenheit degrees (9 Celsius degrees) per inch of span; protected against damage at 220°F (105°C).

(d) Accuracy - Within 0.5°F (0.2°C), plus or minus through the specified scale span.

(e) Stem Fitting should fit one of the connections or fittings described in 3-A Sanitary Standards for Thermometers and Connections Used on Milk and Milk Products Equipment, Serial #09-07.

(f) Bulb - Corning normal, or equally suitable thermometric glass.

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[3]*Available from American Society for Testing and Materials, 1916 Race St., Philadelphia, PA 19103.*

(2) *Air Space Indicating Thermometers for Batch Pasteurizers:*

(a) Type - Mercury actuated; direct-reading, contained in a corrosion resistant case which protects against breakage and permits easy observation of column and scale; bottom of bulb chamber not less than 2 inches, and not more than 3½ inches, below under side of top enclosure, cover or bridge; filling above mercury, nitrogen, or equally suitable gas.

(b) Magnification of Mercury Column - To apparent width of not less than 0.0625 of an inch.

(c) Scale - Should have a span of not less than 25 Fahrenheit degrees (14 Celsius degrees), including 150°F (66°C) plus and minus 5°F (3°C); graduated in not more than 2°F (1°C) divisions, with not more than 16 Fahrenheit degrees (9 Celsius degrees) per inch of scale; protected against damage at 220°F (105°C).

(d) Accuracy - Within 1°F (0.5°C), plus or minus, throughout the specified scale span.

(e) Stem Fitting - Fitting should fit one of the connections described in 3-A Sanitary Standards for Thermometers and Connections Used on Milk and Milk Products Equipment, Serial #09-07.

(f) Bulb - Corning normal or equally suitable thermometric glass.

(3) *Recording Thermometers for Batch Pasteurizers:*

(a) Case - Moisture-proof under normal operating conditions in pasteurization plants.

(b) Scale - Should have a span of not less than 20 Fahrenheit degrees (11 Celsius degrees), including pasteurization temperature, plus and minus 5°F (3°C) graduated in temperature-scale divisions 1°F (0.5°C) space not less than 0.0625 of an inch apart between 140°F and 155°F (60°C and 69°C) [154° -157° for frozen dessert mix] *Provided,* that temperature-scale divisions of 1°F (0.5°C) spaced not less than 0.040 of an inch apart are permitted when the ink line is thin enough to be easily distinguished from the printed line, graduated in time-scale divisions of not more than 10 minutes, having a chord or straight-line length of not less than 0.25 inch between 145°F and 150°F (63°C and 66°C): *Provided,* that on vats used solely for 30-minute pasteurization of milk products (including frozen dessert mix) at temperatures above 160°F (71°C), 2°F (1°C) divisions may be used 0.0625 of an inch apart, with temperature accuracy 2°F (1°C) plus or minus.

(c) Temperature Accuracy - Within 1°F (0.5°C), plus or minus, between 140°F and 155°F (60°C and 69°C) [154° and 157°F for frozen dessert mix].

(d) Time Accuracy - The recorded elapsed time, as indicated by the chart rotation, should not exceed the true elapsed time, as compared to an accurate watch over a period of at least 30 minutes at pasteurization temperature. Recorders for batch pasteurizers may be equipped with spring operated or electrically operated clocks.

(e) Pen-Arm Setting Device - Easily accessible; simple to adjust.

(f) Pen and Chart Paper - Pen designed to give line not over 0.025 of an inch wide; easy to maintain.

(g) Temperature Sensing Device (Bulb, Tube, Spring, etc.) - Protected against damage at temperature of 220°F (105°C).

(h) Stem Fitting - Should fit one of the connections or fittings described in the 3-A Sanitary Standards for Thermometers and Connections Used on Milk and Milk Products Equipment, Serial #09-07.

(i) Chart Speed - A circular chart should make one revolution in not more than 12 hours. Two charts should be used if operations extend beyond 12 hours in 1 day. Circular charts should be graduated for a maximum record of 12 hours. Strip-charts may show a continuous recording over a 24-hour period.

(j) Chart Support Drive - The rotating chart support drive should be provided with a pin to puncture the chart in a manner to prevent its fraudulent rotation.

When installed through the side wall, the location should be such that the thermometer(s) is easily readable. Thermometer connections and/or openings should be located so that the thermometer is not influenced by the heating or cooling medium.

J. *ACCESS*

Means should be provided for access to a manhole and a sight and/or light glass when one or both are provided.

These standards shall become effective September 9, 1984, at which time the 3-A Sanitary Standard for Non-Coil Type Batch Pasteurizers for Milk and Milk Products, Number 24-00, is rescinded and becomes null and void.

3-A SANITARY STANDARDS FOR FARM MILK STORAGE TANKS

Number 30-01

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. Specifications for Farm Milk Storage Tanks heretofore or hereafter developed which so differ in design, material, fabrication, or otherwise as not to conform with the following standards, but which in the fabricator's opinion are equivalent or better, may be submitted for the joint consideration of the IAMFES, USPHS, and DIC at any time.

A.

SCOPE

A.1

These standards cover the sanitary aspects of tanks in which bulk milk is stored on dairy farms. They do not pertain to storage tanks nor to silo type tanks for milk and milk products used in dairy processing plants nor do they pertain to farm milk cooling and holding tanks.

A.2

Tanks made in conformance to these standards will prevent a significant increase in the temperature of the milk stored in the tank by the insulation or by the combination of the insulation and refrigeration. These tanks will not provide the means for cooling the milk.

A.3

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

B.

DEFINITIONS

B.1

Products: Shall mean milk.

B.2

Farm Milk Storage Tank: Shall mean a cylindrical, rectangular, oval or other equally satisfactorily shaped tank having a capacity for product of at least 1,500 gallons.

B.3

Surfaces

B.3.1

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.3.2

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

B.4

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

B.5

Shell: Shall mean the material covering the exterior of the insulation and, if provided, the refrigerated surface.

B.6

Breast: Shall mean that portion of the metal used to join the top of the lining to the top of the shell on an open top type tank.

B.7

Outlet: Shall mean the opening in the lining and the passage for milk to the exterior of the tank. The outlet passage starts at the opening in the lining and terminates at the connection for the outlet valve.

B.8

Mechanical Cleaning or Mechanically Cleaning: 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 that is non-toxic and non-absorbent, and which under conditions of intended use is at least as corrosion re-

[1]The data for this series are contained in the following reference: AISI Steel Products Manual, Stainless & Heat Resisting Steels, December 1974, Table 2-1, pp. 18-19. Available from: American Iron and Steel Institute, 1000-16th Street N.W., Washington, D.C. 20036.

[2]Steel Founders' Society of America, Cast Metals Federation Bldg., 455 State St., Des Plaines, IL 60016.

sistant as stainless steel of the foregoing types except that:

C.1.1

Rubber and rubber-like materials may be used for slingers, drip shields, agitator seals, agitator bearings, protective caps for sanitary tubes or fittings or vents, O-Rings, seals, gaskets and parts used in similar applications. These materials shall comply with the applicable provisions of the "3-A Sanitary Standards for Multiple-Use Rubber and Rubber-Like Materials Used as Product Contact Surfaces in Dairy Equipment, Number 18-00."

C.1.2

Plastic materials may be used for slingers, drip shields, agitator seals, agitator bearings, protective caps for sanitary tubes or fittings or vents, O-Rings, seals, gaskets, direct reading gauge tubes, moisture traps on vacuum lines, in sight and/or light openings and parts used in similar applications. These materials shall comply with the applicable provisions of the "3-A Sanitary Standards for Multiple-Use Plastic Materials Used as Product Contact Surfaces for Dairy Equipment, Number 20-00," as amended.

C.1.3

Except for the protective caps provided for in C.1.1 and C.1.2, sanitary fittings shall be made of materials provided for in the "3-A Sanitary Standards for Fittings Used on Milk and Milk Products Equipment and Used on Sanitary Lines Conducting Milk and Milk Products, Revised, Number 08-17."

C.1.4

Glass of a clear heat resistant type may be used for direct reading gauge tubes and in sight and/or light openings.

C.1.5

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

C.2

The materials used for lining shall not be less than 18 U. S. standard gauge.

[a]Carbon which is specifically in compliance with the Food, Drug and Cosmetic Act, as amended, is that which is included in "V Fillers" in the food additive regulation for rubber articles intended for repeated use, 121.2562 of Sub-part F Code of Federal Regulations, Title 21 - Food and Drugs.

C.3

All non-product contact surfaces shall be of corrosion-resistant material or material that is rendered corrosion-resistant. If coated, the coating used shall adhere. All 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 be at least as smooth as a No. 4 finish on stainless steel sheets. (See Appendix, Section F.) The measuring rod of an immersion type measuring device, if made of stainless steel, may have a dull finish to facilitate reading.

D.2

All permanent joints in product contact surfaces shall be welded except that rolled on sanitary pipeline ferrules or flanges may be used on connections beyond the shell. All welded areas of product contact surfaces shall be at least as smooth as the adjoining surfaces.

D.3

All product contact surfaces shall be easily accessible for cleaning, either when in an assembled position or when removed. Removable parts shall be readily demountable.

D.4

All product contact surfaces shall be self draining except for normal clingage. The tank shall be designed and constructed so that when it is level or when it is in the position in which it was calibrated or when it is in position for calibrating, the bottom shall pitch at least 1/4 inch per foot toward the outlet; or if the tank is a vertical tank designed for mechanical cleaning, the bottom shall pitch at least 3/4 inch per foot toward the outlet. The lining shall be constructed so that it will not sag, buckle or become distorted in normal use. If the tank is designed for use on a vacuum system, the construction shall be such that the lining will not be distorted when the internal pressure is 20 inches of mercury below atmospheric pressure. Horizontal tanks shall be so constructed that they will not prevent complete drainage of water when the tank has a pitch of not more than 1 inch in 100 inches.

D.5

Gaskets shall be removable. Any gasket groove or gasket retaining groove 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.6

All internal angles of 135° or less on product contact surfaces shall have minimum radii of 1/2 inch, except that:

D.6.1

The minimum radii for accessories, appurtenances, or bridges that are welded to product contact surfaces shall be not less than 1/4 inch.

D.6.2

The minimum radii in agitator shaft bottom guide bearings and in gasket grooves or gasket retaining grooves other than those for standard 1/4 inch and smaller O-Rings shall be not less than 1/8 inch.

D.6.3

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.

D.6.4

The minimum radii of covers and agitator assemblies shall be not less than 1/4 inch.

D.7

There shall be no threads on product contact surfaces.

D.8

All sanitary fittings and connections shall conform with the applicable provisions of the "3-A Sanitary Standards for Fittings Used on Milk and Milk Products Equipment and Used on Sanitary Lines Conducting Milk and Milk Products, Number 08-17," as amended and supplements thereto except that materials conforming to C.1.1 or C.1.2 may be used for caps of sanitary design for the protection of terminal ends of sanitary tubes, fittings or vents.

D.9

The breast shall be integral with or welded to the lining, and shall be sloped so that drainage is away from the lining. The junction of the breast and the shell shall be welded or effectively sealed.

D.10

Covers

D.10.1

Main Covers for Open Top Type Tanks.

Main covers (1) shall be sufficiently rigid to prevent buckling (2) shall be self draining, (3) shall be provided with an adequate, conveniently located and durable handle(s) of sanitary design, which is welded in place or formed into the cover material. (4) unless gasketed, shall have downward flanges not less than 3/8 inch along all edges and (5) shall be close fitting. If the cover is not gasketed, the clearance between the surface of the cover and the surface of the tank it is designed to contact shall not exceed 3/32 inch. Covers not exceeding 24 × 30 inches or 30 inches in diameter may be removable and shall be designed to be self draining in the closed position.

D.10.2

Non-removable Covers for Open Top Type Tanks.

Non-removable covers (1) shall be of a type that can be opened and maintained in an open position, (2) shall be designed to be self draining when in the closed position, (3) shall be designed so that when the covers are in any open position liquid from the exterior surface will not drain into the lining and (4) shall be designed so that when in their fully opened position, drops of condensation on the underside will not drain into the tank. Covers of openings that will be held in place by gravity or vacuum may be of the lift off type and may be provided with a clamp(s) or other device to maintain them in position.

D.10.3

Bridges and Fixed Covers for Open Top Type Tanks.

Bridges and fixed covers shall pitch to the outside edge(s) of the tank for complete drainage, and shall have a raised flange not less than 3/8 inch in height where the edge(s) meets the main cover(s). Bridges and fixed covers shall be integral or welded to the lining, and shall be installed so the underside is accessible for cleaning and inspection without completely entering the tank. Bridges shall not exceed 24 inches in width.

Generally horizontal fixed covers, located at ends or sides of an open top type tank (or segments of cylindrical open top type tanks) with generally vertical side walls, shall not extend more than 12 inches over the surface of the product.

D.10.4

Manhole Covers for Closed Type Tanks

Covers for manholes in side walls shall be either the inside or outside swing type. If the cover swings inside, it shall also swing outside, away from the opening. Threads or ball joints employed to attach the manhole cover(s) and its appendages shall not be located within the lining. Covers for manholes in the top of tanks shall be of the outside swing type or be of a removable type.

D.10.5

All openings in the lining or in fixed covers or in bridges, or main covers of open top type tanks not continually in use shall be provided with removable covers, which are designed to make close contact with the upper edges of the opening or cover surface, and when in the main cover the removable cover(s) shall remain in position when

the main cover is in an open position.

D.10.6

An umbrella or drip shield of sanitary design that can be raised or dismantled, to permit cleaning of all of its surfaces, shall be provided to protect against the entrance of dust, oil, insects and other contaminants into the tank through the space around the agitator shaft.

D.10.7

The water compartment of a tank designed for refrigerated water cooling shall have a cover. The clearance between surface of the cover and surface of the water compartment it is designed to contact shall not exceed 1/16 inch.

D.11

Openings

The edges of all openings into the lining that are upward or horizontal, shall extend upward or outward at least 3/8 inch beyond the shell or be fitted with a permanently installed sanitary pipeline fitting.

D.11.1

The main opening(s) of tanks shall be of sufficient number, adequate in size, and so located that all product contact surfaces are easily accessible and, except for the product contact surfaces of parts removable for cleaning, can be inspected visually without entering the tank.

D.11.2

An exception to the requirements of D.11.1 is made for closed top type tanks, having product contact surfaces that cannot be manually cleaned and inspected without entering the tank.

D.11.2.1

The minimum inside height of this type of tank shall be 42 inches and if the inside height exceeds 96 inches, means shall be provided (see Appendix, Section G.) that will facilitate manual cleaning and inspection of all product contact surfaces or means shall be provided for mechanically cleaning the product contact surfaces of the tank and all non-removable appurtenances thereto. This type of tank shall have a manhole opening(s) complying with the provisions of D.11.5.

D.11.3

An inlet sanitary pipeline connection shall be at least 1 1/2 inches or the inlet opening shall accommodate at least 1 1/2 inch 3-A sanitary tubing.

D.11.4

Agitator openings: Agitator shaft openings through the bridge or top enclosure shall have a minimum diameter of 1 inch on tanks which require removal of the agitator shaft for cleaning or be of a diameter that will provide a 1 inch minimum annular cleaning space between the agitator shaft and the inside surface of the flanged opening on tanks which do not require removal of the agitator for cleaning.

D.11.5

Manhole openings: A manhole opening, if provided, shall be located at the outlet end or side of the tank or the top of the tank. The inside dimensions of the manhole opening shall not be less than 15 $\times$ 20 inches oval, 12 $\times$ 27 inches elliptical, or 18 inches diameter.

D.11.6

Sight and Light Openings: Sight and light openings shall be provided when no other opening is available for viewing the surface of the milk and shall be of such design and construction that the inner surfaces drain inwardly, and if the tank is designed for mechanical cleaning, the inner surface of the glass (or plastic) shall be relatively flush with the inner surface of the lining. The inside diameter of the opening, if only one is provided, shall be at least 5 3/4 inches. If two openings are provided, the inside diameter of each shall be at least 3 3/4 inches. The external flare of the opening shall be pitched so that liquid cannot accumulate.

D.11.7

Thermometer openings: Two connections or openings which will accommodate thermometer sensing elements shall be provided. Connections and/or openings shall be located in the top enclosure, cover, bridge or through an end or sidewall. Thermometer wells may be used. The bulb of the temperature sensing element shall be located so as to permit registering the product temperature when the tank contains no more product than 10% of its capacity and if the tank has provisions for cooling, it shall be located so that the sensing element is not influenced by the cooling medium. All connections and/or openings shall conform to one of the following:

D.11.7.1

The applicable fittings found in the "3-A Sanitary Standards for Instrument Fittings and Connections Used on Milk and Milk Products Equipment, Number 09-07."

D.11.7.2

Fittings for temperature sensing devices which do not pierce the tank lining, but which have temperature sensing element receptacles securely attached to exterior of the lining.

D.11.8

The vacuum connection for a tank designed to be

operated under vacuum shall be standard stainless steel tubing not less than 1 1/2 inch in diameter and not longer than 4 inches (See Appendix, Section H.)

D.12

Outlet: The outlet shall provide complete drainage of the tank and shall have an outside diameter conforming to that of 2 inch or larger 3-A sanitary tubing and a wall thickness no greater than 1/8 inch. The terminal end of the outlet passage shall have a rolled-on or a welded sanitary pipeline ferrule or flange. The ferrule or flange shall not be below the bottom of the shell. The distance between nearest point on the shell to the face of the ferrule or flange on the terminal end of a horizontal type outlet shall not be more than the smaller of (1) twice the nominal diameter of the outlet passage or (2) five inches. The outlet shall be one of the following types:

D.12.1

Horizontal type. The bottom of the outlet passage shall be at least as low as the low point of the lining at the outlet. The outlet passage shall be pitched downward toward the terminal end.

D.12.2

Vertical type. The vertical centerline of the outlet passage shall be as close as practical to a side wall of the tank. The outlet passage shall be a generally horizontal extension of an elbow which is a part of or is welded to the lining.

The outlet passage shall not pass through the bottom of the shell if product will be held in the passage.

D.13

Outlet valves: Valves, when provided, shall conform to D.8 or if the valve is within the lining or in the outlet passage, and the seat is an integral part of the lining or the outlet passage, a compression-type valve conforming to the applicable provisions of D.13.1 may be used. A cap conforming to D.8 shall be provided for the outlet end of valves furnished with tanks.

D.13.1

Compression-type valve in the tank or outlet passage. This type of valve shall have a metal to metal or rubber or rubber-like material to metal seat. The rubber or rubber-like material may be either removable or bonded. The handle or valve operating rod shall extend above the bridge or main cover or the handle shall be outside the shell.

D.14

Agitators: Means for mechanical and/or air agitation shall be provided that will result in a variation in milk fat content of the product in the tank of not more than plus or minus 0.1% as determined by an Official AOAC Milk Fat Test[4], when the tank is filled to at least 50% of its capacity with product and the agitator has been in operation for 10 minutes. Agitators, if not designed for mechanical cleaning, shall be readily accessible for manual cleaning and inspection either in an assembled position or when removed. A seal for the agitator shaft, if provided, shall be of a packless type, sanitary in design with all parts readily accessible for cleaning. A sanitary seal for the agitator shaft shall be provided for (1) a horizontal agitator, (2) a vertical agitator when it is specified that the tank is to be located so that the portion of the shaft outside the tank is not in the milk house or milk room, (3) a tank designed to be operated under vacuum and (4) an agitator in a tank having means for mechanically cleaning the tank. The means for agitation shall be one of the following:

D.14.1

Mechanical, top entering, non-removable type.

There shall be at least a 1 inch space between the non-removable agitator and the bottom of the lining, unless the agitator is mounted on a hinged type cover. A bottom shaft bearing shall not be provided for a non-removable type agitator.

D.14.2

Mechanical, top entering, removable type.

This type of agitator shall be provided with an easily accessible, readily demountable coupling of either a sanitary type located within the lining or a coupling located outside of the lining provided that it is above the shield provided to protect the annular space around the shaft. All product contact surfaces of the agitator shall be visible when the agitator is removed. A bottom support or guide, if used, shall be welded to the lining, shall not interfere with drainage of the tank, and the inside angles shall have minimum radii of 1/8 inch. When the agitator shaft has a bearing cavity, the diameter of the cavity shall be greater than the depth. The agitator shall be easily demountable for cleaning of the bearing and any shaft cavity.

D.14.3

Mechanical side entering type.

This type of agitator, shaft and complete seal, if not designed for mechanical cleaning shall be readily demountable for manual cleaning. Non-removable parts having product contact surfaces

[4]The method of making these tests will be found in the following reference: Official Methods of Analysis: Available from the Association of Official Analytical Chemists. P. O. Box 540, Benjamin Franklin Station, Washington, D.C. 20004.

shall be designed so that the product contact surfaces are readily cleanable from the inside of the tank.

D.14.4

Air agitation.

The means for air agitation shall comply with the applicable provisions of D.15.

D.15

Air for Agitation or Movement of Product: Means for applying air under pressure shall conform to the applicable provisions of the "3-A Accepted Practices for Supplying Air Under Pressure in Contact with Milk, Milk Products and Product Contact Surfaces Number 604-03," and the following:

D.15.1

Clamp type fittings shall not be used within the lining.

D.15.2

Tubing and related fittings within the tank shall be readily and easily removable for cleaning outside the tank or be designed for mechanically cleaning. If designed for mechanically cleaning, the tubing and all related fittings shall be self-draining.

D.15.3

Permanently mounted air tubing shall be constructed and installed so that it will not sag, buckle, vibrate or prevent complete drainage of the tank or tubing and shall be located so that the distance from the outside of the tubing to the lining shall be at least two inches, except at point of entrance.

D.16

Mechanical Agitator Driving Mechanism Mounting: The driving mechanism when above the lining shall be securely mounted in a position that will provide a minimum distance of 4 inches measured vertically downward from the bottom of the driving mechanism housing, excluding bearing bosses and mounting bosses to the nearest surface of the tank; and in such a manner that all surfaces of the tank under or adjacent to the driving mechanism shall be readily accessible for cleaning and inspection.

D.17

Thermometers: Each tank shall be provided with an indicating thermometer and/or a recording thermometer complying with the applicable specifications for indicating and recording thermometers in Appendix Section I.

The temperature sensing element of the thermometer shall fit one of the connections or openings provided for in D.11.7.1 and D.11.7.2.

D.18

Vents: A vent(s), if provided, shall be of a hooded type of sufficient free opening area to prevent back pressure during filling and to prevent vacuum during emptying of the tank. It shall be in the front head near the top of the tank or in the top of the tank. The vent(s) shall terminate in the milk house or milk room. It shall be provided with a perforated cover having openings not greater than 1/16 inch diameter, or slots not more than 1/32 inch wide. Woven wire mesh shall not be used for this purpose. It shall be so designed that parts are readily accessible and readily removable for cleaning.

D.19

Cleaning: Tanks having an inside height of more than 96 inches shall be provided with means (see Appendix, Section G.) that will facilitate manual cleaning and inspection of all product contact surfaces or means shall be provided for mechanically cleaning the product contact surfaces of the tank and all non-removable appurtenances thereto.

D.20

Sample Cock: A sample cock must be provided when a sample cannot be readily obtained from a top opening or a sample port opening in the tank. It shall be of a type that has its sealing surface relatively flush with the product contact surface of the tank and have an inside diameter no less than that of one inch 3-A sanitary tubing.

D.21

Tank Supports: The means of supporting a tank designed to be installed wholly within the milk house or milk room or the means of supporting the portion of a tank that will be in the milk house or milk room shall be one of the following:

D.21.1

With legs: Adjustable legs shall be of sufficient number and strength and so spaced that the filled tank will be adequately supported. Legs shall have closed bases. Exteriors of legs and leg sockets shall be readily cleanable. Legs shall be such that will provide (1) the minimum distance between lowest interior surface of the outlet connection and the floor will be 4 inches and (2) a minimum clearance of 6 inches between the floor and the bottom of a tank 72 inches or less in diameter or width, except in the case of a V-bottom or a rounded bottom tank of which the outer shell slopes continually upward from the outlet centerline, in which case the minimum clearance may be 4 inches if it increases to 6 inches within a horizontal distance of not more than 12 inches on each side of this centerline. On a tank more than 72 inches in diameter or width, the minimum clearance shall be 8 inches. (Where Weights and Measures Codes require that a seal be placed on the

legs to detect height adjustment after the tank has been leveled or calibrated, the holes for the seals shall be designed and located, or sealed, to prevent entrance of moisture into the legs.)

D.21.2

Mounted on a Slab or Island: The base of the tank shall be such that it may be sealed to the mounting surface (see Appendix, Section J.)

D.22

Prevention of a Significant Product Temperature Increase. The tank shall be capable of preventing, in 18 hours, an average product temperature increase greater than 3° F in a tank filled to 100% of its capacity with product when the average difference between the temperature of the atmosphere surrounding the tank and temperature of the product in the tank is 30°F. This may be accomplished by one of the following methods:

D.22.1

Insulation

If the prevention of a significant product temperature increase is to be accomplished solely by insulation, the insulating material over non-refrigerated areas of the tank shall have an insulating value equivalent of not less than:

D.22.1.1

Two inches of cork on

(a) tanks to be installed wholly within a building

(b) the portion of the tank within a building on tanks to be installed partially outside of a building

D.22.1.2

Three inches of cork on the portion of the tank outside of a building on tanks designed to be installed partially outside of a building

D.22.2

A combination of insulation and sufficient refrigerated surface.

D.23

Insulation: Shall be of a nature and installed in a manner that will prevent shifting or settling.

D.24

The tank shall have a measuring device. If it is of the immersion type or of the direct reading gauge type, it shall comply with D.24.1 or D.24.2.

D.24.1

Immersion Type: An immersion measuring device shall comply with the applicable provisions of the code entitled "Farm Milk Tanks" in the National Bureau of Standards Handbook 44—Fourth Edition 1971.

The measuring rod shall have graduation marks not less than .005 inch in width and not exceeding .008 inch in depth. The measuring rod consists of a graduated portion, a seat to engage the measuring rod supporting bracket or other supporting means and a handle. It does not include the supporting bracket or other supporting means. The measuring rod may be two or more parts welded together or may be one piece. The handle shall extend above the bridge or main cover, or shall be located outside of the outershell. The tank serial number stamped or etched on the rod shall be located as high on the rod as is practicable. The opening through which the measuring rod extends shall be protected against liquids or other contaminants entering the tank from that portion of the measuring rod outside the tank.

D.24.2

Direct Reading Gauge: A direct reading gauge shall comply with the applicable provisions of the code entitled "Farm Milk Tanks" in the National Bureau of Standards Handbook 44-1980 edition. A direct reading gauge shall be provided on all farm milk storage tanks with a capacity greater than 2,000 gallons or 8,000 liters. A direct reading gauge of the glass or plastic tube type shall be sanitary in design and construction and shall be readily accessible for cleaning or shall be designed for mechanical cleaning. It shall be designed and constructed so that product in the gauge will automatically be discarded. The valve shall be close coupled. The distance, measured along the passage for the product in the tank to the gauge valve, from the nearest point on the shell to the ferrule or flange for the valve shall not be more than the smaller of (1) twice the nominal diameter of the passage or (2) five inches.

D.25

Non-Product Contact Surfaces: Non-product contact surfaces shall comply with the following:

D.25.1

They shall be smooth, free of pockets and crevices and be readily cleanable.

D.25.2

Surfaces to be coated shall be effectively prepared for coating.

D.25.3

The shell shall be effectively sealed against moisture and vermin at all joints and at junctions with the breast, manhole openings, outlets and other openings.

D.25.4

A vent or weep hole may be provided in the shell. If provided, it shall be located in a position that will provide drainage from the shell and shall be vermin proof.

D.25.5

Outside welds need not be ground.

APPENDIX

E.

STAINLESS STEEL MATERIALS

Stainless steel conforming to the applicable composition ranges established by AISI[1] for wrought

products, or by ACl[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 A296-68 and A351-70.

F.

PRODUCT CONTACT SURFACE FINISH

Surface finish equivalent to 150 grit or better as obtained with silicon carbide, is considered in compliance with the requirements of Section D.1 herein.

G.

MANUAL CLEANING

If the inside height of a tank exceeds 96 inches, one means for manual cleaning is to weld a stainless steel rung on each end of the tank to support a removable platform at a height which will facilitate cleaning and inspection.

H.

VACUUM PIPING

When vacuum piping is provided, the piping downstream from an elbow connected to the vacuum connection on the tank (see D.11.8) should pitch downward from the tank to a moisture trap. The piping between the tank vacuum connection and the moisture trap should be stainless steel and have a pitch of not less than 1 inch in the first 12 inches.

I.

INDICATING THERMOMETERS USED IN STORAGE TANKS

Scale Range.—Shall have a span not less than 50°F. including normal storage temperatures plus or minus 5.0°F. with extension of scale on either side permitted; graduated in not more than 2.0°F. divisions.

Temperature Scale Divisions.—Spaced not less than one-sixteenth of an inch apart between 35°F and 55°F.

Accuracy.—Within 2° F. plus or minus, throughout the specified scale range.

Stem Fitting—Shall conform to the "3-A Sanitary Standards for Instrument Fittings and Connections Used on Milk and Milk Products Equipment Number 09-07" or shall be a stem fitting that does not pierce the lining or means shall be provided to permit securely fastening the temperature sensing element to the outer surface of the lining.

RECORDING THERMOMETERS USED IN STORAGE TANKS

Case.—Moistureproof under operating conditions in a milk house or milk room.

Scale.—Shall have a scale span of not less than 50° F, including normal storage temperature plus or minus 5°F., graduated in not less than 2°F. divisions with not more than 40° F. per inch of scale; graduated in time scale divisions of not more than 1 hour having a chord or straight line length of not less than one-eighth of an inch at 40°F. Chart must be capable of recording temperatures up to 180° F. (Span specifications do not apply to extensions beyond 100° F.)

Temperature Accuracy.—Within 2° F. plus or minus, between specified range limits.

Pen-Arm Setting Device.—Easily accessible; simple to adjust.

Pen and Chart Paper.—Designed to give line not over one-fortieth of an inch thick when in proper adjustment; easy to maintain.

Temperature Sensor.—Protected against damage at 212° F.

Stem Fitting—Shall conform to the "3-A Sanitary Standards for Instrument Fittings and Connections Used On Milk and Milk Products Equipment Number 09-07" or shall be a stem fitting that does not pierce the lining or means shall be provided to permit securely fastening the temperature sensing element to the outer surface of the lining.

Chart Speed.—The circular chart shall make one revolution in not more than 7 days and shall be graduated for a maximum record of 7 days. Strip chart shall move not less than 1 inch per hour and may be used continuously for 1 calendar month.

J.

SLABS OR ISLANDS

When a tank is designed to be installed on a slab or an island, the dimensions of the slab or island should be such that the tank will extend beyond the slab or island at least one inch in all horizontal directions. The slab or island should be of sufficient height so that the bottom of the outlet connection is not less than 4 inches above the floor. The surface of the slab or island should be coated with a thick layer of waterproof mastic material, which will harden without cracking. The junction of the outer shell of the tank and the slab or island should be sealed.

These standards shall become effective September 9, 1984 at which time the 3-A Sanitary Standard for Farm Milk Storage Tanks, Number 30-00 is rescinded and becomes null and void.

[3]Available from American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103

Abstracts of papers in the June Journal of Food Protection

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

Antimicrobial Effects of Selected Antioxidants in Laboratory Media and in Ground Pork, Mohamed B. Gailani and Daniel Y. C. Fung, Department of Animal Sciences and Industry, Kansas State University, Manhattan, Kansas 66506

J. Food Prot. 47:428-433

Butylated hydroxyanisole (BHA), butylated hydroxytoluene (BHT), tertiary butylhydroquinone (TBHQ) and propyl gallate (PG) at 0, 50, 100, 150, 200, 250, 300, 350, 400, 450 and 500 ppm and selected combinations at 0, 100, 200, 300 and 400 ppm in nutrient agar and in brain heart infusion were tested for antimicrobial activity on sixteen gram-negative and eight gram-positive bacteria. In general, in laboratory media the antioxidants inhibited gram-positive bacteria more than gram-negative bacteria. The antioxidants were more effective in nutrient agar (solid system) than in brain heart infusion (liquid system). In nutrient agar, BHA inhibited the greatest number of organisms followed by PG, TBHQ and BHT, respectively. In brain heart infusion, TBHQ inhibited the greatest number of organisms followed by PG, BHA and BHT, respectively. Of the six combinations tested, the TBHQ-PG combination inhibited the greatest number of organisms followed by BHA-PG, BHT-TBHQ, BHA-TBHQ, BHT-PG and BHA-BHT, respectively. Tests in ground pork indicated the four antioxidants at 100, 200 or 400 ppm significantly ($P<0.05$) reduced psychrotrophs, coliforms and fecal coliform counts after 4 wk of storage at 4°C. There were no significant differences between the control and the samples treated with antioxidants after either 1 or 2 wk of storage.

Sensory Attributes and Safety Aspects of Germinated Small-Seeded Soybeans and Mungbeans, Aminah Abdullah, Ruth E. Baldwin, Marion Fields and Arthur L. Karr, Department of Food Science and Nutrition and Department of Plant Pathology, University of Missouri-Columbia, Columbia, Missouri 65211

J. Food Prot. 47:434-437

Sprouts of two small-seeded soybean strains were characterized as more intense in nutty aroma and flavor and less intense in bitter, grassy and beany flavor notes than mungbean sprouts or market samples of soybean sprouts. Sprouts did not differ in sweetness. The sprouts of the two test soybeans were moderately tender and crisp but less tender than mungbean sprouts. Yeasts and fungi were found on market samples of mungbean and soybean sprouts. Fungi were also present on sprouts of one test soybean. No aflatoxins (B_1, G_1, G_2, B_{2a}) were identified by thin layer or high performance liquid chromatography, and no other toxins were indicated by chicken embryo bioassay.

Enterotoxigenicity of *Staphylococcus aureus* Strains Isolated from Nigerian Ready-to-Eat Foods, Abiodun A. Adesiyun, Department of Veterinary Public Health and Preventive Medicine, Faculty of Veterinary Medicine, Ahmadu Bello University, Zaria, Nigeria

J. Food Prot. 47:438-440

The incidence of enterotoxin production by *Staphylococcus aureus* strains isolated from five Nigerian ready-to-eat products, i.e., roasted beef, dried beef, dried fish, fried fish and fried chicken, was investigated. Ninety-seven (39.1%) strains of 248 tested elaborated staphylococcal enterotoxins A(SEA), B(SEB), C(SEC), D(SED) or E(SEE). SED was most frequently produced as 43(17.3%) strains produced it, representing 44.3% of all enterotoxigenic strains. SEA and SEE were elaborated by 31(12.5%) and 29(11.7%) strains, respectively. Nineteen (7.7%) isolates produced SEB and the incidence of SEC was lowest, with only 12(4.8%) strains positive. Six (50.0%) of the SEC-producers were dried beef isolates. Of the three food sources (beef, fish and chicken) investigated, there was no significant difference ($P>0.05$, X^2) between the incidence of enteroxigenicity of isolates, although beef isolates demonstrated the highest incidence (43.3%) followed by fish products (37.0%) and chicken product (36.0%). Regardless of source, roast beef isolates were the most frequently toxic (55.2%), whereas dried fish isolates were least frequently enterotoxigenic (34.5%). Multiple enterotoxin production most frequently encountered were types ADE, AD and BD which were produced by 6, 5 and 3 strains, respectively. It was concluded that the five ready-to-eat products investigated may pose a health hazard from the view point of staphylococcal intoxication due to the high incidence of enterotoxin production by isolates. SED appears to pose the greatest risk of this hazard to consumers of these products in this environment.

Germination Effects on Flatus-Causing Factors and Antinutrients of Mungbeans and Two Strains of Small-Seeded Soybeans, Aminah Abdullah, Ruth E. Baldwin and Harry Minor, Department of Food Science and Nutrition and Department of Agronomy, University of Missouri-Columbia, Columbia, Missouri 65211

J. Food Prot. 47:441-444

Two strains of small-seeded soybeans contained greater amounts of stachyose and raffinose than market samples of mungbean seeds. These sugars either disappeared or were reduced to trace amounts during 3 d of germination for mungbeans and 4 d for soybeans. Both soybean strains contained more phytic acid and trypsin inhibitor than mungbeans. Germination reduced these antinutrients in both legumes. Phytic acid (wet weight basis) in one strain of soybean sprouts did not differ from that in the mungbean sprouts.

Survival of *Salmonella* in Dry Food and Feed, B. J. Juven, N. A. Cox, J. S. Bailey, J. E. Thomson, O. W. Charles and J. V. Shutze, University of Georgia, Cooperative Extension Service, Extension Poultry Science Department, Athens, Georgia 30602 and United States Department of Agriculture, Agricultural Research Service, Richard B. Russell Agricultural Research Center, P.O. Box 5677, Athens, Georgia 30613

J. Food Prot. 47:445-448

The survival of *Salmonella montevideo* and *Salmonella heidelberg* in dry milk, cocoa powder, poultry feed, and meat and bone meal was studied at three water activities (a_w) in the range of 0.4 to 0.75. *S. montevideo* was more resistant to the various dry environments than *S. heidelberg*. Salmonellae were enumerated immediately after inoculation, after 2 d, and after 1, 3, 7 and 14 wk. Survival was greater at a_w of 0.43 and 0.52 than at 0.75 a_w. Based on these findings and due to the marked differences in survival observed in the different products equilibrated at a specific a_w value, it is concluded that the survival of salmonellae in a dry product cannot be predicted on the basis of the a_w alone.

Effect of Subjective Condition of Beef Quarters on the Microbiology and Storage Stability of Vacuum-Packed Clods and Ground Beef Patties, J. L. Oblinger, J. E. Kennedy, Jr. and R. L. West, Food Science and Human Nutrition Department and Animal Science Department, University of Florida, Gainesville, Florida 32611

J. Food Prot. 47:449-452

The effect of subjective condition of beef quarters, as determined by United States Department of Agriculture (USDA) personnel, on the microbial and sensory quality of vacuum-packaged clods and ground beef during refrigerated or frozen storage was investigated. In addition, the effect of reconditioning or trimming beef quarters considered to be in off-condition before fabrication into clods or ground beef patties was studied. The microbial quality of beef quarters was directly related to the subjective condition classification in that aerobic plate counts (APC's) of beef quarters and derived products were greater with increasing off-condition on the basis of condition "1" being "excellent" and condition "5" being "unfit for consumption." No significant differences ($P<0.05$) were observed in APC's between clods from quarters in various conditions initially or following 14 or 28 d of vacuum packaged storage at 1 to 2°C. Patties derived from quarters in condition "1" had significantly lower ($P<0.05$) APC's than those of patties from quarters in condition "4" or "5". The microbial quality of ground beef patties prepared from quarters in conditions "3" and "4" was not significantly affected by trimming of the quarters before fabrication. Few consistent differences in the sensory quality of ground beef patties were noted as a result of condition classification or trimming of quarters from which they were fabricated. These data indicate that reconditioning or trimming of "off-condition" beef quarters cannot be relied upon to improve the microbial quality of derived products such as ground beef.

Microbiological and Chemical Changes of Spotted Shrimp (*Pandalus platyceros*) Stored Under Modified Atmospheres, Miguel E. Layrisse and Jack R. Matches, Institute for Food Science and Technology, University of Washington, Seattle, Washington 98195

J. Food Prot. 47:453-457

Shrimp (*Pandalus platyceros*) were packed head-on and head-off in pouches with air or 50 or 100% CO_2 and stored at 0 to 2°C for up to 23 d. Carbon dioxide in modified atmosphere pouches dissolved in the liquid phase and the pH decreased. As storage progressed, the pH increased. Only 100% CO_2 was effective in extending the lag in bacterial growth, but the greatest weight or drip was also obtained with this atmosphere. The bacterial flora changed from mixed gram-negative and gram-positive organisms to a predominantly gram-positive flora. Ammonia was produced throughout storage in all atmospheres, but was delayed longer in head-off than in head-on shrimp. Indole was produced readily in air packs but only at low levels in CO_2 packs.

Microwave-Inactivation of Bacterial Pathogens in Various Controlled Frozen Food Compositions and in a Commercially Available Frozen Food Product, George T. Spite, Food and Drug Administration, 1141 Central Parkway, Cincinnati, Ohio 45202

J. Food Prot. 47:458-462

An assessment was made of the inactivation of pathogenic bacteria by microwave energy in frozen foods using various time-temperature configurations, controlled carbohydrate, lipid, protein, moisture, or food mass levels, and on a commercially prepared product. Species of *Salmonella cubana, Staphylococcus aureus, Bacillus cereus,* and *Clostridium perfringens* were separately inoculated into mashed potatoes or one of its controlled variations, giving a concentration range of 10^5 to 10^7 cells per gram of food. After freezing, the food was cooked by microwave oven for 3 to 9 min, depending on test conditions. Samples were withdrawn for pathogens and vertical food core temperatures recorded. Survival percentages were calculated and averaged. All species survived the cooking cycle that was least detrimental to the food's palatability. Increased moisture generally enhanced survival. Higher protein or lipid ratios tended to increase the survival of *C. perfringens* although higher internal temperatures were produced. Sporeforming organisms were generally less susceptible under all test conditions. Addition of whole peas to the mashed potatoes resulted in higher temperatures, but significantly reduced microbial destruction, perhaps by allowing formation of micropockets of cooler food matrices.

Heat Resistance of *Clostridium botulinum* Type G in Phosphate Buffer, Richard K. Lynt, Haim M. Solomon and Donald A. Kautter, Division of Microbiology, Food and Drug Adminstration, Washington, DC 20204

J. Food Prot. 47:463-466

The heat resistance of two strains of *Clostridium botulinum* type G in phosphate buffer was studied by the thermal death time (TDT) tube method and the thermal destruction rate (TDR) method. The strains were estimated to have one highly heat-resistant spore among approximately 100 spores or 10,000 relatively heat-labile spores. The heat-labile spores were studied by the TDR method and the heat-resistant spores by the TDT tube method. Decimal reduction times (D) for the heat-labile spores were determined by the slopes of the survivor curves. D values for strain 89 ranged from 0.6 min at 190°F to 6.9 min at 170°F and for strain 2739 from 0.9 min at 200°F to 5.9 min at 180°F. Thermal destruction curves for the heat-labile spores gave z values of 24.0 and 17.5 for two spore stocks of strain 89 and 26.0 for strain 2739. D values for the heat-resistant spores, calculated from the combined data of replicate experiments by the Schmidt probability method, ranged from 0.29 min at 240°F to 1.51 min at 210°F for strain 89 and from 0.25 min at 240°F to 1.48 min at 210°F for strain 2739. Extrapolated to 250°F,

the thermal destruction curves of the heat-resistant spores gave D_{250} values of 0.14 to 0.19 min. The thermal destruction curves of the heat-resistant spores were very flat, however, with z values of 37.9 and 49.1 for the two spore stocks of strain 89 and 37.7 for strain 2739. Low-acid canned food processes will provide the same margin of safety for type G as for other proteolytic strains of *C. botulinum* but ultra high processing temperatures probably will not.

Microbiological Quality of Biscuit Dough, Snack Cakes and Soy Protein Meat Extender, A. Swartzentruber, A. H. Schwab, B. A. Wentz, A. P. Duran and R. B. Read, Jr., Division of Microbiology, Food and Drug Administration, Washington, D.C. 20204 and Minneapolis Center for Microbiological Investigations, Minneapolis, Minnesota 55401

J. Food Prot. 47:467-470

The microbiological quality of refrigerated biscuit dough, nonrefrigerated chocolate-flavored cream- or custard-filled snack cakes, and seasoned or unseasoned textured soy or vegetable protein meat extender was determined by a statistically based national survey at the retail level. For refrigerated biscuit dough, geometric means of aerobic plate counts (APC) and counts of yeasts and molds, coliforms, *Escherichia coli* and *Staphylococcus aureus* were 34,000, 46, 11, <3 and <3 microorganisms/g, respectively, and for seasoned and unseasoned meat extender 1,500 and 210 (APC seasoned and unseasoned), <25, <3, <3 and <10 microorganisms/g, respectively. Because of the limited availability of unseasoned meat extender in retail markets, the APC of 210 bacteria/g is not necessarily representative of the country.

Rapid Impedimetric Method for Determining the Potential Shelf-Life of Pasteurized Whole Milk, J. R. Bishop, C. H. White and R. Firstenberg-Eden, Department of Dairy Science, Louisiana Agricultural Experiment Station and LSU Agricultural Center, Louisiana State University, Baton Rouge, Louisiana 70803 and Bactomatic Inc., Princeton, NJ 08540

J. Food Prot. 47:471-475

Potential shelf-life of 100 pasteurized whole milk samples, obtained from retail outlets and from dairy processors, was investigated. Parameters studied were: organoleptic evaluation, Standard Plate Count (SPC), psychrotrophic bacteria count (PBC), modified psychrotrophic bacteria count (mPBC), Moseley test (MSPC), and impedance detection time (IDT) at 18 and 21°C. Correlation coefficients were obtained for all possible data combinations in an attempt to detect significant relationships between the parameters studied and the true shelf-life of the product. None of the direct counts (SPC, PBC, and mPBC) correlated well enough with shelf-life to allow shelf-life prediction. Moseley test (MSPC) appeared to possess an adequate relationship to shelf-life with a correlation coefficient at -0.84. IDT 21°C and IDT 18°C proved to have the most significant relationships to shelf-life with correlation coefficients of 0.88 and 0.87, respectively. Therefore, the impedance method had three advantages over the Moseley test: (*a*) it was a better predictor of shelf-life, (*b*) it was less labor intensive, and (*c*) it required only 1-2 d, as opposed to 7-9 d to complete.

Comparison of the Hide Powder Azure and Casein-Trinitrobenzene Sulfonic Acid Methods for Determining Proteolysis in Skim Milk, Robin C. McKellar, Food Research Institute, Agriculture Canada, Ottawa, Ontario, Canada K1A 0C6

J. Food Prot. 47:476-480

Three extracellular psychrotroph proteinases were assayed in a defined buffer system and in skim milk, using the insoluble protein-dye complex, hide powder azure (HPA), as well as by quantifying free amino groups released from casein with trinitrobenzene-sulfonic acid (TNBS). Apparent Km values for HPA of approximately 60 mg/ml were found for each enzyme while for sodium caseinate, the apparent Km of 9.14 mg/ml for enzyme ATCC 15456 was 3-fold greater than for enzymes 13 and 32A. Vmax values for enzyme ATCC 15456 were 3 to 3.5 and 1.6 to 2.8-fold lower than for the other two enzymes with HPA and sodium caseinate, respectively. When activities in skim milk were being determined, trichloroacetic acid (TCA) concentrations of 2 and 8% for HPA and TNBS, respectively, were chosen to maximize recovery of degradation products and minimize background. Proteolysis measurements in skim milk with the two methods were closely correlated ($r=0.903$ to 0.920) for each of the three enzymes. Detectability values (obtained by dividing the standard error of estimate for each method by its slope ratio) of 0.098 and 0.093 for the HPA and TNBS methods, respectively, indicate that the two methods do not differ significantly ($P>0.05$) in reliability.

Microflora of Edible Offal with Particular Reference to *Salmonella,* H.-J. Sinell, H. Klingbeil and M. Benner, Institute of Food Hygiene, Free University of Berlin, Koserstrasse 20, D 1000 Berlin 33, Germany

J. Food Prot. 47:481-484

Feeding of raw offal has been suspected to be a major source of *Salmonella* infections among pets, particularly among dogs, in the city of Berlin (West). The present study revealed that 231 (56.6%) of 408 samples of edible offal (liver, lungs, heart, bovine rumen, porcine esophagus) contained 24 types of *Salmonella*. *Salmonella typhimurium* prevailed (145 samples = 62.8% of the positive samples = 35.5% of the total), including 8 strains of *S. typhimurium* var. *copenhagen*. Three types had an incomplete seroformula. The investigation covered a period of 26 months. The percentage of positive findings did not significantly differ during various seasons. Positive findings were most frequent with porcine esophagus (40/49) and least frequent with imported swine liver (17/58) and bovine rumen (13/45). Presence of salmonellae was not correlated with other microbiological criteria, in particular aerobic plate count and number of *Enterobacteriaceae*. All samples were sold at West-Berlin's central wholesale meat market and originated from slaughter animals judged as "fit for consumption", which means that they were also intended for human consumption and not only as animal feed. Repeated isolation of the same *Salmonella* type from different samples taken on the same day indicated rapid spreading during transport and storage. This contamination did not persist for a longer period but was replaced by other strains which subsequently appeared. Since raw offal for retail sale represents a considerable health hazard, it is recommended that this material should not be offered for retail sale unless in hermetically sealed packages. Packages should have labels with directions for proper handling of the contents

in the home. Warning should also be given that viscera should neither be eaten raw nor fed to pets unless the material is adequately heated.

An Assessment of Food Contamination by Toxic Products of *Alternaria*, D. H. Watson, Food Science Division, Ministry of Agriculture, Fisheries and Food, Great Westminister House, Horseferry Road, London SW1P 2AE, United Kingdom

J. Food Prot. 47:485-488

Invasion of food crops by the common mold *Alternaria* has been widely observed. Consequent contamination of food by five toxic *Alternaria* metabolities, i.e., tenuazonic acid, alternariol and its monomethyl ether, altenuene and altertoxin I, has been demonstrated in a few instances. These compounds have been found together in several food samples and they may have synergistic toxic effects. Suggestions for further work on these synergistic effects and on the effects of long-term feeding of the individual compounds to mammals are made. It is also suggested that more extensive surveys of food for these compounds are needed to establish the likely intakes of these compounds by man.

Effects of Food Processing on Mycotoxins, P. M. Scott, Health Protection Branch, Health and Welfare Canada, Ottawa, Ontario, Canada K1A 0L2

J. Food Prot. 47:489-499

Most data on mycotoxin contamination applies to agricultural products, such as grains, and could be used to assess human dietary intake of mycotoxins if the effects of food processing, storage and home cooking were known. Several factors - the nature of the process, the food matrix, moisture content of the foodstuff, additives, and mode and level of contamination - can affect experimental results on the decomposition or loss of mycotoxins during food processing. Additionally, the various mycotoxins that have been studied possess wide differences in stability. For example, during the making of bread from wheat flour, up to 100% of ergot alkaloids are destroyed, whereas vomitoxin is stable. Most research on processing of foods containing mycotoxins has been carried out with the aflatoxins, including studies on the sorting and roasting of peanuts, cleaning and milling of corn, the various stages in making vegetable oils, storage and cooking of meat, cooking of corn products, breadmaking, and (for aflatoxin M_1) the processing of milk and cheese. In general, aflatoxins are moderately stable during roasting processes and persist into finished foods, such as peanut butter. Ochratoxin A, patulin, and vomitoxin and other trichothecenes have also received considerable attention. Little information is available on conversion products of mycotoxins during food processing.

Calendar

1984

June 11-12, TEXAS ASSOCIATION OF MILK, FOOD AND ENVIRONMENTAL SANITARIANS ANNUAL MEETING. For more information contact: Ron Richter, Animal Science Department, Texas A&M University, College Station, TX 77843.

June 11-13, TECHNICAL SESSIONS AND EXHIBITS, Association of Official Analytical Chemists, Leamington Hotel, Minneapolis, MN. For more information contact: Raymond H. Bowers, General Mills, Inc., 9000 Plymouth Ave. N., Minneapolis, MN 55427.

June 24-27, 30th ANNUAL FANCY FOOD & CONFECTION SHOW, Washington, D.C. For more information contact: Dennis Raveneau, Show Manager, International Fancy Food & Confection Show, PO Box 3833, Stamford, CT 06905. 203-964-0000.

June 24-27, NATIONAL ENVIRONMENTAL HEALTH ASSOCIATION'S ANNUAL EDUCATIONAL CONFERENCE to be held in Grand Rapids, MI. For more information contact: NEHA, 1200 Lincoln, #704 Denver, CO 80203. 303-861-9090.

July 14-21, WORKSHOP ON RAPID METHODS AND AUTOMATION IN MICROBIOLOGY, at Kansas State University, Manhatten, KS. Dr. Daniel Fung, Dr. Nelson A. Cox and Dr. Millicent C. Goldschmidt will present lectures. The course will carry 7.2 Continuing Education Credits for the American Society for Microbiology. For more information contact: Dr. Daniel Fung, Call Hall, Kansas State University, Manhattan, KS 66506. 913-532-5654.

July 16-20, CANNERS TECHNICIANS MOLD COUNT SCHOOL to be held at Purdue University, West Lafayette, Indiana. For more information contact: J. V. Chambers, School Coordinator, Dept. of Food Science, Smith Hall 101D, Purdue University, West Lafayette, IN 47907. 317-494-8279.

July 29-August 2, 24TH ANNUAL MEETING OF THE HOSPITAL, INSTITUTION AND EDUCATIONAL FOOD SERVICE SOCIETY (HIEFSS), at the Riviera Hotel and Convention Center in Las Vegas, Nevada. The HIEFSS Expo '84 will be open on July 31 and August 1. For more information contact: Carolyn Isch, Asst. Exec. Dir., HIEFSS 4410 W. Roosevelt Rd., Hillside, IL 60162. 800-323-1908 or 312-440-2770.

August 6-10, BIOTECHNOLOGY: MICROBIAL PRINCIPLES AND PROCESSES FOR FUELS, CHEMICALS AND INGREDIENTS, a Massachusetts Institute of Technology one week course. For more information contact: Director of Summer Session, MIT, Room E19-356, Cambridge, MA 02139.

Aug. 5-9, IAMFES ANNUAL MEETING, Edmonton Inn, Edmonton, Alberta, Canada. For more information contact: Peggy Marce, Alberta Association of Milk, Food & Environmental Sanitarians, PO Box 8446, Station F, Edmonton, Alberta, Canada T6H 5H3 or call IAMFES at 515-232-6699.

September 11, WASHINGTON MILK AND FOOD SANITARIANS ASSOCIATION ANNUAL MEETING to be held at the Holiday Inn, 128th, Everett, Washington. For more information contact: Lloyd Luedecke, Dept. of Food Science & Tech., Washington State Univ., NW 312 True Street, Pullman, WA 99163. 509-335-4016.

September 12-13, The FIFTH ANNUAL JOINT EDUCATIONAL CONFERENCE of the Wisconsin Association of Milk and Food Sanitarians, the Wisconsin Environmental Health Association, The Wisconsin Dairy Technology Society and the Wisconsin Association of Dairy Plant Field Representatives will be held at the Elisabeth Inn at Plover (Stevens Point), Wisconsin. *Please note that this is a change of location.* For more information contact: Ron Buege, West Allis Health Department, 7120 West National Ave., West Allis, WI 53214. 414-476-3770.

September 15-21, 68th ANNUAL SESSIONS OF THE INTERNATIONAL DAIRY FEDERATION, Prague, Czechoslovakia. For more information contact: Harold Wainess, Secretary U. S. National Committee of the IDF (USNAC), 464 Central Avenue, Northfield, IL 60093. 312-446-2402.

September 20-21, MINNESOTA SANITARIANS ASSOCIATION, INC. ANNUAL MEETING to be held at the Earl Brown Center for Continuing Education on the St. Paul Campus of the University of Minnesota. For more information contact: C. B. Schneider, President, Minnesota Sanitarians Association, Inc. 612-623-5335.

September 30-October 4, 69TH ANNUAL MEETING OF THE AMERICAN ASSOCIATION OF CEREAL CHEMISTS to be held at the Hyatt Regency and Amfac Hotels in Minneapolis, MN. For more information contact: Raymond J. Tarleton, AACC Headquarters, 3340 Pilot Knob Road, St. Paul, MN 55121. 612-454-7250.

October 3, OHIO ASSOCIATION OF MILK, FOOD & ENVIRONMENTAL SANITARIANS ANNUAL MEETING to be held at Duff's Restaurant, Columbus, OH. For more information contact: CDR Ronald H. Smith, USPHS, % State Training Branch, FDA, Room 8002, FOB, 550 Main Street, Cincinnati, OH 45202. 513-684-3771.

October 3-5, KANSAS ASSOCIATION OF SANITARIANS ANNUAL MEETING to be held at the Red Coach Inn, McPherson, KS. For more information contact: Dale Wing, 1014 Cody, Hays, KS 67601. 913-625-5663.

October 9-10, DAIRY INDUSTRY CONFERENCE, Hyatt/Long Beach, Long Beach, CA. For more information contact: John C. Bruhn or Shirley Rexroat, Dept. of Food Science & Technology, University of California, Davis, CA 95616. 916-752-2191.

October 14-17, LONDON INTERNATIONAL FROZEN FOOD TRADE FAIR. For more inforamtion contact: Sandra Paul, 212-752-8400.

October 15-17, ISSUES IN SENSORY EVALUATION - STABILITY AND QUALITY CONTROL - Palo Alto, California. Attendence is limited and there is a fee. For more information and registration contact: Tragon Corporation, 750 Welch Road, Suite 210, Palo Alto, CA 94304.

October 19-25, FOOD SANITATION INSTITUTE 27TH ANNUAL NATIONAL EDUCATIONAL CONFERENCE & EXPOSITION, Holiday Inn Surfside, Clearwater Beach, FL. For more information contact: Jean M. Day, Executive Director, Food Sanitation Institute, 1019 Highland Ave., Largo, FL 33540. 813-586-5710.

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

1985

May 20-23, FOODANZA '85, joint convention of the Australian and New Zealand Institutes of Food Science and Technology. To be held at the University of Canterbury, Christchurch, New Zealand. For more information contact: D. R. Hayes, Convention Secretary, 394-410 Blenheim Road, PO Box 6010, Christchurch, New Zealand.

August 5-9, IAMFES ANNUAL Meeting, Hyatt Regency, Nashville, TN. For more information contact the IAMFES office, PO Box 701, Ames, IA 50010. 515-232-6699.

August 25-30, 9TH SYMPOSIUM OF WAVFH. The World Association of Veterinary Food Hygienists (WAVFH) will hold their 9th Symposium in Budapest, Hungary. For more information contact: 9th WAVFH Symposium, Organizing Commitee, Mester u. 81, H-1453 Budapest Pf 13, Hungary.

1986

April 14-18, FRUIT AND FRUIT TECHNOLOGY RESEARCH INSTITUTE INTERNATIONAL CONFERENCE to be held at the CSIR Conference Centre, South Africa. For more information contact: Symposium Secretariat S.341, CSIR, P.O. Box 395, Pretoria 0001, South Africa. Telephone: 012 869211 x 2063. Telex: 3-630 SA.

May 26-31, 2ND WORLD CONGRESS FOODBORNE INFECTIONS AND INTOXICATIONS will take place in Berlin (West) at the International Congress Centre (ICC). For more information contact: FAO/WHO Collaborating Centre for Research and Training in Food Hygiene and Zoonoses, Institute of Veterinary Medicine (Robert von Ostertag-Institute), Thielallee 88-92, D-1000 Berlin 33.

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