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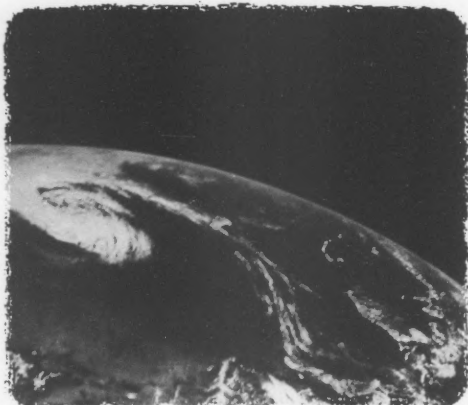
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DAIRY, FOOD AND ENVIRONMENTAL

# SANITATION

OCTOBER 1991

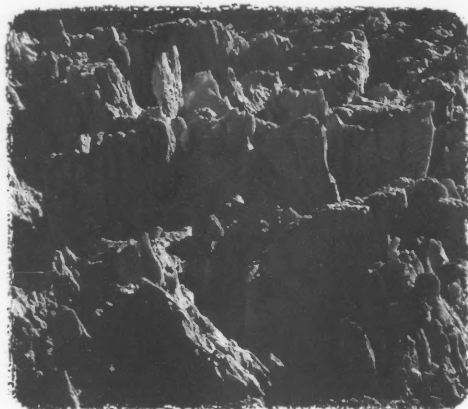
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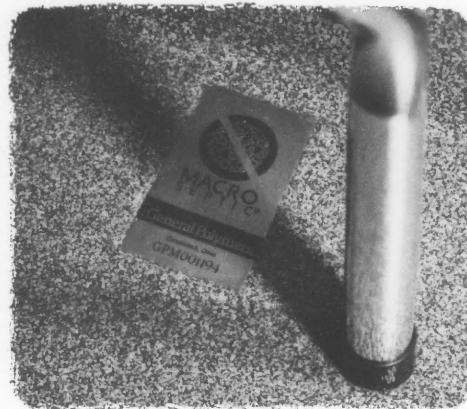
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### ***Awards***

Five (5) awards will be presented: 1st place, \$500 and a plaque; 2nd place, \$200 and a certificate; 3rd place, \$100 and a certificate; 4th place, \$50 and a certificate; 5th place, \$50 and a certificate. All of the winners will receive a 1 year membership including both *Dairy, Food and Environmental Sanitation* and the *Journal of Food Protection*.

### ***Purpose***

1. To encourage graduate students to present their original research at the IAMFES annual meeting.
2. To foster professionalism in graduate students through contact with peers and professional members of IAMFES.
3. To encourage participation by graduate students in IAMFES and the annual meeting.

### ***Who Is Eligible***

Graduate students enrolled in M.S. or Ph.D. programs at accredited universities or colleges whose research deals with problems related to environmental, food and/or dairy sanitation, protection and safety. Candidates cannot have graduated more than one (1) year prior to the deadline for submitting abstracts.

### ***Criteria***

1. A short abstract of the paper must be submitted to the IAMFES office by December 16, 1991. (Use the blue abstract forms from the September issue, if possible).
2. The author must indicate on the abstract form the desire to be considered for the competition.
3. The paper and the student must be recommended and approved for the competition by the major professor or department head.
4. The paper must represent original research done by the student and must be presented by the student.
5. An extended abstract form will be sent to all who enter the competition, and must be completed and returned by the deadline date on that form.
6. Each student may enter only one (1) paper in the competition.
7. Papers are to be presented as oral papers and should be approximately fifteen (15) minutes in length with an additional five (5) minutes allowed for questions, for a total of twenty (20) minutes.
8. The use of slides or other visual aids is encouraged.
9. **All students with accepted abstracts will receive a complimentary membership which includes their choice of *Dairy, Food and Environmental Sanitation* or the *Journal of Food Protection*.**
10. The papers will be judged by an independent panel of judges.
11. Winners are presented and honored at the annual Awards Banquet. All entrants will receive complimentary tickets and are expected to be present at the Banquet.

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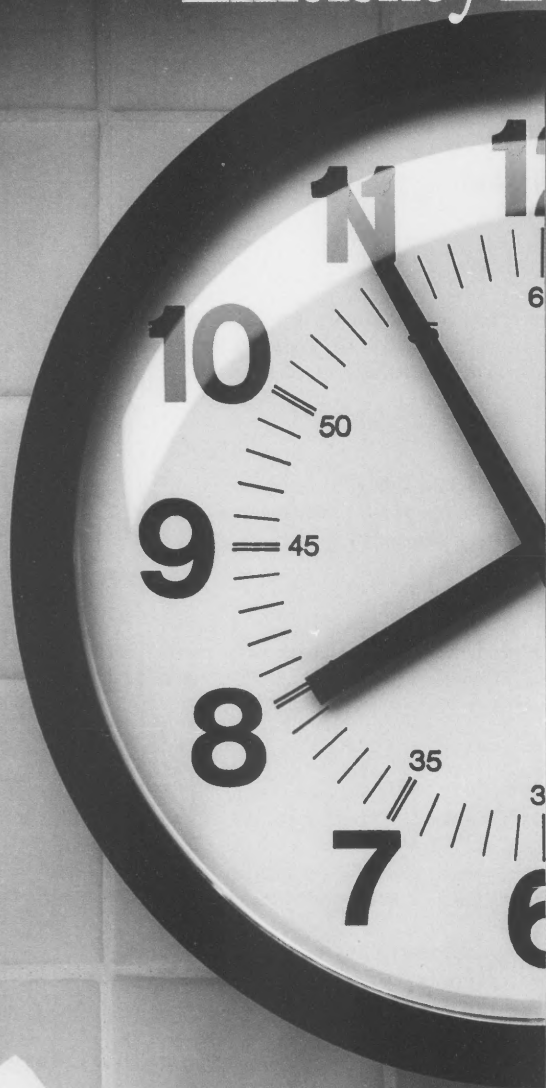
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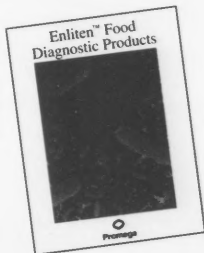
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# Thoughts From The President . . .



By  
**Damien A. Gabis**  
IAMFES President

In 1987-88 a Long Range Planning Committee appointed by then President Roy Ginn prepared a report to help guide IAMFES for two to five years. The 1988 planning effort was led by Dr. Mike Wehr who with a committee of seven others represented the three professional sectors of the association and geographical distribution of the membership.

After considerable work, the committee made the following nine general recommendations to the Executive Board:

- Update the bylaws and statement of objectives to reflect changes in the direction of the association.
- Continue to strengthen the association's membership.
- Retain/expand the association's role in the publication of scientific/technical information.
- Strengthen the association's officer and committee structure.
- Strengthen the association's affiliate organizations.
- Enhance the soundness of the association's financial stability.
- Enhance and develop relationships with other scientific and related associations.
- Maintain IAMFES' association with the 3A Symbol Council.

The Long Range Planning Committee provided detailed ideas for specific activities to achieve their recommendations, but delineation of these activities requires more space than available here. Many of the specific recommendations made in 1988 have now been implemented, and have greatly benefited IAMFES.

In my opinion, it is time to reexamine the goals of our association and to develop a new plan, based on our traditions and previous accomplishments, for the future work of IAMFES. I intend to bring the long range planning issue before the Executive Board at the October 24-25, 1991 board meeting. I am hoping that a task force of members can be organized soon afterwards to begin working on a new plan for our association. In preparation for this work, I urge members to take a few minutes to write to me with your specific ideas for strengthening IAMFES.

# On My Mind . . .



By  
Steven K. Halstead  
IAMFES  
Executive Manager

. . . is volunteerism

A milk sanitarian was recently asked why he belonged to the International Association of Milk Sanitarians. "To get the JOURNAL," was his reply. "I don't go to the meetings. I don't have time. Besides, you can get everything in the JOURNAL."

That brings up the question as to what makes the JOURNAL possible. The answer to this question is, of course, active membership and active interest in the Association. Without this active interest, there would be no JOURNAL and no Association.

Every member is busy with his own work. This is especially true in these times. Officers of the Association are probably more busy than the average member. Yet they must find time or the Association would cease to function.

Attending the annual meetings offers much that is missed in the JOURNAL. It has often been said that the "jam sessions" during program intervals develop into discussions equal in value to the papers themselves. Corridor discussions of mutual problems assist the sanitarian in appraising his own progress.

Taking an active part in Association affairs helps the sanitarian to feel that he is a part of the Association. At the recent annual meeting, the president called for volunteers to work on a standing committee. Only six members responded.

The president of the Association recently asked a member if he would act as chairman of one of the standing committees. To himself the member said, "I can't take this

assignment. I'm snowed under with work now. I'd be a darn fool to add this to an already overburdened schedule." Then the thought occurred to him that if he did not support the Association and its officers he was indeed a poor member. Why belong to an association if you do not support it? Do you deserve the benefits of the JOURNAL if you do not help make it a going concern?

The "let George do it" attitude did not make the Association; it did not make America; and it will not make a successful milk sanitarian. If you are going to be a milk sanitarian, try to be a good one.

In reading the above you may have been asking yourself about some of the "archaic" language and names/titles being used. That is because this first appeared in the *Journal of Dairy Sanitation* in 1945. Dee Buske, our Affiliate Liaison, ran across it as she was looking into the history of some of our affiliates.

I maybe wouldn't have said it in exactly the same way as the author (identified only as J.R.J.), but the bottom line is the same. Then as now. If you are going to be a member, be a full member. Read the journals. Attend the meetings. Serve on committees. And if you feel so inclined, serve as an officer. Your affiliate needs you. We need you.

One last quick thought: We are all cognizant of the hectic pace of life around us. We have far too much to do and far too little time to do it. We also tend to look back upon the "good old days" when the pace was slower.

Well, some things never change, apparently. The above was titled "He was too Busy!"

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**Do you deserve the benefits of the JOURNAL if  
you do not help make it a going concern?**

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# Teaching HACCP Techniques To Food Processors and Regulatory Officials

Frank L. Bryan  
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Training is an essential adjunct to the hazard analysis critical control point concept. For the employment of the HACCP system to food processors and regulatory officials, several categories of persons must be trained. They are:

- 1) Persons who will conduct HACCP evaluations and who will set-up the HACCP system
- 2) Persons who prepare and process foods at critical operations
- 3) Persons who monitor critical control points
- 4) Persons who supervise operations involving critical control points
- 5) Persons who verify monitoring
- 6) Persons who administer food safety, food quality assurance and food regulatory activities

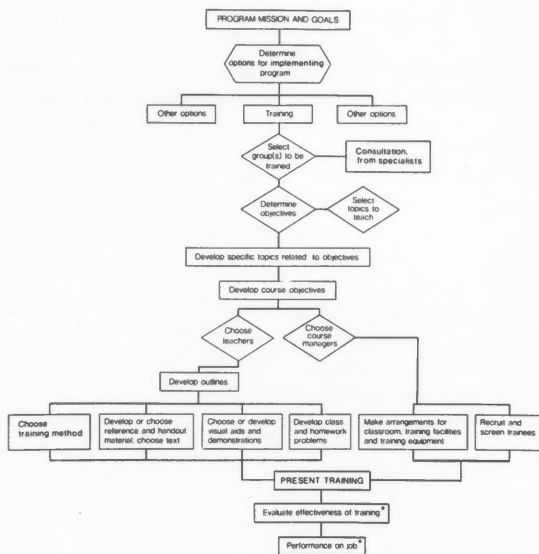
Each of these groups needs to either have or acquire certain knowledge, skills and/or attitudes. These attributes can be obtained by training.

## Developing Training

Good teaching may be an art, but development of training ought to be based on the scientific approach. The sequence of developing, presenting, and evaluating training is illustrated in Figure 1. Certain features of this sequence are described.

When a decision has been made to train a specific group, the first action is to develop statements that describe the goals (objectives) of the training effort. Three types of objectives may be considered: (a) those that guide and give direction to the training program; (b) those that give basic principles or describe information or tasks that must be learned in order to understand why something must be done or how to do it; and (c) those (performance objectives) that describe what the trainee will do at an acceptable level as a result of the training. Performance objectives should cover information that trainees need to know to be able to do a job satisfactorily, skills that they will be able to perform, and attitudes essential to motivate them to do the job at a satisfactory level of performance. They usually can be measured. Thus, a means to evaluate accomplishment of the objectives is provided at the developmental stage of the training.

Figure 1. Sequence of activities for developing, presenting, and evaluating training



\*Feedback to each of the above phases

See Tables 1-6 for a listing of these objectives for each category of persons needing training. (These statements can be changed into performance objectives by modifying the wording.) Related and additional objectives can be found in the chapter on training in the text of the International Commission on Microbiological Specifications for Foods (ICMSF, 1988). Training courses on HACCP prepared for food industry or food safety personnel should be based on wisely-chosen objectives. They must relate to practical matters that are applicable to the group being taught. Special information and skills are needed as the persons' responsibilities relate to hazards, critical control points and monitoring.

**Table 1. Knowledge, skills and attitudes that persons who conduct hazard analyses and set-up HACCP systems ought to acquire as a result of training**

#### **KNOWLEDGE**

- Understand the basic principles of food microbiology
- Understand operations and food-flow patterns of processing and preparing the types of foods for which HACCP systems are to be applied
- Know the important factors that contribute to foodborne outbreaks
- Understand sources of contamination of foodborne pathogens, indicator organisms and spoilage organisms and their usual mode of spread to foods for situations for which HACCP systems are to be applied
- Understand the principles of microbial survival and destruction for situations for which HACCP systems are to be applied
- Understand the principles of microbial growth for situations for which HACCP systems are to be applied
- Know where to locate dependable sources of information on the HACCP concept

#### **SKILLS**

- Develop skills in measuring pH, water activity, time-temperature exposures, disinfectant concentrations and for sampling foods
- Develop skills in diagramming food flow and inserting symbols where hazards occur and at critical control points
- Develop skill in making and interpreting time-temperature graphs
- Develop observation skills so as to identify sources and modes of contamination, likelihood of survival and opportunities for microbial growth during hazard analysis
- Develop skills in setting up HACCP systems, including listing of operations, associated hazards, assessment of the severity of their outcomes and the likelihood of their occurrences (risks), types of critical control points, criteria for control, monitoring procedures, action to take when criteria are out of control, and verification procedures

#### **ATTITUDES**

- Develop a curiosity to learn food processes and food safety interventions
- Develop insight into limitations of traditional food protection activities
- Develop a positive attitude that the HACCP system is the most effective and efficient approach to food safety
- Become stimulated to conduct hazard analyses and set up HACCP systems
- Develop ability to assess priorities of hazards based on their severity and risks

Persons who conduct hazard analyses and set up HACCP systems must be educated in the fundamentals of chemistry, physics, microbiology, and food science and have experience with the products being processed or prepared. Hence, their training should include procedures to measure pH, water activity, temperature, and to collect samples and make simple standard microbiological analyses. These persons must be aware of reservoirs of foodborne pathogens, epidemiology of the diseases that these pathogens cause and the ecology of microorganisms that are likely to give rise to disease or spoilage. Skills in sampling foods and interpret-

**Table 2. Knowledge, skills and attitudes that persons who process or prepare foods at critical operations ought to acquire as a result of training**

#### **KNOWLEDGE**

- Develop a basic understanding about contamination, survival and growth of foodborne pathogens and common spoilage organisms; hence, an understanding of the hazards of their operations
- Understand that some hazards have a relatively-high risk of occurrence as a result of certain processes and practices
- Know appropriate control and preventive measures for their operations and appropriate criteria for these measures
- Realize that risky operations (critical control points) must be under control and monitored to have a high degree of assurance of control

#### **SKILLS**

- Have skills in performing their operations
- Develop skills in either monitoring or supervising and verifying monitoring

#### **ATTITUDES**

- Realize that certain operations can be risky and if improperly carried out, they can result in an outbreak of foodborne illness
- Become stimulated to either monitor critical control points and insist that they are monitored and results recorded (if applicable) and to take immediate action when results indicate that criteria for control are not met so as to make the operation safe

ing laboratory results, given the type and/or number of microorganisms or type and concentration of chemicals present, must be developed. Also, an understanding of the nature, formulation, and processing of the foods under investigation is essential. They must have a thorough understanding of the HACCP system. These sorts of information and skills are essential to identify hazards and assess severity and risks associated with operations. Consequently, anyone teaching these topics should have a thorough understanding of food science and in particular food microbiology.

Based in part on information acquired during hazard analyses, investigators or quality control personnel should have skills in identifying the most critical processes of an operation that will affect or control contamination, survival, and growth of microorganisms. These skills must be based on a knowledge of epidemiology, as well as microbiology, and the processing operations involved. An understanding of the potential severity of the outcome of the hazard and the probability of its occurrence (or risk) is necessary. If a hazard analysis shows that a process or preparation step is either uncontrolled or has the potential to go out of control, appropriate preventive or control measures must be either selected from known measures or devised. Principles and applications of foodborne disease control must be well known to make rational selections. If devised, knowledge of food science, processing operations and/or engineering is required. Furthermore, appropriate criteria and limits must be established, so knowledge about these must be acquired.

Routine monitoring of critical control points will be the responsibility of personnel in the establishment applying HACCP. Therefore, they must be informed of hazards and

**Table 3. Knowledge, skills and attitudes that persons who monitor critical control points ought to acquire as a result of training**

**KNOWLEDGE**

- Become aware that hazards associated with operations must be controlled at certain (critical) operations
- Learn the criteria for control for the operation (critical control points) to be monitored
- Know actions to take when monitoring indicates that criteria are not being met at critical control points

**SKILLS**

- Develop skill in observing operations or measuring attributes of food or process, as applicable to the monitoring procedure
- Develop skills in using all appropriate measuring and testing instruments and equipment
- Develop skill in filling-in work (check) sheets or monitoring forms

**ATTITUDES**

- Understand that there are hazards associated with operation(s) and that monitoring is essential to ensure food safety
- Become stimulated to report to supervisor conditions that do not meet control criteria

critical control points of the operation, and they must learn procedures to monitor them. This may require measurement of temperatures, pH,  $a_w$  or disinfectant concentration; re-viewing recording charts, observing likely points for cross contamination; and collecting samples. Supervisory personnel must also know these procedures to direct the monitoring, to take over in the absence of responsible persons, and to take action whenever criteria set for control of a processing preparation step is not met. Health or regulatory agency personnel must be able to verify the effectiveness of the monitoring procedures. Food industry chief executive officers, plant managers and health/regulatory administrators

**Table 4. Knowledge, skills and attitudes that persons who supervise operations involving critical control points ought to acquire as a result of training**

**KNOWLEDGE**

- Understand the processes under supervision
- Understand hazards associated with all operations under supervision
- Know appropriate preventive and control measures and criteria for their control
- Know applicable monitoring procedures

**SKILLS**

- Either have or develop skills in supervision
- Develop skills in reviewing monitoring reports

**ATTITUDES**

- Become stimulated to insist on proper monitoring and on taking immediate action whenever monitoring indicates that criteria have not been met

**Table 5. Knowledge, skills and attitudes that persons who verify monitoring ought to have as a result of training**

**KNOWLEDGE**

- Understand hazards of operations being monitored
- Learn criteria for control of operations being monitored
- Learn the most efficient means to monitor critical control points of operations of concern
- Understand that verification must be done either at the time operations are done or of records recorded at that time or of samples taken at that time

**SKILLS**

- Develop skills in using monitoring instruments and equipment
- Develop skills in calibrating monitoring instruments
- Develop skills in observing operations for hazards and for failures of monitoring
- Develop skills in reviewing monitoring records

**ATTITUDES**

- Develop curiosity in detecting changes in operations from those for which the HACCP system was planned
- Become stimulated to report to supervisor and/or person responsible for the HACCP system whenever findings indicate that criteria are not met, that monitoring is done incorrectly or that operations have been modified

must understand HACCP concepts and be committed to its implementation.

**Training Techniques**

Effective training consists of presenting information, demonstrating techniques and setting up situations that help trainees obtain knowledge, skills and attitudes specified in the objectives. Information can be taught in classrooms or learned by reading appropriate materials on the subject. Visual aids enhance learning. Skills are usually acquired as a result of actual practice in the field or in situation-oriented exercises which may be presented as homework or group or individual problem-solving sessions. Hence, skills are learned by doing and by practice. Attitudes are not as readily acquired; they often come from mentors who may be teachers, supervisor, an outstanding co-worker or a renowned specialist in the field of interest.

Training techniques should include visual orientation to applicable hazards and critical operations. Trainees should review, and later develop, flow diagrams of processes which have hazards and critical control points that have been designated by persons who are very knowledgeable of operations, food microbiology and food safety (ICMSF, 1988). Applied exercises should be given which allow evaluation of hazardous situations, assessment of risks, determination of critical control points, selection of criteria for control, choice of appropriate and practical monitoring procedures, selection of actions when criteria are not met, and selection of verification procedures. Hence, trainees set up a HACCP system or systems for one or more foods as a learning experience (see Bryan, 1989). In the future, computer programs will guide persons in setting up HACCP systems.



**Table 6. Knowledge, skills and attitudes that administrators must acquire to satisfactorily administer HACCP projects ought to acquire as a result of training**

#### **KNOWLEDGE**

Understand what the HACCP system really is; this includes it's components and definitions

Understand the common factors that contribute to outbreaks of foodborne illness

#### **SKILLS**

Either have or develop basic communications, leadership, and managerial skills

#### **ATTITUDES**

Realize that the inspection mentality is the major barrier to implementation of the HACCP system and devise and take actions to dispel the inspection mentality on the part of the staff

Understand that certain operations (sanitary code items) are vital to food safety while others are of only trivial or minor significance and change program emphasis to activities that relate to the vital items

Develop insight into the limitations of traditional food-protection activities

Develop a positive attitude that HACCP is the most effective and efficient approach to food safety

#### **Evaluating Training**

Evaluation of training of any sort is frustrating. There is virtually unanimous disappointment with results of evaluation of most health education and training programs because success is difficult to define (Marshall, 1980). One reason is that measurements often concentrate on gain of information and not on change in behavior. Another is the common practice of adopting unrealistic goals. To expect, for example, that a food handler training program will result in a significant increase in sanitation scores in community restaurants is unrealistic. Changes in behavior that might result in improvements are often diluted by discrepancies related to physical facilities, existing equipment, and operations that are not easily surveyed (e.g., rate of cooling) or not occurring during a brief inspection. Furthermore, sanitation scores may have no relationship to either food hazards or critical control points. Sometimes a goal of a training program might be to decrease the incidence of disease. If part of the training dealt with epidemiological surveillance of disease, however, its success would be measured by an increase of reported cases due to improved ability to identify outbreaks, to make association between sporadic cases, and to acquired proficiency in conducting investigations. So success in one phase of a program might be reciprocal to success in another phase or even to the accomplishment of a goal of the training; thus making evaluation difficult.

Despite shortcomings in evaluating training, evaluation of knowledge gained and performance of certain skills can be evaluated. The evaluation must be based on course objectives. Trainees should acquire certain information, be able to do certain tasks in an acceptable way, develop certain

outlooks, and acquire skills to continue to learn. Trainees' understanding of these matters that are consistent with the objectives should be evaluated periodically during the training and at its completion by tests, assignments, and/or direct questioning. Furthermore, evaluation should be done to give trainees feedback of their development and to determine the effectiveness of the training.

After the course, training objectives should be evaluated, and if possible, participants' behavior on the job should be evaluated. Furthermore, an analysis of the subject content and training methods (including timing and sequences of training inputs) should be conducted. Instructors' contributions and effectiveness should also be evaluated. This can be accomplished by the instructor's self appraisal and appraisal by colleagues and course participants.

HACCP training programs might be evaluated by recording changes in practices at critical control points from hazardous situations to safe procedures which are being monitored. This would require surveys of practices before and after the training. Another evaluation would be the number of establishments that have verified HACCP programs before and after the training. Decrease in incidence of foodborne or diarrheal diseases may be difficult to detect because of the poor reporting and incomplete investigations that prevail, but the HACCP system implies that hazardous situations are prevented or controlled at critical operations. Monitoring ensures that a process is under control, and verification provides further assurance that monitoring of critical operations were effective. With the HACCP system, it is further implied that the processor/preparer and the verifier/(inspector) are aware of the hazards, critical control points, control measures, and monitoring procedures unique to the operations. These features are the uniqueness of the HACCP system which provides a high level of assurance of food safety.

#### **Resources for Learning HACCP Concepts**

HACCP training is presently available from a number of groups. These include: Food Consultation Safety and Training, Hospitality Institute of Training and Management, State Relations Training of the Food and Drug Administration, National Food Processors Association, Food Safety Inspection Service of the United States Department of Agriculture Training Center at Texas A&M University, and sporadically by state health or agricultural agencies, universities and extension services. Additionally, HACCP topics are frequently presented at meetings and symposia.

A book on HACCP has been written by the ICMSF (1988). It covers HACCP from production to preparation in either foodservice establishments or the home. The Food Marketing Institute has a manual on HACCP which covers seafoods, soup and salad bars, and deli and foodservice operations (Bryan, 1989). The International Association of Milk, Food and Environmental Sanitarians has a manual on procedures for implementing HACCP systems (Bryan *et al.*, 1991). Numerous articles are published on the subject (Table 7). Those listed give a historical perspective and up-dated information. (Quality varies so the user will have to use discretion during reading and subsequent use.)

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### Deterrents to HACCP Implementation

There are deterrents to implementing HACCP systems.

The primary deterrents are:

- 1) The inspection mentality and defensiveness to change is the major deterrent to implementation of HACCP systems.
- 2) Misunderstanding of the HACCP concept is another deterrent. Many persons have incomplete understanding of the HACCP concept. They often think of HACCP as an intensified inspection, a gigantic record-keeping task, or some special concern that they have been advocating.
- 3) Untrained co-workers and supervisors back on the job expect newly trained persons (who go back to their previous job to do the same thing as they did before the training).

Persons in both regulatory and quality control activities have traditionally put emphasis on inspection of food processing and preparation environments and on testing of finish products in their food protection programs. They resist changing their approach. Education about the HACCP con-

cept and an ability to set priority for items in sanitary codes and food processing steps according to relative importance to food safety are needed to hurdle this barrier.

The second deterrent is ageless whenever a new idea is introduced. The HACCP concept, however, is an exactly-defined system of interrelated components; each having specific definitions. Education and time seem to be the only remedies.

The third deterrent is a problem with most job-related training. Having a management commitment to the implementation and maintenance of the HACCP system and training supervisors first will minimize difficulties created by this deterrent.

For HACCP to become the keystone of food safety and quality control, these deterrents must be overcome. This is our challenge.

### Conclusions

Training is essential to implementation of the HACCP concept. It informs those who will be involved with the concept and stimulates them to develop and apply HACCP systems. By focusing training on HACCP concept, food handler and manager training can be streamlined so that only a few topics relating to product-specific hazards, critical control points, and monitoring procedures are emphasized rather than being courses on basic bacteriology, dish washing and vector control. Similarly, training for regulatory officials can be focused on critical operations that will prevent foodborne diseases and spoilage, rather than on aesthetics.

HACCP is the "state of the art and science" of food safety. Quality control and food safety programs must depart from ineffective and inefficient elements of traditional food protection activities. Leaders in these fields must stimulate universal acceptance of the HACCP system and guide its implementation in all food operations. Lead...

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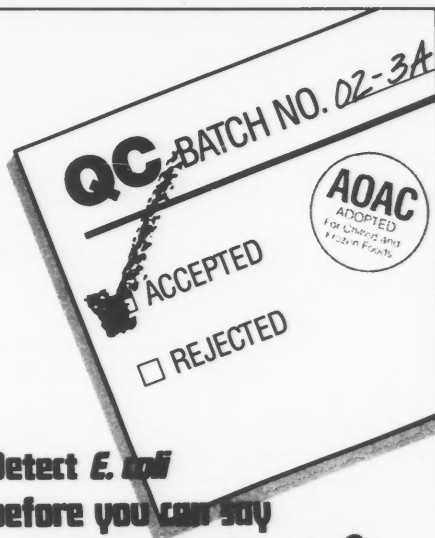
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# Computerized Processing Systems: Realistic Expectations

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Presentation given at the International Dairy Show, October 18, 1990, Anaheim, CA

The process designer of a large dairy cooperative faces making many decisions and selections regarding microprocessor technology that will control new or upgraded processes in plants. Within the supply industry there are those who have developed something of a reputation for being "hard sell" when it comes to control applications. This misconception probably stems from the fact that some have been absorbed by utilizing and applying the power of microcomputers to real time tasks since the late 1970s. In that age, those who were convinced that microcomputers might well revolutionize the way many things were being done were labeled "hackers" by the people who worked on "real" computers. Microcomputers were just a novelty and could never be developed to the point that they could actually do anything useful like main frames could.

## KISS

But, today, in reality, the goal is simply to apply appropriate technology to control the processes in the plants. The application of appropriate technology is the key to achieving realistic expectations of computer processing systems within the industry. But many vendors have a "hard sell" reputation, and this reputation may have something to do with heavy reliance on the KISS principle. Many vendors are not the least bit interested in "keeping it simple" for obvious, but short sighted, reasons. Not all people who are involved in controls are experts in every area of processing or controls or computers that may impact the making of the decision. This need not be an impediment to making good decisions about control technology as long as we don't let the jargon and magic of the computer wizards scare us into ignoring common sense.

## Common Sense

If you apply the same principles to purchasing new control technology that you would apply to buying a new homogenizer or a new ammonia compressor, you probably won't do too badly. The first step is to know what it is that you want to do. For someone to be able to adequately communicate an idea to a potential vendor, it is essential that the concept of how to control a particular process is clear in the mind. Unless you are intimately familiar with all aspects of the process it is wise to involve operational and supervisory personnel in arriving at the concept. Once the concept is clear, the next trick is communicating it to

the potential vendors so that they can respond with proposals on how to do what you want. If anybody fumbles on this play there are likely to be problems ahead.

Here is a story that illustrates the importance of adequately communicating concepts in a relationship. It seems there was this couple who had been married for some time and birthdays had gotten to be something of a burden. They always struggled with what to give each other, but nothing ever really seemed to be on target. One year, the wife said she really wanted to do something special for her husband and she asked that he give careful thought to what he wanted, and she would get it for him no matter what it was. He thought about it for awhile and then it hit him: "I want you to hire somebody to do all the painting around here that you've been hounding me to do for the last five years." Fair enough. The next day while she was going through the yellow pages looking for a decorating contractor, a man knocked at the door saying that he was looking for general household work, did she have anything that needed doing? "Can you paint," she asked. "Oh yes, I am a very good painter!" She was overjoyed! What her husband wanted for his birthday was something she had wanted for years, and now a man who could do the work showed up at her door! She told him he could start right away. The first thing was the porch out back. Her husband had bought four gallons of paint a year before and they were in the garage. While he got to work, she started planning the colors for the rest of the rooms she would have painted. In far less time than she thought it should have taken the man to finish, he was back asking what he could do next. She asked, "Have you finished the porch already? I don't have the paint for the rest of the work, but I'll have it here tomorrow if you want to come back." He responded, "Lady I told you I was a real good painter, and I'll be happy to come back tomorrow, but I gotta tell you, that's not a Porsche out back, it's a Mercedes!"

## Types of Computerization

Computerization in the dairy industry covers a lot of ground. It encompasses anything from general office accounting systems to total Computer Integrated Manufacturing (CIM), in which virtually every task and process is either controlled or at least monitored by a computer. Today's business climate has made office computer operations, ranging from general ledger to sales entry "socially

acceptable" even in the conservative dairy industry. Out in the plant, the computer as a data management tool is becoming more and more common. A PC with word processing, spreadsheet and database management software can be effectively applied to a wide range of plant related paper pushing such as calculating production, ingredient and parts inventories, formula calculations and sanitation recordkeeping, among others. The PC workstation in the plant office is simply taking its place along with other tools like calculators, typewriters and filing cabinets. A case can certainly be made that PCs have made it possible to get so wrapped up in analyzing what's going on in the plant that running the plant may become secondary to the analysis. Overall it isn't likely that either of these scenarios will be devastating. In making decisions about plant computerization of this type, the potential cost/benefit will depend, to a great extent, on the people who will be using the tool.

In real time process control applications the stakes are quite a bit higher. In process control computing, not only is the investment in control equipment a risk, but the process itself is also being risked. The design for a new process addition to the plant can be wonderfully efficient, but if attempts are made to control it with an insufficient or difficult-to-support control package, costly downtime and, conceivably, even product integrity, is risked. That is why it is so essential to make sure that the control technology is appropriate, that we have realistic expectations about its role in the process and that it passes all common sense tests.

A purchaser doesn't have to be a control wizard to make good choices. Don't be afraid to get answers to all questions. If a vendor keeps avoiding a question or can't answer in an understandable fashion, it is quite possible that he or she doesn't know the answer. There is nothing wrong with a salesperson not having all the answers, but it raises a red flag when they seem unable to admit it or unwilling to find the information being asked for.

### **Don't Reinvent the Wheel**

Watch out also for vendors who may have a great deal of experience in industrial process computerization but not too much in the dairy and food arena. Beware of reinventing the wheel. There are a number of suppliers that have been in the dairy supply industry for many years and have more recently become expert in computerization that is appropriate and well-suited to the specific tasks.

Beware of being ignorant of new developments. In 1984 a company was building a major ice cream novelty plant. At that time ammonia refrigeration control systems for two stage plants were generally done with step sequencers and delaytimers linked with relay logic. It seemed that this was an application that cried out to be computerized. When the idea was presented to a major computer company, it was thought to be no problem. But, they wanted \$100,000 for hardware, a year of software development and a small mainframe computer.

So, instead of doing that, \$20,000, six months and the help of a real computer whiz from Southern Illinois University at Carbondale, developed a system based on the Z-80 microprocessor, which controlled a parallel multiplexer that

allowed 32 points of digital input and output and three analog input channels. The project involved building an interface board to link the brain to the real world and also writing the software. The completed system performed beyond expectations.

This year the same company began working on a stand alone ammonia refrigeration system for a large freezer addition at another ice cream plant. They were going to use the same system but found out from the refrigeration vendor that the ammonia compressors being looked at each came equipped with onboard programmable logic controllers that interface together providing almost unlimited control flexibility with sufficient capacity to handle other parts of the system, such as defrost timing, suction trap recirculation and condenser fan and pump motors. That little invention of 1984 had just fallen victim to the onward march of technology.

### **CIM Strategies**

People are often encouraged to spend large sums of money to totally computerize whole plants. But, because of the sizable investment, the whole process, not just the controls, need to be updated. For this reason, Computer Integrated Manufacturing (CIM) has a lot of possibilities for the future of our industry and probably for all industries. When a new plant is being built, with all new process equipment, CIM strategies should definitely be looked at, but it is doubtful whether CIM can be effectively added on from the top down. The CIM concept has to be built in from the bottom up. It is unfortunate that many who agree that CIM strategies need to be built in rather than added on use this as an excuse for never considering CIM in the future of their operations.

A more sensible approach might be to consider the upgrading of individual tasks and processes with an eye toward linking them into cell areas in the future with the eventual prospect of tying the cell areas into an integrated total plant system as a long term goal. If a company intends to incorporate some forward thinking toward a long term goal for Computer Integrated Manufacturing, the burden falls right back into the lap of the specifying designer and the manager making the purchasing decisions. Now, in addition to having the proposed control technology pass the cost/benefit, realistic expectation and common sense tests, companies must consider, from this point forward, the need for integration. If the potential for future integration is present, the proposed system must be capable of forward compatibility.

### **Compatibility**

The quest for compatibility, that is, the ability for computers and controllers to share data and/or interact with one another for the purpose of extended or overlapping control responsibilities is potentially the biggest can of worms in the computer business. It is something of a problem in business computing, but it is the biggest long range headache facing process designers today. There are many reasons for these compatibility problems. The foremost may be the technical complexity of interfacing systems which do similar tasks in radically different ways, by virtue

of their differing internal hardware and software structures. When two systems share data, a wide variety of potentially differing electrical standards, code types and data protocols must be reconciled. If persons involved in selling and specifying systems are not aware of all of these concepts, there will be problems. Being compatible on most of the parameters regarding interfacing isn't good enough. Does this mean that you have to become a specialist in data communications interfaces and protocols? No, but it means that everyone should have a clear idea of how they want new systems to work with existing or future systems and make sure that the contractual agreement with the vendor clearly outlines who is responsible for what in terms of integrating processes. Failure to do this will result in a lot of finger pointing when the big switch is thrown and the processes don't talk to each other.

Once a system was specialized for a high speed batch making process and required an RS-232 data interface capable of communicating in ASCII for the purpose of keeping track of what ingredient quantities had gone into the batches throughout the production run. Everyone was supposedly clear on all this and thought that the microprocessor would spit the data out the RS-232 port as each ingredient was added to the batch. A program which would time stamp and identify the addition of each ingredient and then write it into a file, which could then be used to print a report, was written and run in a PC. Everything was hooked up, but the program got no data. It was found out that this program would have to poll the vendor's program for the data. But that was not the easy task it should have been. The completed batch weights didn't get stored in the vendor's program. The only way to get the data was to constantly read the incrementing weight while testing for a valve closure that would signal the end of that ingredient. It can be done, but is a low priority job for people throughout the industry. It's a good bet that that one particular loose end won't be overlooked in negotiating the next equipment purchase.

Another major impediment to integration of systems besides technical complexities is the proprietary operating system. There have been control manufacturers who designed their systems specifically so that they could not interface to anyone else's equipment to force the user to purchase any future related systems from them. This mentality is seen less and less, but it is still worthwhile to be on the lookout for such strategies.

### **Separate by Choice**

When you look at several tasks that make up a cell area with an eye to make sure that things function as an integrated system, that doesn't necessarily mean that process can be cabled together and run from a remote keyboard. There may be cases where well-thought-out integration suggests an appropriate reliance on human logic. When the high speed batch system mentioned earlier went on line, the manager of this large ice cream plant thought that many of the accountability and measurement problems he had experienced would disappear due to the much higher level of measurement accuracy of the new processing equipment. After a few weeks passed, he realized that he wasn't seeing

the kinds of improvements he had expected. He was convinced that the calibration of the new system was in error. The reason turned out to be the way the mixes were being calculated. Rather than go through the time-consuming extended Pierson Square formulas for each batch of mix to insure exactly the right fat and solids content, over the years the mix department had arrived at operational recipes where ingredient amounts for certain mix batches were fixed, the fat was brought into line by varying the cream, and the Milk Solids Not Fat were close, but really left to chance. When everything was being measured through a small beam balance scale tank on the way to being vat pasteurized in 500 gallon batches, it was reasonable that the measurement accuracy didn't justify the painstaking math day after day. There was measurement accuracy but no formula precision. The solution was in the form of a PC based computer program which was the result of a joint effort by one very talented ingredient salesman and several industry folks from a number of dairies for whom the project became something of a labor of love. In its final version, the operator enters the fat and solids tests from all of the dairy ingredients in use on a particular day, and then selects the mixes to be made from a menu in which all the formulas used by the particular plant are stored. The program keeps track of multiple sources, all non dairy ingredients, such as powders and sugars, and even allows for inclusion of rework or rinse while maintaining exacting calculation standards. With the batch sheets now being produced by this program, the accountability immediately moved into the expected range. It would be very simple to interface the personal computer calculating the batches to the microprocessor in the batching panel and transmit each batch to be run electronically. Some chose not to do this because it would unnecessarily take the common sense logic capability of the human brain of the mixmaker out of the decision and responsibility loop. A keyboard error or computer aberration could cause an unrealistic value to be transmitted to the batch system. The software could be safeguarded against many of the potential errors, but just cite good Mr. Murphy's laws and corollaries throughout this industry to see that it is safer if somebody looks at the batch on its way to production. The logic of the human brain can pick out anomalies that the best of programs may overlook. By thinking this through, the situation is arrived at where the level of human intervention thought appropriate is maintained, but all of the hardware and the software have enough compatibility and accessibility so that they can be further integrated to future systems.

### **Forward Planning For CIM Makes Sense**

It really makes fiscal sense to start taking a look at small projects in the context of the long term future. Just about any control device you wish to consider; Programmable Logic Controllers, variable frequency motor controllers, batchers, PID controllers and personal computers all are available with some sort of communications port options to provide addressability. In the case of most PCs it is no more costly to add data communications when needed than it is to purchase it with the system. But this



is often not the case with other types of process control systems. It is wise to consider this option when accepting bids for equipment because the communications capability may cost very little more to include, and will then be there if you decide to make use of it in the future.

If you subscribe to the theory that the way to move into a position where Computer Integrated Manufacturing makes sense for your facility is from the bottom up rather than from the top down, then it should be obvious that the key to realistic expectations is successful planning and communication. Designers and managers will be forced to take a look at the long term implications of what might now be considered to be an isolated small project. Planning from the bottom up rather than the top down is an important concept for people as well as computers. When looking at upgrading a process system it is wise to go into the planning process with an open mind and with as few preconceived ideas as possible. In the early stages of "what ifing" and prior to signing on the dotted line it is good to involve all the personnel who will be caused by the nature of their jobs to interface with the new system. This should include operators, supervisors, QA personnel and maintenance people. This group of people, each bringing to the process their own concerns, can often point out problems with the concept when they are easiest to deal with. As a manager or designer it will be your task to assign the proper weight to each of the arguments from the various perspectives, but the overall planning process will be more effective if effort is put into considering a varied number of viewpoints. This effort often brings concerns to the surface which point out the realities of the proposed system's ability or the vendor's willingness to be flexible and adaptive to your unique situation. Some vendors try to get your process to fit their control package instead of the other way around, and the involvement of all related interests often points this out pretty quickly.

The only absolute of computers and process control systems is that there are no absolutes. Conditions and possibilities in this industry are changing at a rate that predecessors could never have dreamed of and you can no more afford to ignore this new technology than those who came before could afford to ignore HTST pasteurization. What is cutting edge technology today will be commonplace tomorrow. If you don't utilize the advantage this offers, competitors probably will. It is worth noting that some of yesterday's cutting edge technology didn't last, either because it was so rapidly eclipsed or because it didn't prove to be the advantage that it was hoped to be. The technological improvements that are upon you are an asset to the industry. They will help those who utilize them wisely to achieve new levels of efficiency and product quality, which must certainly be our highest individual and collective goal. Wise people have observed that the only constant in life is change, and that certainly seems relevant to the revolution in computerized process control systems today. Managers and companies who are challenged by change will excel, those who accept change will survive, and those who reject change are likely to fail. Be open to new ideas but trust your experience and your common sense. Be sure that proposed new technology is appropriate

to the process which it is to control and make sure that you understand it well enough to define realistic expectations. Freely question the concepts that you don't understand and steadfastly refuse to let anyone delude you into the notion that computerized process control systems are too complicated for you to grasp. Integrate your new understanding with your past experience as you consider new process control strategies for your operation and you will soon find that computer technology is but one more tool to be used in the quest for excellence.

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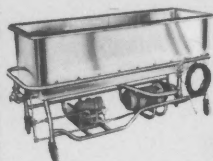
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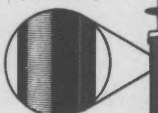


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# Insects Found During Sanitary Inspections

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## Abstract

The identification of insects found during inspections of bakeries, food stores, warehouses, and restaurants in Connecticut is reported. Beetles comprised 47% of the 290 insect infested samples, moths 22%, and roaches 15%. Sixteen different species of beetles were identified, of which about half were the confused flour beetle, found mainly in bakeries. About 77% of the moths identified were the Indian meal moth, found mainly in food stores. German cockroaches accounted for 86% of all roach types identified.

## Introduction

One of the duties of inspectors in the Food Division of the Connecticut Department of Consumer Protection is to make sanitary inspections, e.g. at bakeries, stores, warehouses, restaurants, for compliance with sanitary regulations. Included among the samples collected were those containing insects, or evidence of insect infestation, e.g. frass, webbing, larvae. We report here on insects found during inspections at different commercial sources. Additionally, we report cases where homeowners alleged insect infestation in purchased foods.

## Methods

Samples were collected by inspectors of the Connecticut Department of Consumer Protection from January 1, 1990 through December 31, 1990. Inspections were made at bakeries, food and convenience stores, restaurants, and food warehouses in Connecticut. Insects in homes were usually noted by the homeowner and reported to the inspector. Samples were delivered to this laboratory, and insects, or evidence of insect infestation, were identified using reference books (1,2), comparison with the aid of reference specimens, and use of a microscope. Identifications were made of live and dead adults, larvae, frass, webbing, or other evidence of infestation.

## Results and Discussion

In all, 290 samples were analyzed during the two year period. These included 45.5% of the samples collected at bakeries, 26.2% at food or convenience stores, 7.6% at restaurants, and 6.9% at warehouses. Allegations by con-

sumers of infestations comprised 13.4% of the samples. The remaining samples, 1.4%, were from processing plants, a school, and a vending operation.

Of the 290 samples taken, beetles comprised 46.9% of the identifications. These were found mostly at bakeries. Moths accounted for 22.4% of the identifications and were found at stores, bakeries, and restaurants and roaches, 14.5%, were also found, mostly at stores, bakeries, and restaurants. Mites accounted for 2.4% of the total, flies 2.4%, and silverfish 1.0%.

At least 16 different species of beetles were identified and are listed in Table 1. The confused flour beetle, *Tribolium confusum* Jacquelin du Val, accounted for about half of all the beetles identified and 90% of these were from bakeries. Carpet beetles accounted for 16.2% of all beetles, and 73% of these were from bakeries and stores.

Table 1. Types and source of beetles found during inspections

Type	No. found	% of total <sup>b</sup>	Number found at each source <sup>a</sup>				
			Bak	Str	Home	Rest	Ware
Asiatic Garden Beetle (U) <sup>c</sup>	1	0.7	1				
Black Carpet	2	1.5	1			1	
Carpet (Trogoderma)	22	16.2	9	7	4	2	
Cigarette	1	0.7	1				
Click	1	0.7	1				
Drug Store	1	0.7	1				
Flour							
Flour (U)	12	8.8	12				
Confused flour	69	50.7	62	4		2	1
Red flour	4	2.9	3	1			
Broadhorned	1	0.7	1				
Grain							
Grain (U)	1	0.7		1			
Sawtoothed grain	9	6.6		3	4	2	
Merchant grain	8	5.9	5	1	1	1	
Ground (Carabidae)	1	0.7			1		
Larder	2	1.5	2				
Totals (% from each source)			72.8	12.5	8.1	5.9	0.7

<sup>a</sup> Bak = bakery, Str = store, Rest = restaurant, Ware = warehouse

<sup>b</sup> % indicates percent of beetles identified

<sup>c</sup> (U) indicates unidentified as to species

Flour beetles are generally cosmopolitan. In large numbers they may cause flour to turn greyish and to mold more quickly. Sometimes they impart a disagreeable odor to flour from scent gland secretions. Beetles in the genus *Tribolium* may constitute 80% or more of flour mill insects. They attack cracked grain but not whole grains. The confused flour beetle is attracted to flour of high moisture content. The

sawtoothed grain beetle cannot attack sound grain kernels but will attack such products as cereals, dried fruit, macaroni, dried meats, chocolate, and even tobacco and snuff (1).

Five different types of moths were identified, of which 77% of these were Indian meal moths, *Plodia interpunctella* (Hubner), and most (86%) were found in food stores (Table 2). Indian meal moths are general feeders and will attack a variety of products such as grains, dried fruits, crackers, birdseed, and dog food containing meat and cereal. They can be very destructive where dried fruits are stored. More food items are spoiled by webbing than is consumed by the insect (1,2).

**Table 2. Types and source of moths found during inspections**

Type	No. found	% of total	Number from each source <sup>a</sup>				
			Bak	Str	Home	Rest	Ware
Geometridae	1	1.5				1	
Indian meal	50	76.9		32	14		4
Lepidoptera	2	3.1			1	1	
Meal <sup>b</sup>	9	13.8	1	4	2		2
Moth (U) <sup>c</sup>	3	4.6	1		1		1
Totals (% from each source)			3.1	55.4	27.7	3.1	10.8

<sup>a</sup> Bak = bakery, Str = store, Rest = restaurant, Ware = warehouse

<sup>b</sup> Insufficient evidence to classify as Indian Meal Moth

<sup>c</sup> unidentified

German cockroaches, *Blattella germanica* (Linnaeus), accounted for 86% of all roach species which could be identified and were found about equally among bakeries, stores, and restaurants (Table 3).

**Table 3. Types and source of roaches found during inspections**

Type	No. found	% of total	Number from each source <sup>a</sup>					
			Bak	Str	Home	Proc	Rest	Ware
Cockroach <sup>b</sup>	5	11.9	4			1		
German	36	85.7	12	11	1	1	10	
Oriental	1	2.4		1				
Totals (% from each source)			38.0	28.6	2.4	2.4	26.2	2.4

<sup>a</sup> Bak = bakery, Str = store, Proc = processing plant, Rest = restaurant, Ware = warehouse

<sup>b</sup> Species unidentified

Only 39 of the 290 samples taken were from homes. Most of the insects identified in these 39 samples were from commercial food products. Baked goods comprised 10.3% of samples obtained from homes, cereal foods 28.2%, soup mixes 12.8%, canned foods 25.6%, candy 7.7%, and 2.6% each for raisins, rice, and bakery mixes. The most common insects found in stored foods in stores and homes were the confused flour beetle, Indian meal moth, roaches, and red flour beetle, *Tribolium castaneum* (Herbst).

In all cases inspectors should attempt to ascertain the source of the insect infestation. For example, they should note that the infestation may be from grain on floor and under pallets, or in stored products rather than just reporting a general infestation. In this way the source of the infestation can be removed before an infestation of other products occur.

In this report we have shown the types of insects found during sanitary inspections in Connecticut. Such information

may indicate to other inspectors what areas to examine during their inspections.

#### Acknowledgments

The excellent inspections by personnel of the Food Division of the Connecticut Department of Consumer Protection is acknowledged.

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# Interrelationships Between Select Quality Tests and Levels of Milk Components

Vernal S. Packard<sup>1</sup> and Roy E. Ginn<sup>2</sup>

## Abstract

Select quality and component test results of a cross-section of milk supplies analyzed by Dairy Quality Control Institute, Inc. were evaluated to determine the interrelationships between the quality tests as such and levels of various milk components. In particular, the study focused on milk supplies found to be of high quality, i.e., bulk milk of low somatic cell count, low bacteria count and low freezing point. A generally good relationship was observed between somatic cell counts under 500,000/ml and total bacteria numbers. This finding confirms the general observation that dairy farmers capable of maintaining low somatic cell counts do so at least in part by good cleaning and sanitizing practices. As for relationship to level of milk components, somatic cell counts correlated best to percentage of lactose ( $r = -.398$ ) and showed only a slight positive correlation to protein content ( $r = .101$ ). Freezing point, on the other hand, showed relatively good negative correlation to all milk components. Implications of these and other related scientific findings are discussed.

## Introduction

The dairy industry is swiftly moving to premium pay programs in which price of milk to dairy farmers is based both on composition and quality. In the Upper Midwest, the pay price for milk is often increased incrementally with graded improvement in bacteria count and somatic cell count. Additionally, a freezing point base is applied. Often, the assumption is made that these parameters of quality are also positively linked to composition, either in terms of level of components essential for enhancing efficiency of processing of given dairy products or specific factors other than component level that in some way indirectly enhance processing efficiency. In particular, cheese processors are looking for both high levels of protein—casein, specifically—as well as milk supplies that minimize losses of casein during manufacture of cheese.

Payment of premiums on the basis of milk quality places more significance on the variability and implications of quality test results in milk supplies of highest quality—where the greatest amount of money is involved and where test methods are expected to produce precise results, though often at the limits of their potential to do so. Some of the questions posed are as follows: What more value can be

derived of a milk supply of 100,000 vs 200,000 somatic cell count per ml? What is the relationship between somatic cell count and bacteria count at levels of somatic cell count under 500,000/ml? To what extent is freezing point of milk as much a predictor of level of various milk components as of water addition, and especially in current milk supplies in which the standard freezing point base no longer accurately reflects the composition of the milk? These were some of the questions/issues this research sought to explore.

Considerable research has been devoted recently to the relationship between various quality test results and sanitary conditions on the farm, sources of contaminating organisms and finished product quality. McKinnon and Pettipher (9) found that 90% of thermophilic and psychrotrophic bacteria in raw milk originated from teat surfaces. Tests for psychrotrophic bacteria have been shown to be more useful than the standard plate count, coliform or preliminary incubation methods in assessing cleanliness of teats and udders (17). Janzen (7) found a good relationship between somatic cell count of bulk milk and shelf-life of processed fluid milk products. In a similar vein, Senyk *et al.* (16) were able to link bulk milk somatic cell count to off flavors and proteolysis in pasteurized milk. Others (2,5,15) have noted a relationship between somatic cell count and loss of casein during cheese manufacture. Bennet (4) has suggested that the bulk milk somatic cell count is the most universally useful measure of both milk quality and status of mastitis in dairy herds.

On milk samples taken from opposite quarters, Ashworth *et al.* (1) found milk of high SCC to show a slight decrease in total solids and solids-not-fat. Research comparing total protein content of milk of high vs low SCC suggests little or no change, although the ratio of casein to total protein appears to decrease as SCC increases (5,6). Content of whey proteins ranges higher in milk of high SCC (5,6). Questions yet remain regarding the impact of very low SCC counts on protein content of pooled herd milk, especially to the extent that differences might be anticipated as such counts move from 500,000/ml on down to counts of 100,000/ml or less.

Although the standard plate count (SPC) or modifications thereof has been found to be less than adequate as a measure of psychrotrophic bacteria (3,8,12,14), it nonetheless remains the method most commonly applied to raw milk. It is not generally thought to be related to milk composition. However, total bacteria count and SCC might

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well be expected to show a positive relationship, particularly at low SCC counts, and the present study explores this aspect. Freezing point of milk has been applied almost exclusively to determine presence of added water and without much thought to its general relationship to milk composition. Recent work (10,11) has shown that freezing point of milk has been gradually declining over recent years and that the freezing point base currently used in regulatory and industry programs is no longer valid, at least for a number of milk supplies. This fact has implications both in interpretation of results in questions of water adulteration of milk and in the establishment of a base(s) freezing point in premium payment milk pricing programs.

### Materials and Methods

A cross-section of grade A and manufacturing grade milk supplies from throughout Minnesota were selected for this research. These supplies were analyzed in the on-going operations of Dairy Quality Control Institute, Inc. during the month of September 1990. Bacteria numbers were enumerated by the plate loop method, somatic cell counts by the electronic somatic cell counting (fluorescent dye) procedure, freezing point by thermistor cryoscope and milk components by infra-red analysis, with all tests being conducted according to procedures outlined in Standard Methods for the Examination of Dairy Products (13). In total, 651 milk supplies were tested for bacterial numbers, 652 for somatic cell count and freezing point in addition to analyses for fat, protein, lactose, solids-not-fat and total solids from those same milk supplies. The data were then subjected to computer analysis.

### Results and Discussion

Table 1 provides the means (averages) and standard deviations for all of the analyses made on the milk supplies evaluated in this study. The data reflect a broad range in both composition and quality. Standard deviation values may be interpreted as indicative of the variability among these farm milk supplies in the specific methods and components cited.

**Table 1. Overall means and standard deviations of various quality and component analyses evaluated in this survey<sup>1</sup>**

Quality/component variable	Mean	Standard Deviation
Plate Loop Count (cfu/ml)	41,000	89,000
Bulk milk somatic cell count (per ml)	402,000	270,000
Freezing Point (°H)	-0.5454	0.0072
Fat (%)	3.59	0.278
Protein (%)	3.18	0.161
Lactose (%)	4.59	0.157
Solids-not-fat (%)	8.55	0.238
Total solids (%)	12.14	0.434

<sup>1</sup>N = 651 for the Plate Loop Count and 652 for all other variables.

Plate loop counts (PLC) showed considerable variability, as did somatic cell counts, with standard deviations of 89,000 and 270,000, respectively. Variability in freezing point falls within normal levels (11,12). Protein and lactose show typically low variability and fat, solids-not-fat (SNF) and total solids (TS) comparatively high variability.

Data in Table 2 show the correlation (r) between the three quality tests used in this study, both as such and as they apply to levels of various components of milk.

**Table 2. Correlation (r) between certain quality tests and level of various milk components**

Component	Correlation (r)		
	Freezing Point	Bulk Milk Somatic Cell Count	Plate Loop Count
Fat	-0.199	0.022	-0.004
Protein	-0.311	0.101	0.045
Lactose	-0.394	-0.398	-0.115
Solids-not-fat	-0.477	-0.186	-0.053
Total Solids	-0.389	-0.088	-0.088
Bulk milk SCC <sup>1</sup>	0.120	-----	0.283

<sup>1</sup>Somatic cell count

As might be expected, bulk milk somatic cell count (SCC) correlates somewhat better to PLC than to freezing point. Data in Tables 3, 4 and 5 give evidence of these relationships at various levels of SCC and PLC counts.

Both the average PLC and average freezing point of milk supplies may be seen to decrease at incremental decreases in SCC under 500,000/ml (Table 3). In milk supplies of over 500,000 SCC per ml, the average PLC was 76,000 cfu/ml and in milk supplies of less than 500,000 SCC, the average PLC was 30,000 (see Table 4). When PLC is broken down into incremental ranges of counts less than 50,000/ml, average somatic cell counts show a distinct trend in the same direction (see Table 5). In other words, it appears as though those practices that result in a lowering of PLC counts likewise result in lowering of SCC or vice versa. This relationship does not necessarily hold for milk supplies of relatively high PLC and SCC counts. In this latter instance, high PLC counts will be found associated with high SCC counts, at least during the active stage of mastitis infection.

**Table 3. Mean values for Plate Loop Count, freezing point, and various milk components at several different ranges of bulk milk somatic cell counts**

Bulk milk SCC <sup>1</sup> (X 1,000)	PLC <sup>2</sup> (N)	PLC <sup>2</sup> (cfu/ml)	FP <sup>4</sup>	Fat (%)	Prot. (%)	Lact. (%)	SNF (%)	TS <sup>3</sup> (%)
401-500	84	49,000	-.5443	3.60	3.19	4.54	8.52	12.12
301-400	143	29,000	-.5454	3.62	3.21	4.61	8.60	12.22
201-300	137	32,000	-.5462	3.57	3.16	4.65	8.58	12.16
101-200	102	15,000	-.5464	3.59	3.14	4.66	8.57	12.16
<= 100	24	12,000	-.5471	3.62	3.16	4.67	8.61	12.23

<sup>1</sup>Somatic cell count per ml

<sup>2</sup>Plate Loop Count (total bacteria)

<sup>3</sup>Total solids

<sup>4</sup>Freezing point (°H)

**Table 4. Average values of various milk quality and component test results at two ranges of bulk milk somatic cell counts**

Bulk Milk SCC <sup>1</sup> Range	Milk Quality Tests			Milk Components				
	SCC <sup>1</sup> (per ml)	PLC <sup>2</sup> (cfu/ml)	FP <sup>3</sup> (°H)	Fat	Prot	Lact	SNF <sup>4</sup> (Percent)	TS <sup>5</sup>
500,000 or less/ml <sup>6</sup>	290,000	30,000	-0.5457	3.60	3.18	4.62	8.58	12.17
Over 500,000/ml <sup>7</sup>	750,000	76,000	-0.5443	3.57	3.20	4.50	8.47	12.05

<sup>1</sup>Somatic cell count

<sup>2</sup>Plate loop count

<sup>3</sup>Freezing point

<sup>4</sup>Solids-not-fat

<sup>5</sup>Total solids

<sup>6</sup>N=591

<sup>7</sup>N=60

**Table 5. Mean somatic cell counts at various ranges of plate loop counts of total bacteria numbers**

Plate Loop Count (cfu/ml) (X 1,000)	(N)	Mean Somatic Cell Count (per ml)
51-100	48	507,000
31-50	57	493,000
21-30	62	483,000
11-20	118	429,000
1-10	307	308,000

However, low PLC to SCC ratios tend to occur as the infectious agents die off and somatic cell counts yet persist in the milk at relatively high numbers.

It is of practical value to know that a good relationship between PLC and SCC appears to occur at low counts, if only to emphasize that good herd health and low bacteria numbers go hand in hand. There is the suggestion, as well, that infectious conditions existent around the teats and udders, which can indeed be reduced by washing/sanitizing and teat dipping, appear to be major contributors to high bacteria counts. One is further led to suspect that, as such conditions are effectively managed, bacteria found in the milk supply originate more and more frequently and in larger and larger proportion from milking equipment surfaces.

The correlation between SCC and freezing point of milk is not as good as that between SCC and PLC, though neither shows a very high *r* value (see Table 2). The best correlations, negative in this case, occur between freezing point of milk and level of various components. These relationships are particularly good between freezing point and level of protein, lactose, SNF and TS. That the best relationship occurs between freezing point and lactose is not surprising. However, it is enlightening to see how much better a freezing point analysis speaks to protein level than does SCC. In fact, SCC shows a very slightly positive *r* value, which says, in effect, that protein content tends to be slightly higher the higher the somatic cell count. Such indications appear to be evidenced in the data of Table 4, where protein content averages 3.18% at SCC levels below 500,000/ml and 3.20% at SCC counts above 500,000. Incremental decreases in SCC as shown in Table 3, show no clear-cut relationship to protein content of the milk supply. If anything, lower SCC ranges are associated with lower protein levels. Other

researchers (6) have found little or no change in total protein content as SCC increases to counts above one million per ml. Data of Haenlein *et al.* (6) and Grappin *et al.* (5), however, suggest a likely increase in ratio of casein to total protein content as SCC goes down. Conversely, the ratio of whey protein to total protein level increases under the same conditions (5,6). The net implication, of course, is that SCC should not be looked upon as providing good information about the total protein content of milk, but rather the level of casein in proportion to whey proteins and particularly as that consideration may be found to enhance cheese yield.

Data in Tables 3 and 4 show the expected good relationship between level of SCC and lactose content. Percentage lactose may be seen to increase inversely to SCC. The implication, not new in this respect, is that lactose content, like level of SCC, has potential application/meaning as a measure of status of mastitis in a herd. As severity of an infection goes up, lactose content goes down, and in nice orderly fashion.

Please note from Table 4 that, comparing the composition of milk to SCC counts at less than and higher than 500,000/ml, average total protein differs by only 0.02% while lactose differs by 0.12%. Without doubt, the ratio of casein to total protein content might well show better general relationship to SCC, but milk is not presently purchased on the basis of casein content. Hence, any increase in total protein content in milk supplies of high SCC should be taken to imply only that whey protein level has risen in relation to casein content, not that the milk has greater value for cheesemaking because it in fact shows a high or higher-than-normal level of protein. Although similar results have been observed for samples of milk taken from individual quarters of the udder (6), this issue has not been entirely clear for samples of bulk, pooled milk. The findings of this study seem to verify what might have been anticipated and suggest a need to re-emphasize such facts in an era where significant dollar value is placed on content of particular milk components and on specific quality measurements.

Overall, this information seems to indicate that premium payments based on SCC counts of less than 500,000/ml serve their most useful function mainly as a gauge of *quality* of milk as quality relates to efficiency of processing and yield of cheese as well as to potential keeping quality of finished dairy products.

Data in Tables 6 and 7 provide more detail regarding milk composition as related to changes in PLC, SCC and freezing point of milk. Data in Table 6, specifically, indicate the rather good relationship between freezing point and milk composition generally, and for all major components. Average levels of these components may be seen to rise in direct inverse relationship to freezing point.

Because freezing point of milk is influenced mainly by levels of minerals and lactose, the finding that fat, protein, SNF and TS show a relationship similar to lactose possibly carries somewhat subtle implications. This is not that water adulteration causes an equivalent lowering of percentage of all milk components, but that breeding practices that have resulted in increases in fat/protein content of milk have likewise resulted in increase in lactose content. Furthermore, freezing point would seem to be perhaps a more significant

gauge of normality of component interrelationships and levels than it has been given credit for in the past.

In fact, as data in Table 2 indicate, SCC and freezing point show essentially the same correlation to lactose content ( $r = -.398$  and  $-.394$ , respectively). Data taken from Tables 3 and 6 suggest that lactose level averages about 4.60 at a SCC range of 300,000 - 400,000/ml and at a freezing point of between  $-0.541$  and  $-0.550^{\circ}\text{H}$ . Equivalent values for a lactose content of about 4.64 are, for SCC, 200,000 to 300,000/ml and, for freezing point,  $-0.551$  to  $-0.560^{\circ}\text{H}$ . A combination of SCC and freezing point test results, therefore, appears to be an especially good way of assessing normality of bulk milk, both in terms of status of mastitis and composition of the milk.

**Table 6. Average percentages of major milk components at various freezing point ranges**

Freezing Point Range ( $^{\circ}\text{H}$ )	Milk Components (% w/w)					
	(N)	Fat	Protein	Lactose	SNF	TS <sup>1</sup>
$\geq -0.520$	5	3.37	2.98	4.27	8.04	11.42
-0.521 to -0.530	14	3.47	3.08	4.37	8.25	11.72
-0.531 to -0.540	108	3.53	3.12	4.51	8.41	11.94
-0.541 to -0.550	375	3.59	3.17	4.60	8.55	12.14
-0.551 to -0.560	149	3.67	3.25	4.64	8.69	12.36

<sup>1</sup>Total solids

**Table 7. Average values of three milk quality test results at various ranges of protein and solids-not-fat**

Range in protein (%)	Plate Loop Count		Bulk Milk SCC <sup>1</sup> (per ml)	Freezing Point ( $^{\circ}\text{H}$ )
	N	(cfu/ml)		
< 3.20	365	37,000	379,000	-0.5439
3.20-3.25	85	34,000	389,000	-0.5463
3.26-3.30	66	54,000	405,000	-0.5467
3.31-3.40	78	46,000	498,000	-0.5476
over 3.40	57	51,000	435,000	-0.5488
Range in SNF <sup>2</sup> (%):				
<8.75	521	42,000	412,000	-0.5444
8.76-8.80	49	55,000	363,000	-0.5482
8.81-8.85	29	24,000	403,000	-0.5494
8.86-8.90	21	21,000	339,000	-0.5491
over 8.90	31	29,000	335,000	-0.5517

<sup>1</sup>Somatic cell count

<sup>2</sup>Solids-not-fat

In Table 7 are shown data comparing the average PLC, SCC and freezing point of milk at various ranges of protein and SNF, the two components of milk other than fat most frequently used in premium payment programs. Of the three quality measures, only freezing point values show good consistency in their relationship to percentage protein and SNF. This fact is mentioned only because SCC has taken on considerable importance of late as an indicator of milk quality, and with implications, at least, of compositional

considerations. As a result, the significance of freezing point of milk may well have been overlooked or perhaps given less emphasis than it deserves, particularly in premium payment programs. Furthermore, the need for dairy plants to establish individual plant freezing point bases and to consider such factors as seasonal variations in freezing point takes on greater meaning. If in the past dairy organizations have looked upon freezing point analyses as simply a gauge of water adulteration, it is perhaps important now to see in such analytical data their clear relationship to milk composition generally. Data in Tables 6 and 7 provide a basis for somewhat more precise interpretation of freezing point values as applied to current milk supplies.

## Summary

A few summary statements would appear to be in order as a way of review and of updating the relationship between quality tests and their implications. In general, then, the following facts seem worthy of note:

1. Total bacteria count and SCC show a reasonably good relationship at SCC counts below 500,000/ml. Reductions in SCC counts below 500,000 go hand in hand with good cleaning and sanitizing practices.
2. SCC counts below 500,000/ml suggest little about total protein content of the milk. Rather, such counts are indicative of higher casein to total protein ratios. Comparatively, you get more cheese and less whey proteins as SCC drops below 500,000/ml.
3. Milk with high SCC counts (above 500,000/ml) may average somewhat higher total protein content than milk of lower counts. The increase implies a greater level of whey protein in proportion to casein.
4. A good inverse relationship exists between SCC and lactose content, and, indeed, level of lactose can serve well as a gauge of the presence and severity of mastitis infections.
5. SCC counts below 500,000/ml perhaps serve their most useful function as an indicator of milk quality as quality relates to improvement in cheese yield, processing efficiency in cheese manufacture and keeping quality of fluid and other dairy products.
6. Freezing point of milk shows a good negative correlation to all major components, including fat, protein, SNF and TS, a fact which suggests that breeding practices of recent years, focused as they were mainly on enhancing level of fat, have likewise enhanced protein and lactose content. Dairy plants paying premiums for milk based in part on some base level(s) of freezing point as a requisite would do well to establish such level(s) not on the present standard for water adulteration, but on freezing point data derived by the plant in on-going operations.
7. Freezing point of milk is perhaps the best single measure currently in use of the appropriateness of component interrelationships and levels. A combination of freezing point and somatic cell count data can provide even better verification of the status of mastitis in a herd and the relative normality/abnormality of component relationships and levels.



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# The Yogurt Story - Past, Present and Future Part VII

Ebenezer R. Vedamuthu, Ph.D.  
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## Varieties of Yogurt

Several years back when my interest was directed towards yogurt as an upcoming cultured dairy product, I wrote the following on the varieties of yogurt on the market and mused on future developments that could come about: In the U.S. itself, we have so many different "kinds" and "types" of yogurt offered for sale. We have plain yogurt, flavored yogurt without fruit (e.g. vanilla), fruit flavored yogurt, sundae-style yogurt, Swiss-style yogurt, and nebulous, so-called "natural" yogurt. Further, there are frozen yogurts, long shelf-life pasteurized/sterilized yogurts, and lyophilized instant yogurt powders. Additionally, the ingredient mixtures and their proportions used in yogurt vary a great deal. It is conceivable that very soon, a nonfermented, direct acid-set, chemically flavored, acceptable product made with dairy and/or nondairy basic ingredients may be developed and sold as yogurt with only a slight hint that it is a noncultured (nonfermented), nondairy/filled product(8)! Looking back on what I wrote before even the standards for yogurt were existent, and the spurt of new "yogurt desserts" that have come on the market recently, I was not too far out in projecting into the future(7).

Two yogurt products stand out in going over the list of products that found their way to the marketplace. One of these, namely frozen yogurt, made a short appearance several years back and was soon off the market. The time had not come for frozen yogurt to capture the attention of the consumer at that time. With the shift in dietary preferences of the consumer, frozen yogurt rose from the ashes like the Phoenix to occupy prominent shelf space in the grocery stores. The second product that was a flash in the pan, for which time is ripe for a more promising resurrection, is *yogurt drink*. In this paper, we shall discuss some aspects of the technology and positive attributes of yogurt drink as a high impact dairy product of the 90's.

Yogurt drink could be conceived as a fluid, pourable, milk that has been fermented with yogurt starter bacteria and processed such that it has a milk shake-like consistency and texture. With imaginative and compatible flavoring using fruit juices or essences/extracts, yogurt drink could be offered as a refreshing, nutritious and healthful alternative to carbonated soft drinks or milk shake. With the introduction of soft frozen yogurt as a regular item of fare in ice

cream parlors and fast-food establishments, yogurt drink could be included in the fare as a healthful companion product. Very few published papers on the technology of yogurt drink are available. An attempt will be made here to briefly bring together some of the ideas I have been able to gather on this product from various sources.

The main attribute of yogurt drink that is different from that of conventional yogurt is its pourability. So, yogurt drink could be made from whole milk, lowfat, or skim milk without any fortification with nonfat milk solids or any other processes previously discussed for increasing solids content of the basic mix. The basic mix for yogurt drink could be made to meet Federal Standards for regular, lowfat and nonfat yogurts. The other important characteristic sought after in yogurt drink is the thick, smooth, silky body and texture, which resembles that of a milk shake. Such a body and texture imparts the "rich" mouth-feel consumers look for in a milk-based drink. To attain such a body and texture, a combination of special starter culture and stabilizer systems is necessary. This would insure retention of the desirable body and textural properties through large scale commercial handling and filling operations. Yogurt starters containing exopolysaccharide-producing rod or coccus components yield a product with a thick, heavy, viscous body which, when stirred gently through the use of slow speed agitators, imparts a milk shake-like consistency (9). In large plants, gentle handling and stirring is difficult to achieve. Under such conditions, the thick, silky, pourable quality and mouth-feel is destroyed. In extreme cases, because of the snapping of the fine strands of casein mesh, wheying off will be noticed on refrigerated holding. To avoid such problems a suitable combination of culture and stabilizer system should be worked out.

Special starter cultures, usually termed as "heavy body yogurt cultures," are marketed by most culture houses. In such culture combinations, either the coccus or the rod components are capsule-producing types. In certain pairings, both components may be capsule producers. The choice of the culture will depend upon the heaviness of the body desired, the type of equipment available for breaking the coagulum, pumping and moving the product, the stabilizer used, the composition and proportion of flavoring used, and finally, the consumer preference.

## Manufacture of Yogurt Drinks

Alternate terminology used for yogurt drinks include "Fluid yogurt", "Liquid yogurt" and "Pourable yogurt." These names describe the body and consistency desired in the final product. In published articles, these names are interchangeably used. One of the primary sources for basic information on cultured dairy products is Dr. Frank Kosikowski's classic book *Cheese and Fermented Milk Foods*(4). Kosikowski has included make-procedures for two types of liquid yogurts. The procedure given for basic liquid yogurt will be discussed here. According to Kosikowski (4), the first step is the standardization of fluid milk to 2% milkfat. To the standardized milk, enough high-grade nonfat milk powder is added to give a total milk solids content of 12-15%. After good mixing, the milk is heat-treated at 195°F for 40 to 60 sec. or at 302°F for 2.5 sec. After cooling the milk to 185°F, the milk is homogenized at 500 psi., single-stage and further cooled to 100°F and inoculated with 1.25% each of rod and coccus cultures. Incubation at 100°F is continued until a soft curd is formed. The curd is gently stirred and pumped through a homogenizer without any pressure to smooth out the curd into a free-flowing thick fluid. At this stage, a suitable fruit slurry, at a level 10% above the normal proportion used for regular yogurt, is added through a fruit-feeder, cooled and handled the same way as regular yogurt. The important points are gentle handling of the soft curd during breaking, smoothening into a thick liquid, and line-feeding of the fruit puree.

Morley (6) described a process for making yogurt drink using a commercial stabilizer. The mix was made up of milk standardized to 1.0% milkfat and 9.25% nonfat milk solids (may require the addition of skim milk powder), 5.5% sugar and 0.25% Yogurt stabilizer. The commercial stabilizer used contained agar standardized with dextrose and lactose. The current supplier of the stabilizer, Dairy-Tech industries (Atlanta, GA), recommends using 2.0% milkfat in the mix. After uniformly blending the ingredients, the mix is pasteurized either by HTST at 185°F for 30 sec. or by batch process at 180°F for 30 min. The pasteurized mix while hot is homogenized either at 1300 psi., single-stage or at 1200 psi. at the first stage and 800 psi. in the second stage. The mix is then cooled to 108°-112°F and inoculated with a yogurt culture. After mixing to get the culture uniformly distributed, the seeded mix is incubated undisturbed until a titratable acidity of 0.85-0.9% is reached or a pH of 4.3 is attained. The coagulum is broken gently with chill water on in the jacket to cool down to 45°-50°F. A plate cooler could also be used. The author recommended using a specially-made yogurt flavoring at 10% (V/V) in the cooled yogurt which, when mixed in, gave a fluid consistency. Morley (6) emphasized that agar was the stabilizer of choice because it is a naturally occurring thickener, is compatible for kosher status, and does not mask the delicate flavors of yogurt drinks.

The process for a drinkable yogurt manufactured by Dan-Maelk dairy plant in Denmark was described in a dairy trade magazine in the U.S.(2). The stirred yogurt drink was made from milk standardized to 3.5% fat and 3.8% protein which is subjected to deaeration, homogenization and pas-

teurization at 203°F for 5 min. Culture is added at 109°F and incubation continues until a typical yogurt curd is formed. To the yogurt curd, a 15% jam is added resulting in a finished sugar content of 8%. The dairy uses aseptic fruit preserve without any stabilizers or preservatives. The fruit preparations also have strict specifications with regard to color, aroma and particulate identity and should be shelf-stable at room temperature. Another unique feature in the production of this yogurt drink is the special packaging machine used in the line. The machine had two lines each capable of filling different sized cartons at 3000 containers per hour from the bottom up to eliminate foaming. Another unique feature was the specially designed valve to handle fluids containing particulates without jamming. During filling the stirred yogurt base is pumped at 74°F, and the fruit preserve is line-fed and mixed before entering the filler bowl.

A formula for a yogurt drink provided by a commercial stabilizer supplier consists of 44.49 parts by weight of 1.5% pasteurized fluid milk; 44.49 parts by weight of 1.5% fat yogurt; 10 parts of granulated sugar; and 1.02 parts of a stabilizer combination. The stabilizer combination consisted of 1.0 part of a proprietary preparation of pectin and 0.02 part of another proprietary carrageenan. For a thicker milk shake-like product, the supplier recommends the application of tapioca starch in combination with carrageenan and pectin. Hydrated and properly dissolved stabilizer mixture in warm pasteurized milk is probably added to the other ingredients in a sanitized tank, thoroughly mixed, chilled and then filled(3).

White and his associates (10) made yogurt drinks using six fruit flavors. The basic formula for the product was 86.8% low-fat milk (2% milkfat); sucrose; and 0.2% stabilizer. The mix was inoculated with an active yogurt culture, and after coagulation, 1% fruit flavoring was mixed in. A general consumer panel was used to select the top three flavors. Red raspberry and strawberry were the most preferred flavors. The authors also collected other data on consumer preferences for yogurt drinks flavored with red raspberry and strawberry from surveying 181 respondents consisting of 5 age groups, namely, 5-13 yrs., 14-18 yrs, 19-25 yrs., 26-40 yrs., and over 40 yrs. From this study they suggested that fruit-flavored yogurt drinks would be accepted by a major segment of the consumer market.

News of successful marketing of yogurt drinks have appeared in trade magazines(5). Special cultures for yogurt drinks have been on the market for more than a decade(1). So efforts should be made by the industry to revive serious research and development efforts on yogurt drinks to make the same in-roads in the marketplace with these fluid yogurts as frozen yogurts of today.

## Research and Development Needs

From the foregoing discussion of yogurt drink, it is evident that the information available on the technology is sketchy. So, research is necessary. The first step is to write out a detailed definition of the product with respect to all the attributes desired in the product. From that description, suitable ingredients, cultures, stabilizers etc., could be selected. If a milk shake-like consistency is desired, it may be

advantageous to use an exopolysaccharide-producing culture. It is then useful to select stabilizer and flavoring systems to complement the desirable properties derived through the use of thick-body cultures. The stabilizer should have good water-holding capacity, should be stable to heat treatment, retain activity at low pH normally encountered in yogurt, and should yield a smooth product. The flavoring should be compatible with yogurt base. There should be uniformity in the size of fruit particles. The fruit pieces should be small enough that they do not compactly settle down at the bottom of the filled container. The flavoring preparation should not cause phase-separation (wheying off) in the fluid product. Proper post-fermentation handling procedures should be developed to retain the desirable body and texture characteristics. Attractive packages designed for easy opening, storage, etc. would help in popularizing the product.

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## "I'm Not a Sanitarian!"

*an editorial by Joe Delaney*

Often, when discussing AIMFES (Associated Illinois Milk, Food and Environmental Sanitarians) with colleagues, they say, "Well, I'm not a sanitarian. Why should I join a sanitarian's association?" I have heard this reply from Plant Managers, Quality Control supervisors, engineers, sanitation suppliers and ingredient suppliers.

Each time I hear this response it bothers me. Do these people simply not understand what a sanitarian is? Or do they really feel no responsibility for food safety and quality?

A man I greatly respected and admired, the late Fletcher A. Gourley, made statements relating to this issue. Mr. Gourley was the General Manager and CEO of my company for 50 years. His leadership took Prairie Farms Dairy from a single creamery in small Carlinville, Illinois to a Fortune 500 company with responsibility for greater than a billion dollars in sales.

Often he would be asked the reasons for this success. You would expect this man to speak of the conservative fiscal policy, economics and marketing strategies of the company. Mr. Gourley always stated the cornerstones of Prairie Farms success was simply "Quality" and "Service."

In the last speech I heard Mr. Gourley deliver, he spoke on "The Challenges In the Decade of the 90's" He again said that quality and service will be the key. He also added a third key. He said: "Food Safety will become a major concern of the consumer and will therefore be critical."

It is not merely a coincidence that the basic keys to the success of a food company parallel the objectives of this Association.

Clearly, YOU have some responsibility for Quality, Service and Food Safety if you are a plant manager, quality control supervisor, engineer or supplier to the food industry. You are a sanitarian and never knew it!

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*Reprinted from Issue #2/Fall 1991/AIMFES Newsletter*

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### CORRECTION:

The Membership Prices listed in the September *Dairy, Food and Environmental Sanitation* (p. 548) were incorrect.

#### The Correct Prices are:

Membership Plus - \$80  
Membership - \$50  
Sustaining Membership - \$450  
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Student Membership (DFES) - \$25  
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We apologize for any inconvenience this may have caused.

## ***Ecolab and Henkel Complete Formation of European Joint Venture - Ecolab Also Purchases Certain Henkel Operations in 19 Non-European Countries***

Ecolab Inc. and Henkel KGaA, Düsseldorf, Germany, announced today that they have completed the formation of Henkel-Ecolab, a joint venture of their respective European institutional cleaning and sanitizing businesses with approximately \$750 million in annual revenues. In addition, Ecolab has acquired Henkel's institutional cleaning and sanitizing businesses in 19 other countries in the Latin American and Asia Pacific regions, which will add approximately \$50 million in annual revenues to Ecolab's international operations. As a result of the transaction, Henkel now owns 24 percent of Ecolab's common shares.

### **Transaction Financial Details**

In consideration for a 50 percent economic interest in the European joint venture and the outright purchase of Henkel's non-European operations, Ecolab contributed its European institutional cleaning and sanitizing business, with 1990 revenues of \$151 million, issued to Henkel approximately 3.8 million Ecolab common shares, and paid approximately \$138 million in cash and other consideration.

In a separate transaction, Henkel converted the \$110 million of Ecolab Series A Cumulative Convertible Preferred Stock, which it purchased in December, 1989, into approximately 3.67 million shares of Ecolab common stock. As a result of these transactions, Henkel now owns approximately 7.47 million shares of Ecolab common stock, representing 24 percent of Ecolab outstanding shares.

Henkel's ownership of Ecolab stock is subject to an agreement containing restrictions pertaining to, among other things, maximum shareholdings, transfer and voting rights. Henkel's ownership position cannot exceed 26 percent of Ecolab's outstanding common shares during the first nine years of the agreement, and 30 percent thereafter, without Ecolab's approval.

Henkel is entitled to representation on Ecolab's board of directors proportionate to its Ecolab stock ownership. Albrecht Woeste, chairman of Henkel's supervisory board and shareholders' committee, and Hans-Dietrich Winkhaus, deputy president of Henkel, have been appointed to Ecolab's board. This increases Ecolab's board membership to 14.

### **European Joint Venture**

Ecolab and Henkel each have a 50 percent economic interest in the Henkel-Ecolab joint venture, which

operates throughout Europe. Henkel will serve as managing partner. The joint venture employs approximately 3,500 people and is expected to initially have about \$750 million in annual revenues. Ehrhart Shlüter, previously Henkel's corporate vice president of Institutional Hygiene/Industrial Cleaning, serves as the chief executive officer of Henkel-Ecolab. Lars Olson, previously Ecolab's corporate senior vice president, finance and controller, is chief financial officer. Other individuals from both Ecolab and Henkel comprise the rest of the joint venture's management team. The joint venture's administrative and technical headquarters are located in Düsseldorf, Germany. While the joint venture has its own manufacturing, training and R&D facilities, it also has access to the basic technology of both Ecolab and Henkel.

### **Non-European Acquisitions**

Ecolab purchased Henkel's institutional cleaning and sanitizing businesses in 19 locations outside of Europe, improving Ecolab's market position in Australia, Brazil, Hong Kong, Malaysia, Mexico, New Zealand, Singapore, Taiwan, and Thailand; and establishing a new direct presence in Argentina, Chile, Costa Rica, El Salvador, Guatemala, Honduras, Indonesia, Jamaica, the Philippines, and Venezuela. Ecolab purchased Henkel's Brazilian institutional cleaning and sanitizing business in exchange for Ecolab's Brazilian Magnus/Pulp & Paper business and a note from Ecolab.

### **Grieve, Winkhaus Comments**

Pierson M. Grieve, Ecolab chairman and chief executive officer, commented, "The transaction with Henkel creates a business organization with global service capabilities second to none in our industry. It culminates over eighteen months of extensive negotiations and planning by our two companies. More importantly, it begins what we believe will be an era of exciting opportunity for Ecolab, its customers, shareholders, employees and suppliers."

"This is the largest investment ever made by Ecolab in its international business. As a result, we will have, jointly with Henkel, a stronger position in the cleaning and sanitizing markets in Europe, Asia Pacific and Latin America, as well as North America."

Grieve continued, "The issuance of common stock to Henkel and the anticipated future cash flows from the joint venture will further strengthen Ecolab's balance sheet. We anticipate that the transaction will have a slightly dilutive impact on 1991 earnings per share while future earnings per share are expected to benefit from the transaction."

In Germany, Hans-Dietrich Winkhaus, deputy president of Henkel, said, "Now that the long and complex negotiations to develop this important partnership are finally completed, we have every confidence

that the joint venture will be very successful as it competes in the new European economic environment of 1992, with its broad economic perspectives. We are also proud of being the largest single shareholder of Ecolab Inc., a company which we respect very much. We trust that our investment will be another successful element in building our international partnerships."

Ecolab is a leading worldwide developer and marketer of premium cleaning, sanitizing and maintenance services for the hospitality, institutional and residential markets. For the year ended December 31, 1990, Ecolab reported sales of \$1.390 billion and earnings of \$46.0 million, after preferred dividends, or \$1.95 per share. Ecolab's shares are traded on the New York Stock Exchange and the Pacific Stock Exchange.

Henkel is the world's largest manufacturer of oleochemicals made from natural fats and oils and is one of the leading producers of adhesives and metal treatment products worldwide. Henkel ranks among the top companies in Europe for detergents and cleaning agents, institutional hygiene and industrial cleaning, personal care and cosmetic products. For the year ended December 31, 1990, the Henkel Group reported sales of DM 12.017 billion, or \$8.044 billion, and net earnings of DM 429 million, or \$264.8 million.

## *New Dairy Policy Would Benefit Consumers, Producers*

Current federal dairy policy is in need of a major overhaul. Today, tens of thousands of Urgent lobbying/climbing prices head midyear delegate meeting farmers are not receiving enough for their milk to cover their cost of production. Claims that seasonal increases now taking place in milk prices will change this picture are wrong. Projections indicate that milk producer returns will deteriorate even further under current dairy policy during the next five years.

The long-term federal dairy policy being advocated by Milk Marketing Inc. would balance milk production and consumption each year to stabilize farm income and consumer prices without additional costs to government. Congress recently began working on just such a plan called the Milk Inventory Management Act of 1991.

This plan, a carefully crafted compromise supported by milk marketing cooperatives across the nation, puts the needs of the dairy industry and those that consume its products before the needs of any individual producer. It uses a carrot and stick approach to balance milk supply and demand that requires producers to share a substantial burden of the program's cost. The higher the surplus, the more severe the measures to curtail excess production.

Our commodity programs are designed to provide Americans with an adequate supply of wholesome affordable food, and the cost to us as tax payers is well worth the savings to us as consumers. The nation needs

a new federal dairy policy that benefits farmers as well as consumers, and doesn't cost the government any additional funds.

If the dairy legislation currently working its way through Congress fails to produce such a bill, many dairy farms will fail, and everyone in our community with ties to those farmers and their products, will lose.

For more information contact Ann Emerich, Manager of Communications, Milk Marketing Inc., P.O. Box 36050, 8257 Dow Circle, Strongsville, OH 44136-1797, (216)826-4730.

## *Paulson Appointed VP of King Company*

Bruce A. Paulson has been promoted to Vice President of King Company in Owatonna, MN. As such, he has assumed overall responsibilities for coordinating all of the firm's sales and marketing activities. Since 1972, Paulson has held engineering, sales and product group marketing positions at King.

King Company is one of the nation's leading manufacturers of specialized HVAC equipment and systems for dairy processors and others for whom temperature, humidity and sanitation are critical. The firm's other products include equipment for industrial heating, cooling and heat recovery applications.

In recent years, King Company has also developed a growing market for its heat transfer products. These includes standard and specialty coils designed to meet the unique specifications found in the pulp and paper, power generation and food processing industries.

For more information, contact: The King Company, 1001 21st Avenue, NW, Owatonna, MN 55060, FAX 507-455-7400 or call 507-451-3770.

## *Labs Face Cradle-to-Grave Liability for Hazardous Waste - AOAC Shortcourse Can Help Prevent Violations*

New OSHA-promulgated regulations regarding the generation and proper disposal of hazardous waste went into effect January 31, 1991, requiring that laboratories prepare and implement a Chemical Hygiene Plan and designate a Chemical Hygiene Officer. In response, the AOAC (Association of Official Analytical Chemists) has developed a new short course, **Laboratory Waste Disposal and Environmental Compliance**, designed to help scientists comply more easily with the new government regulations. As Carol Rouse, AOAC Meetings and Education Coordinator, explains, "Hazardous waste disposal is of more concern than ever. Laboratories face a cradle-to-grave liability for proper waste disposal and the U.S. Justice department is increasing criminal



# CALL FOR PAPERS

## IAMFES 79th Annual Meeting

July 26-29, 1992  
Toronto, Ontario

### Instructions to Prepare Abstracts

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- Use the printed Abstract form that appears on the other side of this page.
- Type in the title, Capitalize the first letter of the first word and proper nouns.
- List the names of authors and institution(s). Capitalize first letters and initials.
- Give the name, title, mailing address and the office telephone number of the author who will present the paper.
- If the paper is to be presented by a graduate student entered in The Developing Scientist Award Competition, check the box to indicate this and have the form signed by your major professor or department head.
- Check the most appropriate box to indicate the general subject area of the paper. Indicate subject if checking other.

Type the abstract *double-spaced*, in the space provided on the abstract form.

Mail *two* copies of the abstract before December 16, 1991 to:

Steven K. Halstead  
Executive Manager, IAMFES  
502 E. Lincoln Way  
Ames, IA 50010-6666

Enclose *two* stamped, self-addressed post cards. Two cards must be included with *each* abstract that is submitted. One will be returned to acknowledge receipt of the abstract and the other to notify the presenter of the time the paper is to be presented.

#### Content of the Abstract

The abstract should describe briefly: (a) the problem studied, (b) methods applied, (c) essential results, and (d) conclusions.

#### Presentations Format:

Papers may be presented orally or by poster format at the discretion of the Program Committee. Oral presentations will be scheduled so a speaker has a maximum of 15 minutes, including a 2-4 minute discussion. Carousel projectors for 35 mm slides will be available. **Overhead projectors are not to be used and none will be available.**

#### Subject Matter for Papers

Papers should report the results of applied research on: food, dairy, and environmental sanitation; foodborne pathogens; food and dairy microbiology; food and dairy engineering; food and dairy chemistry; food additives and residues; food and dairy technology; food service and food administration; quality assurance/control; mastitis; environmental health; waste management and water quality.

#### Developing Scientist Award Competition

Open to students enrolled in M.S. or Ph.D. programs at accredited universities or colleges who will present their own original research. Candidates will have graduated no more than one year prior to the deadline for submission of abstracts. The abstract form must be signed by the student's major professor or department head. Entrants are required to complete an extended abstract. Such forms are available upon request from Mr. Halstead at the above address.

Winners are presented and honored at the annual Awards Banquet. All entrants will receive complimentary tickets and are expected to be present at the Banquet.

#### Additional Abstract Forms

Extra copies of the abstract forms may be obtained from Steven K. Halstead, Executive Manager, or you may photo copy this one.

#### Membership in IAMFES

Membership in IAMFES is NOT a requirement for presenting a paper at the IAMFES Annual Meeting.

(OVER)

# IAMFES Abstract Form

## DEADLINE: DECEMBER 16, 1991

Title of Paper \_\_\_\_\_

Authors \_\_\_\_\_

Name and Title of Presenter \_\_\_\_\_

Institution and Address of Presenter \_\_\_\_\_

Office Phone Number (\_\_\_\_)\_\_\_\_-\_\_\_\_\_

General Subject Area	
<input type="checkbox"/> Quality Assurance/Control	<input type="checkbox"/> Food Service
<input type="checkbox"/> Food Microbiology	<input type="checkbox"/> Sanitation
<input type="checkbox"/> Dairy Microbiology	<input type="checkbox"/> Food Safety
<input type="checkbox"/> Waste Management	<input type="checkbox"/> Processing
<input type="checkbox"/> Lab Methods	<input type="checkbox"/> Epidemiology
<input type="checkbox"/> Foodborne Pathogens	<input type="checkbox"/> Other _____
<input type="checkbox"/> Chemical Residues	
<input type="checkbox"/> Environmental Health	

Check the presentation format you prefer.	
<input type="checkbox"/> Oral	<input type="checkbox"/> Poster
<input type="checkbox"/> Video Theater	<input type="checkbox"/> No Preference

Developing Scientist Award Competition  Yes  No An Extended Abstract Form will be sent.

Major Professor/Department Head approval (signature & date) \_\_\_\_\_

Please type abstract, double-spaced, in the space provided here.

**Selected presentations, with permission, will be recorded (audio or video).**

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Signature \_\_\_\_\_ Date: \_\_\_\_\_

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Signature \_\_\_\_\_ Date: \_\_\_\_\_

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I do not wish to be recorded.

Signature \_\_\_\_\_ Date: \_\_\_\_\_

enforcement actions against indiscriminate hazardous waste disposal practices, including indictments returned against laboratories. This course is designed to save the often overworked laboratory scientist from having to sift through and make sense of ever-changing legislation and research. The information is presented in a condensed, digestible format so that participants will be able to return to their labs and put into practice what they have learned."

The course outline includes basic toxicology, laboratory hygiene, regulatory compliance, and related topics such as hazard communication. The last is especially important as laboratories often mistakenly assume that their employees know the hazards of the chemicals they handle. At the close of the course, attendees receive a certificate of completion.

The course will be conducted at three different locations in 1991: August 10-11, 1991 in Phoenix, AZ, November 6-7, 1991 in San Diego, CA and December 2-4, 1991 in Durham, NC. In recognition of tighter budgets, AOAC has not increased its short course registration fees from 1990. Each course is \$495 for members and \$560 for non-members. New this year are discounts for those who register more than one person per office. AOAC has negotiated special hotel rates for each location and some government rates are available. Special airline fares are also available to the Phoenix location. Finally, AOAC offers a money back guarantee if participants are not completely satisfied.

For space availability or more information, please contact Carol Rouse at +1(703)522-3032, or write AOAC, 2200 Wilson Boulevard, Suite 400, Arlington, VA 22201-3301 USA. Fax +1(703)522-5468.

The AOAC is an international scientific organization whose primary objective is to ensure the development of precise and accurate chemical and microbiological/biological standardized methods for analyzing foods, feeds, agricultural and industrial chemicals, pharmaceuticals, water, soil, air, disinfectants, forensic materials, and any other products or substances affecting the public health, the economic protection of the consumer, or the quality of the environment.

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CONTENTS 4 OZ.

# Food and Environmental Hazards to Health

## Fatal Carbon Monoxide Poisoning in a Camper-Truck – Georgia

On December 27, 1990, three children, aged 6, 10, and 11 years, died as a result of carbon monoxide (CO) inhalation while riding in the back of their parents' pickup truck, which had a camper shell cover. The family was returning overnight to Georgia from Mississippi, and the children were sleeping in the back of the truck. After 50 miles of travel, they stopped at a service station; the children did not complain of headache or other problems. During a second stop 250 miles further, the children appeared to be asleep. On the arrival at their destination in Georgia, following a total drive of 550 miles, the children could not be aroused; resuscitation attempts were unsuccessful. The parents and two younger children riding in the truck cab were asymptomatic.

Autopsy examinations revealed that the three children had carboxyhemoglobin (COHb) levels of 15%-20%, 23%-28%, and 31%-36% and that cerebral edema was present in each. No evidence was found of other cause(s) of death. COHb levels were not measured in the parents and the two other children.

An inspection of the 1970 truck by the Georgia Bureau of Investigation found that the muffler had been replaced, but the original tailpipe was not securely joined to the muffler. Several holes in the wall of the truck bed behind the cab allowed fumes leaking from the muffler to enter the enclosed bed. In addition, the camper shell cover was attached to the truck without a gasket, and the rear door of the cover was loose.

**Editorial Note:** Death from CO poisoning associated with vehicles is entirely preventable. The three deaths described in this report were caused by the combination of an aging vehicle, a defective exhaust system, and passengers being transported in an inadequately ventilated space.

Any moving vehicle with a vertical rear tailgate or door (e.g., a station wagon or pickup truck with a camper shell cover) creates negative air pressure behind it. Because of this vacuum, opening the rear window of a camper or station

wagon can result in high concentrations of exhaust fumes entering the vehicle. Holes in the body of the vehicle or leaks around windows or doors may also allow fumes to enter the passenger compartment.

Of 68 deaths attributed to CO poisoning in vehicles in Maryland during 1966-1971, the implicated vehicles were considerably older (mean: 7.6 years) than the total sample of registered cars (mean: 4.4 years) ( $p < 0.01$ ). Of the 68 deaths, 51 (75%) occurred in cars that had a defective exhaust system and/or holes in the fender panels, floor, or trunk. Thirty-three (49%) deaths occurred among persons with measurable blood alcohol levels; in 18 (26%) of the 68, blood alcohol levels were  $>0.1$  mg/dL. Most deaths occurred in parked cars in which the motor was running to provide heat.

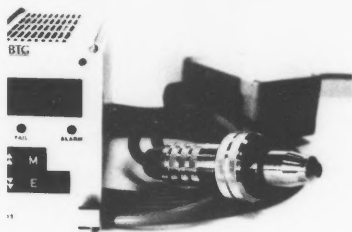
The relation between COHb levels and clinical manifestations varies. The COHb levels in the children in this report were lower than levels generally present in survivors of CO poisoning (however, resuscitation attempts may have lowered the COHb levels before samples were obtained).

Since 1968, the average quantity of CO produced by new cars has been reduced by  $>90\%$ , largely because of engineering improvements to comply with Clean Air Act regulations. Although a primary goal of the regulations is to reduce ambient CO in urban areas, a collateral benefit is increased safety for persons exposed to automobile exhaust fumes in enclosed places. The 1990 amendments to the Clean Air Act should result in further reduction of CO emissions by mandating the introduction of oxygenated fuels and more advanced pollution control systems.

CO production by vehicles can be minimized by regular preventive maintenance, inspection of exhaust systems, and emissions testing. Use of leaded gasoline in cars with catalytic converters or bypassing the pollution-control systems will result in production of higher levels of CO and nitrogen oxides. Annual inspections of vehicles should include an examination for rust holes or defects in the body or floor that could permit exhaust fumes to enter the passenger compartment.

MMWR 3/8/91

# Industry Products



## *In-line CIP (cleaning in place) Monitoring*

For CIP operations, many food processors use timers or other simple means to control a fixed cleaning sequence for caustic, water or acid. This method is not cost effective.

### **Introducing ... the MET-3011 Turbidity Transmitter!**

Equipped with a simple, user friendly menu, this compact electronic in-line transmitter monitors emulsions and suspensions at very low concentrations, as well as suspended solids like fruit pulp in juice. The PP-301 stainless steel sensor, with 25mm Ingold-style mount, operates using the 180° backscattered light measurement principle.

Monitoring turbidity saves time and cost involved in CIP operations. As soon as the sensor detects clean media, the CIP operation is stopped and product processing is immediately resumed.

The MET-3011 also offers a feature which allows user parameters such as measuring range, limit value and output range to be expressed in the user's choice of engineering unit, thus eliminating the need for time consuming conversions by the operator.

With the MET-3011, CIP chemical usage, waste volume and cycle time can all be minimized. Reduced downtime means increased production. In combination with reductions in chemical and waste disposal costs, in-line process control with the MET-3011 presents an attractive alternative to traditional CIP control techniques.

BTG Inc. - Decatur, GA

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on your Reader Service Card**

## *Filter Handles Heavy-Duty Steam Filtration*

The new MicroPure segmented filter, already in wide use in air and gas filtration applications, provides special benefits as a steam filter. Equipped with a woven stainless steel filter membrane, this unit has great structural integrity, can withstand repeated pressure and temperature recycling, and can easily be backflushed in place. Filter pore sizes are available from 3 to 300 microns.

The MicroPure filter system, awarded a U.S. patent, sandwiches self-sealing filter media between discs of stainless steel. A stainless steel connecting rod clamps the end discs to form the cartridge. The number of disc segments and the size of filter media used are determined by the application. Replacement costs are minimal as only the media are replaced on an occasional basis.

MicroPure Filtration, Inc. -  
Rockford, IL

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on your Reader Service Card**

## *Micro Motion® Releases the Net Flow Computer for Accu- rate Determination of Components Within a Flow Stream*

Micro Motion, Inc., a leader in Coriolis mass flow technology, has released their newest peripheral device, the Net Flow Computer. Using Micro Motion's mass flowmeter, the Net Flow Computer determines the net quantity of a target component in a flow stream.

The Net Flow Computer totalizes, batches, indicates flow rate and determines net quantities of a component expressed in percent mass, percent volume or net flow. Output signals include RS-232 and 4-20 mA. The RS-232 output allows the user to print data and interface with a computer. Additionally, the Net Flow Computer's relays can be activated to batch a predetermined quantity of net material, for example, net solids. Alarms may be programmed to activate when fluid density, temperature, net flow rate or percent solids deviate from preset parameters.

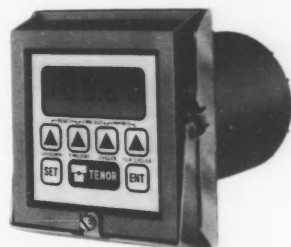
Applications for the Net Flow Computer are wide ranging. One common application in the Food Industry is direct totalization of net sucrose or fructose in sugar flow streams. The Net Flow Computer's direct measurement capabilities improve efficiency in the production of soft drinks, fruit juice, confections and other products.

Using a Micro Motion flow sensor and transmitter, the Net Flow Computer directly receives mass, density and temperature signals. The computer combines these signals with target and carrier densities to calculate net flow in real time. The computer can also compensate for temperature effects on density to determine more accurate measurements of net material.

The Net Flow Computer interfaces with Micro Motion transmitters and any Micro Motion Model D flow sensor. Standard product features include an alphanumeric LCD, which displays several variables, including net material percent and flow.

Micro Motion, Inc. - Boulder, CO

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on your Reader Service Card**



## *Microprocessor-Based Solid State Timer from Tenor Co.*

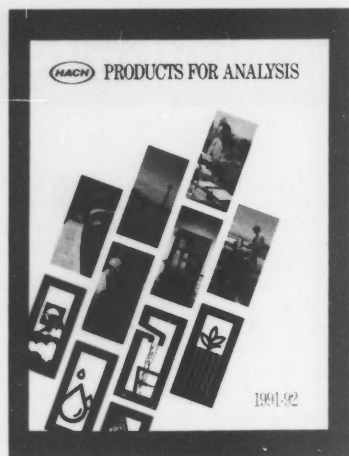
The Model 652 is a fully electronic, round-case, plug-in timer with a digital LCD readout. With its sealed faceplate and membrane keypad, it is designed to operate in harsh industrial environments. But with its extensive timing capability, it is also well suited for laboratory applications.

The 652 has five (5) timing ranges covering time values from one (1) Milli-second to 199 Hours, 59 Minutes. With an output that can be programmed for 14 different sequences, the 652 is effectively 70 timers in one housing. One of its unique features is the incorporation of an internal cycle counter. This counter not only counts the number of timing cycles run, but also allows the control of the number of cycles run for those output sequences that are repetitive.

The Model 652 operates on either 115VAC or 230VAC with a line frequency of 50/60 Hz. Programming is done using an internal 8 switch DIP assembly and the keypad on the front face. Programmed values are retained by a lithium battery and secured by a keypad lockout command. The unit is self-testing and has an internal diagnostic routine.

Tenor Company - New Berlin, WI

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on your Reader Service Card**



### New 320-Page Catalog on Water Quality Testing

A free catalog is now available to analysts who use laboratory, on-line, and process instruments for a broad variety of water quality testing applications: drinking water and wastewater, chemical manufacturing, power steam generation, foods and beverages, aquaculture, swimming pools, surface finishing, ultrapure water, ecological studies, water conditioning, petrochemicals, environmental education, and more.

Products featured inside this 320-page catalog include spectrophotometers, turbidimeters, pH/ISE systems, bacteriological testing, BOD/COD systems, laboratory chemicals, digestion apparatus, and more than 200 test kits for measuring everything from acidity to zinc. New features include an expanded labware selection, details on free training workshops, and an environmental teaching program for Grades 7-12.

To receive a free copy of *Products for Analysis 1991-92*:

Hach Co. - Loveland, CO

**Please circle No. 245  
on your Reader Service Card**

### New USDA/3A-Approved Comminuting Machine Available from the Fitzpatrick Company

A new FitzMill® comminuting machine bearing USDA/3A approval for dairy processing applications is being introduced by The Fitzpatrick Company. The new Model VFS-DAAS06-SSB comminuting machine, which performs size reduction of dairy product solids with a throughput capacity of up to 400kg (900 lbs.) per hour, features a specially designed rotor with interchangeable blades and a variable-speed feed screw (VFS).

Fitzpatrick's new USDA/3A rotor, the principal operating component of the new comminuting machine, features an assembly of 16 impact blades precisely grooved to position solid Teflon

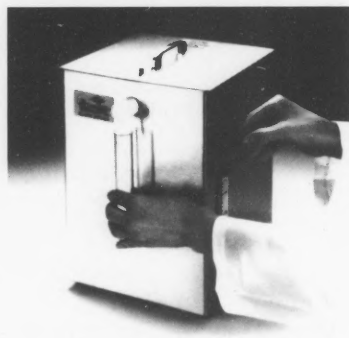
O-ring seals between blades, closing those interfaces against product accumulation. Special lock nuts, which hold the blade and rotor assembly together, are sealed in like fashion. This offers the advantage of individually replaceable blades, while eliminating the need to dismantle the rotor/blade assembly for routine cleaning and sanitizing.

The new rotor design also features solid Teflon split O-ring packing glands to seal the rotor/chamber interfaces per USDA/3A requirements. This new rotor design is retrofittable to earlier USDA FitzMill comminutors, allowing upgrade to current 3A specifications without the expense of replacing the entire mill.

All product-contact components of the machine are constructed of Stainless Steel, polished to a smoothness exceeding the USDA-required #4 finish to aid in cleaning and to eliminate any potential contamination.

The Fitzpatrick Company - Elmhurst, IL

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on your Reader Service Card**



### New, Improved Reagent Dispenser Added to Akrofil Line

An industry staple since 1968, the original Akrofil Reagent Dispenser has been upgraded with new components and ergonomic design changes to improve upon its long record for safe and efficient lab use.

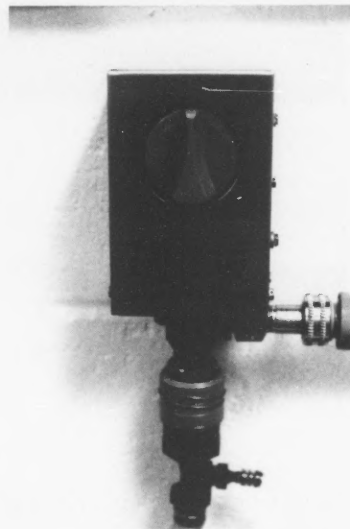
Ideal for all laboratory applications, industrial, academic, dairy, government, clinical and food processing, Akrofil II removes the danger of spilling and burns when filling test tubes and beakers with acid while protecting sinks, surfaces and plumbing components. It accurately dispenses any amount of fluid from 0 to 20cc's with a single lever stroke.

The self-contained portable unit has a stainless steel case. Interior components are crafted of stainless steel, glass and Teflon. All moving parts are impervious to sulphuric acid and a host of other industrial grade chemicals. Akrofil II measures 9"x9"x12" and weighs 12 pounds unfilled.

To obtain additional information, technical literature or to order:

Synsat Industrial Sales - Owatonna, MN

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### Timed Dispenser from Hydro Systems Saves Labor by Providing Hands-Free Filling of Sinks, Pails, etc.

By using the new Streamline Model 864, it is now possible to fill, without attendance, a wide variety of containers without the danger of overfilling. Hydro Systems Company, Cincinnati, Ohio (USA), has integrated a timer, the Streamline molded eductor and valve to dispense a predetermined volume of automatically diluted solution at four gallons per minute.

Water flow to the eductor — the only operation power required — is limited by the timer. Concentrated cleaning products are siphoned through a metering tip to regulate the water-to-product ratio. Once the timer has been set, a turn of the knob begins the dispense of the desired volume.

The Model 864 is useful in a variety of filling applications, such as pot and pan sinks, automatic scrubbers, mop buckets, etc. It comprises chemical resistant components, offers a wide range of dilutions and provides variable dispense times in order to meet a wide range of needs. As Model 866 (less the eductor), it yields "fresh water" filling without addition of a concentrate.

For more information on the timed eductor and other dispensing products:

Hydro Systems Co. - Cincinnati, OH

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### Wireless Data Corp. Telemetry Transmitters

Wireless Data Corporation (WDC) manufactures miniaturized telemetry transmitters for capturing measurement and control data from rotating machinery and equipment.



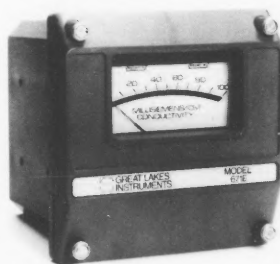
WDC telemetry products have satisfied an extensive range of customer applications over the past 20 years. The automotive industry uses our products to acquire test data from the rotating elements of engines, transmissions and brakes. We monitor torque and torsional vibrations in pumps, fans and large rotating shafts in steel mills, paper mills and ship propulsion systems. As an example of one of our very high performance applications, we measure turbo fan blade stress and temperature in jet aircraft engines. Survival in that hostile, rotating environment requires our products to withstand 175°C and 50,000 g's.

Our transmitters are designed to connect with strain gages, thermocouples and other physical sensor devices. We can enable our transmitters either by battery or induced power. WDC provides a complete line of RF receivers designed to capture the output of our miniature transmitters. Our transmitters can each sample (multiplex) data from a quantity of physical sensors on the same rotating platform. WDC products require no wires, no slip rings, no rotary transformer bearings and can operate in virtually any industrial environment.

Our customers include G.E., Ford, Caterpillar, Boeing, Alcoa, Boise Cascade and a host of other major domestic and international corporations who have solved many challenging measurement problems on rotating equipment using WDC products. To learn how we can help with your application;

Wireless Data Corporation -  
Mountain View, CA

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### ***New Conductivity Analyzer is Versatile, Economical and Compact***

The Model 671E conductivity analyzer from Great Lakes Instruments, Inc. is designed to provide accurate measurement and control versatility, while requiring minimal space. It uses GL1 wide range, small-bore electrodeless conductivity sensors for measurements from 0-200 up to 0-1,000 microSiemens/cm.

The 671E is ideal for custom system designs. It's housed in a compact NEMA 4X enclosure, conforms to 1/2 DIN size standards and may be panel, surface or pipe mounted. A range expand feature allows the 4-20 mA instrument output to represent a display scale segment as small as 10% of the measuring scale span. This reverse/direct output may be used as a proportional controller for simple control applications. With the small-bore electrodeless sensor, the process sample is electrically isolated from the analyzer. This eliminates the expense of output isolation because the analog output is effectively isolated.

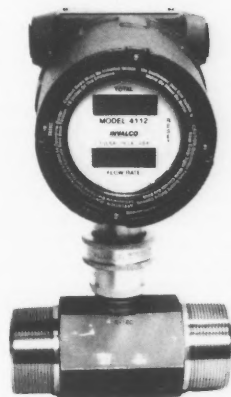
The 671E has two fully configurable relays with independent setpoint and deadband controls and selectable low or high operating modes. An AUTO/OFF/MANUAL mode switch provides added control flexibility for one of the relays.

For applications where a permanent record must be kept, the Model 674E monitor is offered. This packaged system includes the Model 671E analyzer and a strip chart recorder in a NEMA 4X styrene enclosure.

Great Lakes Instruments, Inc., is a leading instrumentation specialist in the measurement and control of pH/ORP, conductivity, flow, level, dissolved oxygen and turbidity to the process, power and water and wastewater industries.

Great Lakes Instruments, Inc. -  
Milwaukee, WI

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### ***Battery-Powered Totalizer and Rate Indicator Available***

INVALCO, Inc. has added a new low cost instrument to its metering and monitoring product line.

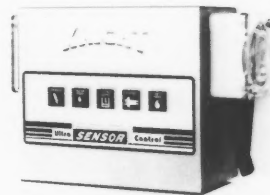
The battery-powered Model 4112 Totalizer and Rate Indicator is a self-contained unit in explosion-proof, watertight and dust-tight enclosures that meet NEMA 4, 7 and 9 specifications. It mounts directly on a turbine flowmeter and is designed to provide continuous totalization and instantaneous flow rate display. The six-digit LCD counters can be reset to zero without opening the enclosure by a magnet that is provided with the unit.

In addition, the Model 4112 provides five-volt TTL pulses at input frequency and one five-volt TTL pulse per scaled count. It features an internal 500 Hz precision quartz-controlled oscillator for easy field calibration and testing. Power comes from three "C" size alkaline batteries that have a guaranteed service life of two years.

The Model 4112 is union mounted to the flowmeter for ease of installation and access to the magnetic pickup. An optional housing and cable are available for remote mounting.

INVALCO, Inc. - Tulsa, OK

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### ***US-395 Ultra Sensor Control the "Smart Control"***

Knight Equipment Corp. is now supplying the warewash industry with the first "smart" chemical control system. The Ultra Sensor Warewash Control system gives the chemical distributor real control over detergent usage. The unique "Ultra Sense" function controls overshoot of the desired setpoint, providing just the right amount of chemical to the cleaning operation. The "smart" controller reads dry or liquid detergent injection rates and regulates feed to enhance the conductivity control process. The US-395 is designed to offer superior control, reliability and the best value in advanced warewash controls available today.

Special Features Include: Adjustable Pulse Feed, Temperature Compensation, Hi-Low Range, Weather Proof Locking Stainless Steel Case, Snap-in Circuit Board Chips and Quick Release Plug-on Electrical Barriers, Adjustable Rinse Delay, Rinse Limit Feature.

Knight Equipment Corp. -  
Costa Mesa, CA

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### Princo Null-Kote™ Presence/Absence Detector Keeps Food Processes Running Smoothly

Princo Instruments has introduced an RF (radio-frequency) Non-Intrusive Presence/Absence Detector for the food and beverage processing industry that helps protect equipment and processes. The detector can sense the presence or absence of material in a pipeline and shut down a malfunctioning system or protect sensitive equipment (such as a progressing cavity pump) before it is damaged by dry running. The detector can also be used to indicate material in overflow lines and alarm and/or shut down the process before materials are lost or wasted.

The Model L2515 detector is ideal for pipelines used to convey viscous, sticky materials such as ketchup and mayonnaise. Special Null-Kote circuitry ignores material coatings and buildup on the sensor. The device is completely non-intrusive so there are no obstructions to block material passage or create material bridging. The detector has USDA approval for use with meat and poultry products.

The Model L2515 consists of an electronics unit housed in a heavy-duty cast aluminum weatherproof, explosion-proof enclosure and an integrally mounted sensor flange. Standard sensors are available with wetted surfaces of food-grade epoxy resin and 316 stainless steel; sensors whose wetted surfaces consist of Teflon and 316 stainless steel are also available. Flanges are available in standard pipe sizes from one to twelve inches; connection is made by using flat faced flanges with full faced gaskets or by using sanitary type fittings.

The sensors can withstand process temperature from -300 to 300°F. The system is based on RF Impedance sensing circuitry so there are no moving parts to wear out or maintain. The system is extremely simple to install and requires

no routine maintenance. A manual override button facilitates system startup or pump priming with an empty line. An adjustable 0-30 second time delay prevents unnecessary shutdowns due to occasional voids which might appear in the process stream.

**PRINCO Instruments, Inc. -  
Southampton, PA**

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### New System For Environmental Monitoring

Simplify environmental monitoring with the new HYCHECK™ system. Monitoring the microbial flora of a manufacturing plant, equipment and environmental surfaces is an important stage in maintaining Good Manufacturing Practices in factories handling foods, cosmetics or pharmaceuticals.

HYCHECK is a hygiene contact slide used to assess the microbiological contamination of surfaces or fluids. The double-sided hinged slide bends for easy sampling of hard to reach sites. The rectangular surface fits easily next to corners unlike round contact plates. Both sides of the slide are covered with either the same or two different types of media. The slide is enclosed in a clear container for easy reading. A grid etched onto the slide facilitates semi-quantitative analysis.

The range of HYCHECK hygiene control slides consists of six combinations designed to meet various needs for monitoring different types of microbial contamination including total count, yeast and molds, *Enterobacteriaceae* and disinfection control. Most products have one agar medium to give a non-selective total count. HYCHECK slides contain two agar media surfaces. HYCHECK's medium surface is designed to identify or select a specified group of microorganisms.

Difco Laboratories, your "Partner in Microbiology", introduces the HYCHECK product line to meet the increasing needs in your laboratory and high quality standards you expect. Difco products are available from leading laboratory distributors.

**Difco Laboratories - Detroit, MI**

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### New! Analytical Instrumentation Catalog

New, full color catalog details analytical instrumentation available from ANTEK Instruments, Inc. Featured is the new, microprocessor controlled ANTEK 7000 Elemental Analyzer. The 7000 performs total nitrogen and/or total sulfur determinations on gas, liquid, and solid samples in as little as one minute. This technology is also available for process/on-line applications in ANTEK 6000 Analyzers. The catalog also features ANTEK 3000 Gas Chromatographs including Nitrogen Specific GC, Helium Ionization GC, and Application Engineered GCs. Sample Handling Equipment, Data Handling Systems, Autosamplers, application information, accessories, and consumables are also included.

**ANTEK Instruments, Inc. - Houston, TX**

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### New Valve Lockouts Keep Valves Secure and Tamper Free

Seton Name Plate Company now makes safety a little easier with their new Valve Lockouts. Seton's Valve Lockouts are a safe, inexpensive and easy to use method of securing valves and preventing injury due to tampering or human error.

When placed over a valve the lockout completely surrounds the valve handle. Each workman on the line simply inserts a padlock through the product and the Valve Lockout is secure. Until every padlock is removed the lockout cannot be disturbed and no one can tamper with the valve handle - workmen are protected. Durable Valve Lockouts are made of an indestructible plastic. Their bold red color makes them easily identifiable. Available in 5 sizes, there is a lockout to fit over most any valve.

In addition to their Valve Lockout Seton offers a variety of other products designed to secure and identify valves. Products include: pipe safety shields, open/closed valve signs, and various styles of valve tags.

For free catalog and samples;

Seton Name Plate Company -  
New Haven, CT

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### Analytab Products Proudly Announces the Introduction of ALADIN™

ALADIN™ is an "Automated Laboratory Diagnostic Instrument" utilizing Video Image Processing as its reading mechanism. Video Image Processing allows automated reading and interpretation of handwritten specimen numbers, product codes, colorimetric reactions and turbidometric reactions. Critical parameters of

incubator temperature and humidity, water reservoir level, reagent level and waste level are all monitored by the instrument. Graphs of temperature and humidity are available based upon hourly and daily readings. ALADIN will be capable of reading UniScept® susceptibility tests, UniScept® 20E® Gram negative identification, UniScept® 20GP™ Gram positive identifications and the An-IDENT® system for identification of anaerobes

After incubation of the test panels appropriate reagents are dispensed. The results are interpreted, stored and the product disposed into the waste station. ALADIN is truly a hands-free instrument: once a susceptibility and/or identification is placed into the incubator - ALADIN takes charge of the processing. ALADIN shares information with the UniScept® dezone-er™ System, a complete and flexible laboratory data management system linking up to 30 workstations for greater efficiency in information sharing.

Analytab Products - Plainview, NY

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### CHASE-DURUS Publishes New Traffic Doors Catalog

CHASE-DURUS has published a new full line catalog describing the company's expanded range of traffic doors for industrial and commercial applications. The 16-page catalog contains full-color photographs, complete descriptions and detailed drawings to assist in the selection and/

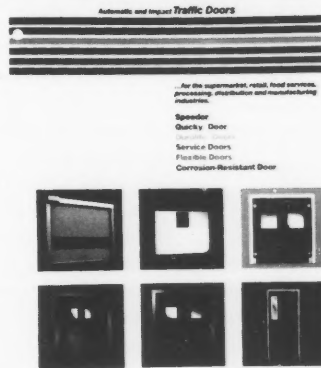
or specification of the correct traffic door for every type of application.

Information is included on the company's two new lines of automatic, motorized traffic doors as well as the various standard and special impact doors. Included are insulated impact traffic doors, rigid sheet style, rigid full thickness and flexible vinyl models.

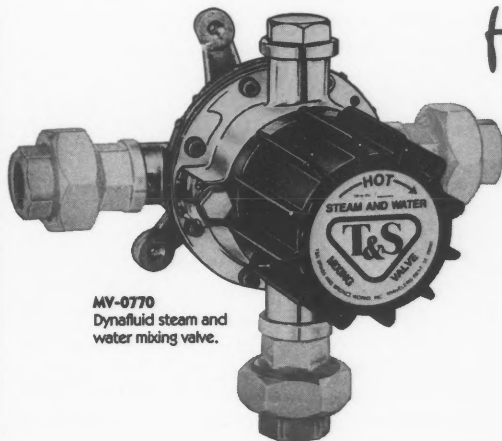
Custom sizes, special options and features are available to facilitate design of the correct door for any application ... for the supermarket, retail, food services, processing, distribution and manufacturing industries.

CHASE-DURUS - Cincinnati, OH

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DAIRY, FOOD AND ENVIRONMENTAL SANITATION/OCTOBER 1991 599

# Sanitary Design

## A Mind Set (Part IV)

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

Interior sanitary design of a food processing plant is heavily dependent on the overall design of the structure. Sanitation of an old plant constructed with wooden beams, open bar joists or other unsanitary structures can be, and usually is, much more difficult and complicated than cleaning a newly constructed building. Its double tee roof and precast walls constructed using the "pocket beam" technique designs sanitation into the structure.

Sanitary design of the walls, floors and ceilings in the process areas is not something that can be pulled out of a file or of a standards book. The demands of the process and products dictate the sanitation methods to be taken. These demands can range from requirements of a clean room environment to an ambient environment. However, there are certain principles that form a basis for sanitary design. It is these basic principles that are discussed in this article.

### Walls

Walls should be impervious to moisture, easily cleanable, flat, smooth and resistant to wear and corrosion. In addition, walls in wet areas must also be able to withstand the action of cleaning compounds. Dry areas require a hard, smooth finish free of pits, cracks and checks. A good rule of thumb: have no more than one hole or pit of one-eighth of an inch per square foot of wall surface, whether finished concrete or concrete block construction.

When treating existing walls in plants to be renovated, a number of acceptable materials can be used. Fiberglass board is a hard, impervious material that provides a surface acceptable to the USDA for meat, poultry or egg plants if installed properly.

Walls should be coved at the floor with a minimum one-inch radius. Plywood or pressed wood should not be used for interior walls because expansion and contraction make them impossible to seal. They also become havens for bacteria, mold, and yeast spores. If concrete block walls are used, construct them with a solid cap block for the top course to prevent infestation. If at all possible, block walls should be constructed using a stack bond rather than a running bond pattern. Dust or moisture follows the vertical joint all the way to the floor and doesn't get stranded on a horizontal joint as happens with running bond patterns. If a stock bond pattern is used, the wall requires additional reinforcement.

All penetrations should be sealed the day they are made to prevent bugs, rodents and other unwanted pests from entering the plant. All openings around the window frames,

door frames and any other penetrations required to equip the plant and to facilitate the operation of the processing line should be caulked.

Wet processing areas or processing areas for micro-organism sensitive products should be ceramic tiled to enhance the cleanability of the walls. Glazed ceramic tile on walls in processing areas of breweries, bottling plants, and dairies has been the standard for many years. The tiles are resistant to blood, food, acids, alkalies, cleaning compounds, steam and hot water. Tile walls are expensive to install but are easily and inexpensively maintained. Many plants in existence today have ceramic tile walls that look as good as they did when they were originally installed. These walls have been well maintained at minimal cost. For any wall area in a food processing plant that is continually exposed to high moisture, foods, acids, high temperatures, etc., tile is the recommended wall treatment. Other coatings, i.e. epoxy paints over a compatible sealer, have also been developed to resist many of the abuses that tile is able to withstand. The epoxy should be either a semigloss or glossy enamel. New finishes are appearing on the market all the time so when choosing one, be sure to investigate the smoothness when applied, its ability to fill wall pits and checks, and its durability. The supplier should have done a thorough job of testing the product under varying conditions so ask to see the test results as they would apply to plant conditions similar to your application. If the product is to be used in a USDA inspected plant, be sure the supplier produces a letter from the USDA stating the particular paint or covering material is approved.

When applying any wall treatment, make sure the surface to be covered is prepared correctly. When covering poured concrete, make sure the concrete is fully cured before application. When renovating old walls, be sure old paint is removed and the surface is completely dry before applying a new covering. A method of removing old paint successfully from wood, concrete and galvanized metal is to blast the surface with crushed walnut shells. There is no reason this method wouldn't work just as successfully on other surfaces.

The major criteria to be remembered when covering walls is to make them impervious to moisture, and easy to maintain and keep clean, preventing them from becoming a source of contamination to the food being processed. Flaking paint from walls, ceilings and floors that have not been correctly prepared or treated is one of the major complaints found during regulatory inspections of food processing plants.

One last comment about using concrete block for in-plant walls: there are a number of densities for concrete block. Heavy density block is recommended for food processing plants. The lighter density material is usually very porous, and these pores will support bacterial growth, especially if there is any moisture present. In dry areas, insects will find a home in the pores. There are effective fillers that will eliminate these pores, but the better recommendation is to use heavier density block. Volcanic ash and cinder blocks should not be used in any area of a food processing plant, regardless of the type of operation. These blocks are very porous and have pin holes extending all the way to the core that can be, and are, penetrated by insects and micro-organisms. These blocks also make fumigating difficult due to problems in obtaining a good gas seal, plus they tend to absorb fumigants and release them later, possibly contaminating the products and endangering the employees.

### Ceilings

False ceilings should not be used. The area above these ceilings quickly becomes inhabited by insects and presents a potential contamination area for food products being processed below. An American Institute of Baking inspection automatically fails a facility if insects are found above processing areas. Some types of dropped ceilings are acceptable. These must be constructed so they are almost another floor. Ideally, they are installed so they can be completely sealed off from the processing areas below and contain utility runs, air handling ducts, fans, etc. They are usually constructed with catwalks so the maintenance crew can service the equipment or lines passing through the area. The area is kept pressurized to avoid dust infiltration. When over a refrigerated area, the panels are sealed, insulated type with insulated support rods to prevent condensation and the formation of rust on the rods.

The preferred ceiling construction is concrete slab of exposed double tees. Exposed structural steel should not be used over processing areas unless it has been enclosed in concrete, Gunitite or the equivalent. The objective is to eliminate flat overhead surfaces that collect dust and debris, provide runways for rodents, and homes for insects. When possible, box sections or tubular beams with welded ends should be used. In warehouses or non-processing areas, angles and channel beams are often used. They are not recommended, but if used they should be installed with legs down to minimize the dirt-holding flat areas.

Metal panels are not recommended in production areas because their high heat transfer rate can cause condensation problems. In addition, the expansion and contraction of the metal makes it difficult to maintain the seals at the joints resulting in ideal harborage for insects. Corrugated or

ribbed sheet metal should never be used for food plant operations. They create runways for rodents and insects, provide uncleanable areas as they pass over the structural members, and the joints are difficult to properly maintain.

Concrete ceilings should be checked for rough surfaces, and, if necessary, ground smooth. All pin holes, voids or honeycombed areas must be filled with a trowel coat or sprackle before sealing. When precast slabs or double tees are used, they must have the joints caulked. It is important that the caulking compound bonds properly and withstands building vibration and the normal expansion and contraction without cracking or falling out.

Design and construction of the ceiling in a food plant must consider the pipe hangers that carry utility piping as well as process and CIP lines. Sanitary design of these pipe hangers and racks must be integrated into the overall design of the ceiling and roof and taken into consideration very early in the design. The design of pipe hangers for a food plant will be discussed in a future article.

### Insulation

The best insulation can be sealed off from insects. Insects thrive in most insulating material, especially if there is an ample supply of food and moisture nearby. Rodents, however, will live and thrive in fiberglass batting. Fiberglass batts are not recommended for use in food processing plants. The author has experienced the problem of Norway rats living and nesting in fiberglass insulation in a freezer storage room maintained at minus ten degrees F. Other types of insulation such as Styrofoam, foaming glass and other inert materials that meet R value criteria appear satisfactory. Asbestos, of course, is not to be used because of the hazards involved.

Insulation used in a food plant should not be exposed since it is usually not impervious to moisture and presents a rough, hard-to-clean surface that attracts dust and other debris.

The type of insulation used must be considered at the same time decisions are being made about the type of exterior and interior walls and roof/ceilings that are to be used. When renovating an existing plant, replacing the existing insulation must consider an R-value as well as sanitation and pest considerations.

### References

- Imholte, T. J. 1984. Engineering for Food Safety and Sanitation. Technical Institute of Food Safety. Minneapolis, MN.
- Latsuyama, Allen M. 1980. Principles of Food Processing Sanitation. Food Processors Institute, Washington, DC.

# Federal Register

## Food and Drug Administration

### Cottage Cheese Deviating From Identity Standard; Temporary Permit for Market Testing

Agency: Food and Drug Administration, HHS.

#### Action: Notice.

**Summary:** The Food and Drug Administration (FDA) is announcing that a temporary permit has been issued to Wells' Blue Bunny to market test a product designated as "nonfat cottage cheese" that deviates from the U.S. standards of identity for cottage cheese (21 CFR 133.128), dry curd cottage cheese (21 CFR 133.129), and lowfat cottage cheese (21 CFR 133.131). The purpose of the temporary permit is to allow the applicant to measure consumer acceptance of the product, identify mass production problems, and assess commercial feasibility.

**Dates:** This permit is effective for 15 months, beginning on the date the food is introduced or caused to be introduced into interstate commerce, but no later than November 25, 1991.

**For further information contact:** Frederick E. Boland, Center for Food Safety and Applied Nutrition (HFF-414), Food and Drug Administration, 200 C St., SW., Washington, DC 20204, (202)485-0117.

**Supplementary information:** In accordance with 21 CFR 130.17 concerning temporary permits to facilitate market testing of foods deviating from the requirements of the standards of identity promulgated under section 401 of the Federal Food, Drug, and Cosmetic Act (21 U.S.C. 341), FDA is giving notice that a temporary permit has been issued to Wells' Blue Bunny, One Blue Bunny Dr., Le Mars, Iowa 51031.

The permit covers limited interstate marketing tests of a nonfat cottage cheese, formulated from dry curd cottage cheese and a dressing, such that the finished product contains 0.4 percent milkfat. The food deviates from the U.S. standards of identity for cottage cheese (21 CFR 133.128) and lowfat cottage cheese (21 CFR 133.131) because the milkfat content of cottage cheese is not less than 4.0 percent and the milkfat content of lowfat cottage cheese ranges from 0.5 to 2.0 percent. The test product also deviates from the U.S. standard of identity for dry curd cottage cheese (21 CFR 133.129) because of the added dressing. The test product meets all requirements of the standards with the exception of these deviations. The purpose of the variation is to offer the consumer a product that is nutritionally equivalent to cottage cheese products with dressing but contains less fat.

For the purpose of this permit, the name of the product is "nonfat cottage cheese." The information panel of the label will bear nutrition labeling in accordance with 21 CFR 101.9.

This permit provides for the temporary marketing of 493,970 kilograms (1,089,000 pounds) of the product. The product will be manufactured at Wells' Blue Bunny Milk Plant, 12th and Lincoln Sts. SW., Le Mars, Iowa, 51031, and distributed in Iowa, Kansas, Minnesota, Missouri, Nebraska, and South Dakota.

Each of the ingredients used in the food must be declared on the label as required by the applicable sections of 21 CFR part 101.

This permit is effective for 15 months, beginning on the date the food is introduced or caused to be introduced into interstate commerce, but not later than November 25, 1991.

Federal Register/Vol. 56, No. 165, Monday, August 26, 1991/Notices.

**Dated:** August 15, 1991.

Fred R. Shank,  
Director, Center for Food Safety and Applied Nutrition.  
(FR Doc. 91-20346 Filed 8/23/91; 8:45 am)

## Department of Agriculture

### Food Safety and Inspection Service

#### Elimination of Jar Closure Requirements for Meat and Poultry Products

Agency: Food Safety and Inspection Service, USDA.

#### Action: Proposed rule.

**Summary:** The Food Safety and Inspection Service (FSIS) is proposing to amend the Federal meat and poultry products inspection regulations by eliminating the current requirements for jar closures. Under the present regulations, vacuum-packed containers that are sealed with quick-twist, screw-on, or snap-on lids must either not have annular space between the lid and the container, or the annular space must be sealed to protect it from filth or insects. The Agency is proposing this action because the requirement increases production costs and there is no evidence of continued public health benefit.

**Dates:** Comments must be received on or before October 25, 1991.

**Addresses:** Comments should be sent to the Policy Office, Attention: Linda Carey, FSIS Hearing Clerk, room 3171, South Agriculture Building, Food Safety and Inspection Service, U.S. Department of Agriculture, Washington, DC 20250.

**For further information contact:** Mr. William C. Smith, Director, Processed Products Inspection Division, Science and Technology, Food Safety and Inspection Service, U.S. Department of Agriculture, Washington, DC 20250. (202)447-3840.

**Supplementary information:** Comments. Interested persons are invited to submit comments concerning this action. Written comments should be sent to the Policy Office and should refer to Docket Number 88-032P. Requests to present oral comments, as provided by the Poultry Products Inspection Act, should be directed to Mr. William C. Smith so that arrangements can be made for such views to be presented. A record will be made of all views orally presented. All comments submitted in response to this rule will be available for public inspection in the Policy Office between 9 a.m. and 4 p.m., Monday through Friday.

Federal Register/Vol. 56, No. 165/Monday, August 26, 1991/Proposed Rules.

## Book Review

*"Food Irradiation - A Technique for Preserving and Improving the Safety of Food"* is a 1988 publication of the World Health Organization in collaboration with the Food and Agriculture Organization of the United Nations.

A short text of 84 pages, it is not intended to be a technical or scientific manual. Rather, this book provides basic information on the role of food irradiation to students, consumers, consumer protection groups, media, government officials, and policy makers.

**Food Irradiation** consists of six chapters dealing with: Established methods of Food Processing, The Process of Food Irradiation, Effect of Food Irradiation, Practical Application of Food Irradiation, Legislation and Control, and Consumer Acceptance. Also included are three annexes, one of which lists all countries (and products) that have cleared irradiated food for human consumption.

The many contributors to this text have concluded that food irradiation has not become popular due to government's uncertainty of public acceptance. To address this problem, the author's (and this reviewer) feel public education is a must. They accomplish this by giving extensive evidence (supported by practical experiences in over 30 countries) to explain what the food irradiation process is, how it works, and what it will and will not do!

**Food Irradiation - A Technique for Preserving and Improving the Safety of Food** is available through World Health Organization Publications (in English, French and Spanish in preparation) for US \$12.80.

Kevin Anderson  
City Sanitarian  
Ames, IA

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# Abstracts of Papers Presented at the Seventy-Eighth Annual Meeting of the IAMFES

Louisville, KY, July 21-24, 1991

Abstracts of most papers submitted for presentation at the 78th Annual Meeting of the IAMFES appear on this and the following pages. The complete text of some of the papers will appear in future issues of the *Journal of Food Protection or Dairy, Food and Environmental Sanitation*.

## IVAN PARKIN LECTURE

### PROTECTING OUR FOOD SUPPLY: AN INDUSTRY, REGULATORY AND ACADEMIA JOINT EFFORT

Gary Hanman, Chief Executive Officer, Mid-America Dairymen, Inc., 3253 E. Chestnut Expressway, Springfield, MO 65802

The dairy and food industry, regulators, and academia share a common responsibility, providing an adequate food supply which is safe and wholesome to consumers of the United States and to the world. The last decade of the twentieth century and well into the 21st century will require effective cooperation between the industry, regulators, and academia for the basic purpose of managing the wealth of knowledge which has been developed in the 20th century. Knowledge which at times raises questions about product safety without answering other pertinent questions such as what is safe and how can an agreed definition of safe be achieved.

We cannot ask consumers to accept risks; but yet technology continues to move the definition of zero which is often presented as a definition of safe. These and other issues can be effectively dealt with through cooperation of Industry, Regulators, and Academia and the consumers of the United States and the world will be provided an adequate food supply which is unquestionably safe.

## THE KENTUCKY DAIRY INDUSTRY

### MILK SAFETY-KENTUCKY HISTORICAL REVIEW

Dudley J. Conner, Manager, Food Branch, Department for Health Services, 275 East Main Street, Frankfort, KY 40621

A brief historical review will be made concerning milk regulatory programs in Kentucky. Included in the presentation will be development of the Milk Control Act and implementation of a statewide program for controlling sanitary production and distribution of milk and milk products. Other appropriate information on dairy and dairy products will be included.

### KENTUCKY MILK CONTROL PROGRAM

David W. Klee, Manager, Kentucky Milk Control Branch, Cabinet for Human Resources, Dept. for Health Services, Div. of Community Safety, 275 East Main St., Frankfort, KY 40621

The Milk Control Mission is to protect the public health by reduction of adulteration, misbranding, and false advertising of milk and milk products. Kentucky has a long history of producing a safe, wholesome milk supply. The Milk Control Program in Kentucky administers both the Grade A and Manufacturing Programs and carries out various other functions and activities. The administration of the Milk Control Program will be discussed in detail at this symposium. Milk, because of its composition, is an ideal medium for the transmission of disease. The disease may originate in the cow, or the milk may be contaminated by improper handling during and after the milking process. For this reason, milk has become one of the most regulated food products during production, transportation, processing, and distribution. Often in Kentucky we describe our services as being "From Moo To You".

### DRUG RESIDUE TESTING PROGRAM IN KENTUCKY

Dale Marcum, Kentucky Milk Control Branch, 275 East Main Street, Frankfort, KY 40621

This presentation will consist of an overview of the current Drug Residue Program that is being conducted by Regulatory and Industry. The National Drug Residue Program in which Kentucky is participating will be discussed.

Also included will be the findings for the last fiscal year and a projected program for new fiscal year.

## DAIRY FORECAST

William L. Crist\*, Extension Professor and Coordinator of Animal Sciences Extension, G. Heersche, D.M. Amaral-Phillips and A.J. McAllister, University of Kentucky, 407 W.P. Garrigus Bldg., Lexington, KY 40546

Dairy farming is a major economic enterprise in Kentucky, with about \$300 million worth of milk produced annually. Cow numbers have declined from a 600,000 cow peak in 1953 to 206,000 in 1990. Total milk production has declined from a 2.7 bill. lb. peak to 2.26 bill. lbs. in 1990. In January 1991 there were 3670 commercial farms selling milk, 3006 grade A producers and 664 manufacturing grade producers. If the current decline of 200 manufacturing grade producers per year continues, they will be eliminated by 1995. The potential for dairy farming in Kentucky is tremendous. Kentucky has the land and climate to produce the high quality forages necessary for economical milk production. The demand for milk and dairy products in the Southeast exceeds the production, so Kentucky has a readily available market. Kentucky has been economically competitive in milk production, even with its low annual production per cow of 10,947 lbs. (the U.S. average is 14,642 lbs. and New Mexico has the top state average of 18,815 lbs.). However, Kentucky's dairy industry is at a critical turning point. Adoption of modern production technology and a business approach will be necessary to sustain a strong and viable Kentucky Dairy Industry in the 21st century.

## BULK MILK HAULER REGULATIONS IN KENTUCKY

Russ Bledsoe, Supervisor-Milk Control Branch, Health Services-Milk Control Branch, 275 East Main Street, Frankfort, KY 40621

Background of bulk milk haulers program.

What constitutes a milk hauler in Kentucky.

How many organizations regulate a milk hauler.

How do you find a milk hauler.

How do you become a licensed and permitted milk hauler in Kentucky.

Why we regulate haulers.

## PROFILES OF KENTUCKY DAIRY PLANTS

### SURVEY OF KENTUCKY DAIRY PLANTS

E.B. Aylward and A. Deklef\*, Production Manager, Fromageries Bel, Inc. PO Box 156, Leitchfield, KY 42755-0156

Kentucky manufacturing grade milk processors make many products: condensed and evaporated milks; dry products; butter; and many cheeses. A small cheddar facility, started in Leitchfield in 1958, collected milk in cans and turned it into cheese the same day. Acquired in 1970 by Fromageries Bel, Inc., milk procurement is now 8 times the 1958 amount, but from 20% as many producers. Grade A milk procurement was 0% in 1960, 38% in 1980, and is 75% today. The physical facility is now 6 times larger than in 1970. Cheeses manufactured have expanded from cheddar to: semisoft cheeses; other hard cheeses; reduced calories cheeses; and pasteurized process cheese spreads. Professional relations between regulatory agencies and industry plus detailed attention to quality, from milk through finished product keeping quality, help Fromageries Bel make products in Kentucky, for distribution throughout the US and Canada.

## HISTORY OF RYAN MILK COMPANY

Ken Evans, Plant Manager, Ryan Milk Company, Inc., P.O. Box 1175, Murray, KY 42071

The history of Ryan Milk Company started well over half a century ago as Ryan Milk Company at its present location in Murray, Kentucky. Incorporation



porated in 1929 as the Murray Milk Products Company this dairy plant was originally conceived as a "milk receiving station" by Mr. Joseph Ryan. It was to be a branch of the successful new Pet Milk Company condensary in nearby Mayfield, Kentucky. In 1956, Ryan was producing only 40,000 pounds of Grade "C" milk per day but within 15 years their overall volume increased by 300% peaking at 240,000 pounds per day. Ryan Milk's unexcelled growth yet today is attributed to the management and technological foresight of its immediate past president, James E. Garrison. He led the way for Ryan Milk becoming the leader in extended life dairy products which are distributed now nationwide.

## SURVEY OF KENTUCKY DAIRY PLANTS

John G. Murray, General Manager, Winchester Farms Dairy, 500 Rolling Hills Lane, Winchester, KY 40391

Winchester Farms Dairy is owned and operated by the Kroger Company, known in the trade as a "Supermarket" dairy. It is now nearly ten years old but it is a high volume, highly automated operation producing fluid milk, cottage cheese, yogurts, sour cream, and citrus juices and other drinks. The plant serves Kroger stores and other customers in a four-state area. The plant is capable of processing, packaging, and shipping in excess of a million gallons per week of fluid products as well as 250,000 pounds of cultured products on a five-day basis. All raw milk requirements are purchased through Cooperatives. A very strict regulatory compliance posture is maintained in our facility with the able assistance of our State agencies. This compliance posture coupled with strict internal controls assures our customers of the highest quality products.

## SHELF-LIFE OF DAIRY FOODS

### SHELF-LIFE TESTING METHODS

J. Russell Bishop, Ph.D., Associate Professor, Food Science & Technology, Virginia Polytechnic Institute and State University, Blacksburg, VA

Over the years, many tests and assays have been developed to estimate the quality and potential shelf-life of dairy products. These have ranged from simple standard bacterial enumerations to more complex metabolite detections. Methods to be discussed are SPC, coliform count, psychrotrophic count, modified psychrotrophic count, petri film, impedance microbiology, endotoxin, colorimetry, and bioluminescence. Parameters used to estimate or indicate the inherent quality of dairy foods will be reviewed.

### DAIRY PLANT ENVIRONMENT VS. SHELF-LIFE

Charles H. White, Head, Department of Food Science and Technology, Mississippi State University, P.O. Drawer NH, Mississippi State, MS 39762

A study of six dairy plants was conducted to evaluate the effect of general plant cleanliness on the shelf-life of products produced by these plants. In addition, the presence of environmental pathogens was determined. For both shelf-life and the presence of environmental pathogens, an attempt was made to correlate the results of inspections relating to plant cleanliness and compliance to GMP's. Also, use was made of simple microbiological tests as a predictor of shelf-life and the presence of environmental pathogens. For the six plants evaluated, mean shelf-life values were reported for the following products: whole milk (11.7 d); lowfat milk (11.7 d); skim milk (10.3 d); chocolate lowfat milk (10.5 d); ice milk mix (14.3 d); and cottage cheese (19.6 d). In general, as plant cleanliness improved, shelf-life was extended. As one might expect, as a plant is cleaned where psychrotrophs are eliminated, some or most pathogens must also be eliminated since the two groups of bacteria are found in similar places.

### IMPLEMENTATION OF SHELF-LIFE/QUALITY ASSESSMENT PROGRAMS

M. Jeffrey Bloom, Manager, Satellite Laboratories Environmental Systems Service, Ltd.

Successful shelf-life and product quality programs are dependent on several factors: 1) high quality raw milk 2) clean milk plant storage, processing and packaging equipment 3) processing and storage times and temperatures

conducive to maximum quality and shelf-life and 4) properly trained and equipped laboratory personnel capable of monitoring a well designed shelf-life program.

Good shelf-life programs utilize line samples to determine trouble spots during processing as well as finished product monitoring. Shelf-life tests include microbiological, chemical and organoleptic analysis. Since conventional testing may take from 7 days to several months, more recent quick methods such as the V.P.I. modified P.I. count have become popular. These tests allow a "predicted" shelf-life to be calculated from laboratory results. Actual store product monitoring is also an important part of a good shelf-life program.

## DAIRY INDUSTRY VIEW OF SHELF-LIFE/QUALITY ASSESSMENT

Gale Prince, The Kroger Company, 1014 Vine Street, Cincinnati, OH 45202

Shelf life is the life blood of the dairy industry. Customer satisfaction with dairy products hinges upon a firm's performance in maintaining a product with a consistently good shelf life. The quickest way to lose a valued customer is with a container of milk that does not keep to the customer's expectation. Shelf life must be built into the product through raw ingredients that are properly processed, packaged and held under refrigeration to maintain that quality.

## DAIRY MICROBIOLOGY, CHEMISTRY AND SANITATION

### THE DISPERSAL OF MICROORGANISMS BY CLEANING SYSTEMS

J.T. Holah\* and J.S. Holder, Campden Food and Drink Research Association, Chipping Campden, Glos., U.K.

The dispersal of microorganisms, including *Listeria*, via soil particles, water droplets and aerosols (<40um) was assessed for a range of cleaning techniques. The techniques could be divided into two categories: those that dispersed microorganisms to a height that could contaminate product or product contact surfaces (assumed as > 1m) and those that did not spread a significant number of droplets to this height. A high pressure/low volume spray lance and a low pressure/high volume hose were both shown to spread water to a height well in excess of 1m and their use in areas where microbial contamination of product is undesirable, during production periods, should be restricted. In addition, because of the dispersal range, when these techniques are used out of production periods all product contact surfaces should be disinfected as the final stage of the total environmental sanitation program. A number of techniques including a rotary floor scrubber, a rotary wall/floor scrubber, a scrubber drier, a high pressure/low volume floorhood attachment and manual techniques were shown to be unlikely to contaminate product/product contact surfaces and are hence more suitable for use in 'clean as you go' operations. All cleaning techniques were shown to disperse viable microorganisms from biofilms developed on flooring materials via both water droplets and aerosols.

### IMPACT OF ENVIRONMENTAL PATHOGENS ON EXTENDED SHELF-LIFE DAIRY PRODUCTS

Cameron Ray Hackney\* and J. Russell Bishop, VPI & SU, Food Science and Technology Department, Blacksburg, VA 24061

The shelflife of dairy products such as liquid milk and ice cream mixes are being extended using combinations of higher temperature thermal processing and clean packaging technology. Organisms in these products are either thermotolerant or post processing contaminants. Shelflife is often extended from 14 to greater than 45 days. These products are more prone to exposure to temperature abuse and the consequence of any contamination, when it does occur is greater. Organisms of concern include both psychrotrophic pathogens and near psychrotrophic pathogens that may enter the product by post processing contamination or that are sufficiently thermotolerant to survive the heating process. Spore forming bacteria fall in to the later category.

In extended shelflife products, cells have far longer time to adapt and multiply. Many microorganisms respond to low temperatures by greatly extending their lag phase of growth. In conventional products spoilage may occur before pathogens can adapt to growth at lower temperatures. In addition, injured cells also have greatly extended lag times that may last for

days under cold temperatures. These may repair during the extended shelf life of the products. The use of HACCP is of critical importance to control contamination. Also, an approach that might be used to increase safety is deliberate inoculation of starter cultures in the products. These organisms would only grow in response to temperature abuse.

#### DETERMINATION OF ATRAZINE IN MILK BY ENZYME IMMUNOASSAY

Rodney J. Bushway, Lewis B. Perkins, Heather L. Hurst and Titan S. Fan\*, ImmunoSystems, Inc., 4 Washington Avenue, Scarborough, ME 04074

A polyclonal enzyme immunoassay (EIA) method has been developed to determine atrazine in process milk including skim, lowfat, whole, chocolate, evaporated, nonfat dry milk, and "half-and-half." The procedure is sufficiently simple for plant use, rapid (15 min) and sensitive (0.2 ng/ml). A linear response from 0.2 to 6.4 ng atrazine per ml was observed using atrazine-spiked milk standards. Same day and day-to-day (over a 2 month period) reproducibility was excellent with most percent coefficients of variation (%CV) below 12 even at the 0.2 ng/ml level. Cross-reactivity was such that this method could be used to determine other triazine pesticides in milk. Confirmation and triazine identification could then be performed by conventional chromatography (GC or HPLC) methods. Milk products collected around the world have been tested by this immunoassay procedure. The EIA was proven to be a very effective screening method for triazine milk contamination.

#### A RAPID BIOLUMINESCENCE ASSAY OF ALKALINE PHOSPHATASE IN MILK AND DAIRY PRODUCTS USING THE CHARM II SYSTEM

S. Trivedi, E. Zomer\* and S. Charm, Charm Sciences Inc., 36 Franklin Street, Malden, MA 02148

A simple procedure was developed to detect either contamination of pasteurized milk/dairy products with raw milk, or an erroneously done pasteurization process. The procedure uses a substrate which in the presence of alkaline phosphatase breaks down and generates light. The amount of light generated correlates to the amount of alkaline phosphatase in the sample. The assay can detect as little as 0.005% raw milk (equivalent to .05 phenol equivalent), making this assay about 20 times more sensitive than the Scharer Rapid Test for Alkaline Phosphatase. Assay time is only 3 minutes and the assay uses a single reagent.

Dairy products such as cream, heavy cream, butter, cheese and ice cream require a simple extraction with aquas buffer (no butanol is required) with a 5 minute centrifugation. The assay for these products is 3 minutes, similar to fluid milk. Chocolate milk is tested using the same procedure as is used for regular fluid milk (phenol does not interfere with this test).

Market milk samples (20), heavy cream samples (4), various cheese products (4), and chocolate milk samples (2) were analyzed with the Scharer Rapid Test and the bioluminescence assays and found negative by both methods. The samples were then spiked with mixed raw milk (silo milk) at 0.1% and 0.02%. The 0.1% level was detected as positive by both methods; however the 0.02% level was detected only by the bioluminescence method. The bioluminescence assay therefore sets a higher standard for the pasteurization process.

#### EXTENDING THE KEEPING QUALITY OF FLUID MILK

S.E. Barnard, The Pennsylvania State University, University Park, PA 16802

Dairy processors are extending sell by or open dates on fluid milk to 14 or more days. The best available processing and sanitation procedures must be regularly followed or packaged milk will be spoiled if held at 45°F. One alternative would be to request that the maximum product temperature be reduced to 40°F for fluid dairy products from filler to consumer purchase. Unless this occurs all possible steps must be taken in processing and packaging rooms to prevent the slightest recontamination after pasteurizing. In nearly all cases hot water sanitizing is a must with the temperature at the point of discharge from filler valves being a minimum of 170°F. Some plants have achieved acceptable flavor and excellent bacterial counts of packaged milk on more than 95% of samples held for 14 days at 45°F. Other plants have samples of acceptable flavor, but bacterial counts are high. Our studies have shown that 30% or more of dairy plants have spoiled product from a given days processing after 14 days at 45°F. A list of recommended procedures and practices will be most of the presentation.

#### EFFECTS OF OXYGEN ABSORBER AND OTHER PACKAGING CONDITIONS ON THE SHELF LIFE OF DRY WHOLE MILK

J.A.F. Faria\* and M.R. Silva, Universidade Estadual de Campinas/FEA, C.P. 6121, 13081-Campinas-SP, Brazil

The shelf life of dry whole milk packed in tinplate cans and high gas barrier pouches with air, nitrogen, under vacuum, or air plus oxygen absorber (Ageless) was evaluated at ambient temperature and at 37°C. The samples were analyzed initially and at 2 months intervals over 18 months by measuring headspace volatile, oxygen, carbon dioxide contents using gas chromatography, color formation, vitamins (A and C), peroxide value, physico-chemical properties, and sensory scores. No significant differences were observed among the treatments prior to 3 months of storage and after this time only the sensory results showed statistical difference ( $P < 0.05$ ). The flavor stability was the most affected parameter but it was stable enough even after 8 months for the samples under vacuum, nitrogen or with absorber. It was concluded that the use of oxygen absorber is the most effective technique for extending the shelf life of dry whole milk when over 12 months of storage is required.

#### DETERMINATION OF THE INCIDENCE OF COLIFORMS BY PRELIMINARY INCUBATION—ONE WAY TO PREDICT MILK QUALITY

R.A. Ledford, R.A. Holley, J. Labatt, E.T. Wolff\*, K.T. Scofield, Cornell University, Dept. of Food Science, 11 Stocking Hall, Ithaca, NY 14853

Recently coliforms were detected in 4% of commercial milk samples tested by the VRBA method at day 1 while 42% of the same samples were positive after 14 days at 6.1°C. An accurate method for the early detection of all viable coliforms is essential for the determination of compliance with the coliform standard. Ledford et al. (1983) developed a preliminary incubation procedure that involves incubating milk samples for 6 hours at 37°C prior to plating on VRBA. Results of several years research at Cornell indicate that this PI method correctly predicts the incidence of viable coliforms 79 and 81% of the time in commercial milk samples held at 6.1°C for 10 and 14 days, respectively. Samples from 25% of the dairy plants were consistently coliform-free throughout storage for 14 days at 6.1°C. In order to improve the PI method, variations of incubation times and temperatures were investigated. Research is also being conducted to determine the correlation between plant practices and the incidence of coliforms in the packaged products.

#### RAPID CONCENTRATION PROCEDURE FOR MICROORGANISMS IN RAW MILK

E. Pahuski, L. Martin\*, K. Stebnitz, J. Priest and R. Dimond, Promega Corporation, 2800 Woods Hollow Road, Madison, WI 53711

We have developed a simple, rapid concentration procedure for removing microorganisms from raw milk samples. In this procedure a novel concentrating reagent is mixed with a raw milk sample, and the mixture is centrifuged at 12,000 x g for 5 minutes. After this treatment microorganisms are concentrated 100-fold into a small pellet while milk components separate into an easily removable upper phase. Following this procedure the microorganisms obtained are amenable to a number of standard evaluation techniques including total viable organism assay, direct microscopic evaluation, and immunochemical testing. Data collected using this procedure with a luciferase-based ATP viable cell assay demonstrated a linear correlation to 22°C Standard Plate Count over a 3 log range of cell concentrations with an assay sensitivity of approximately  $2 \times 10^4$  Colony Forming Units (CFU). The correlation coefficient (r) for a linear regression analysis comparing the two methods was 0.9 for 80 raw milk samples tested. The test exhibits precision for duplicate samples comparable to standard plating methods. Data also shows that direct microscopic examination of bacteria concentrated by this procedure is far superior to standard staining procedures with respect to background, sensitivity and scoring due to the concentration of cells in the assay and removal of milk contaminants.

#### PREVALENCE OF SALMONELLA, CAMPYLOBACTER, YERSINIA ENTEROCOLITICA AND LISTERIA MONOCYTOGENES IN FARM BULK MILK TANKS

F.A. Draughon\*, B. Rohrbach and P.M. Davidson, University of Tennessee, Dept. Food Tech. & Science, Knoxville, TN 37901-1071

This study was undertaken to document the prevalence of *Salmonella*, *Campylobacter*, *Yersinia enterocolitica*, and *Listeria monocytogenes* in farm bulk tanks from a sample of 300 Tennessee dairies. Other factors evaluated in association with samples was herd size, grade of milk, somatic counts, consumption of raw milk on farm and a general questionnaire. From 300 bulk milk samples, 27 were positive for *Salmonella*, 12 were positive for *Listeria monocytogenes*, 36 were positive for *Campylobacter jejuni*, and 43 were positive for *Yersinia enterocolitica*. Over 20 of the milk samples were positive for more than one pathogen. Approximately 37% of those surveyed reported the consumption of raw milk at the dairy farm.

#### GERMICIDAL ACTIVITY OF A CHLORINE DIOXIDE CONTAINING TEAT DIP

B. E. Langlois\*, R. J. Harmon, and K. Akers, University of Kentucky, 204 W.P. Garrigus Bldg., Lexington, KY 40546-0215

The A.O.A.C. germicidal and detergent sanitizer assay and modifications of the A.O.A.C. procedure were used to evaluate the efficacy of a chlorine dioxide containing teat dip. In one study, broth cultures rather than resuspended agar cultures were used for inocula. Exposure of 36 strains, representing 26 species, to the chlorine dioxide teat dip for 30 sec resulted in greater than a 99.999% reduction in count for all strains tested. *Bacillus cereus* and *Bacillus subtilis* were the only species to show survivors after 30 sec exposure. In another study, the use of modified growth media and neutralizing broths did not influence the reductions in count observed for *Pseudomonas aeruginosa* ATCC 15442, *Salmonella choleraesuis* ATCC 10708, and *Staphylococcus aureus* ATCC 6536 after 30 sec exposure to the chlorine dioxide teat dip. In a third study, many staphylococci of bovine origin failed to reach sufficient numbers in broth media to be tested by a modified A.O.A.C. procedure.

#### A COMPOSITIONAL EVALUATION OF COMMERCIAL SOFT-SERVE FROZEN YOGURT

Ronald H. Schmidt\*, Patricia O. Myers, and Maria T. Ferreira, Food Science & Human Nutrition Department, University of Florida, Gainesville, FL 32611

Because of perceived health benefits and nutritional value, frozen yogurt has become a popular frozen dairy product. Wide variation in manufacturing methods used for frozen yogurt mix may have resulted in potential variability in composition as well in the level of "active" yogurt microorganisms. Therefore, a compositional survey of frozen yogurt product was conducted. Samples of vanilla flavored soft-serve frozen yogurt were randomly obtained from eleven retail outlets in Gainesville, FL during the months of January, February and March 1991. Samples were obtained in sterile jars and stored on ice during transport to the laboratory for analysis within 1 hr of purchase. Compositional analysis conducted on the samples included: total solids, fat, and protein level, and acidity level by titratable acidity and pH determination. Microbiological analyses included: differential plating for *Streptococcus thermophilus* and *Lactobacillus bulgaricus* and calculation of the rod:cocci ratio, and coliform counting. The total solids, fat, and protein level ranged from 22.4 to 26.3%, 0 to 3.1%, and 2.7 to 5.7%, respectively. The pH values ranged from 6.1 to 7.1 and titratable acidity ranged from 0.18 to 0.42%. The level of microorganisms varied considerably between the samples taken from each vendor as well as between samples from the same vendor on different days. The range in log plate count data for yogurt microorganisms was 3.11 to 8.25 log colony forming units (CFU)/ml *S. thermophilus* and 3.38 to 8.45 log CFU/ml *L. bulgaricus*. A 1:1 rod:cocci ratio was observed in 55% of the samples examined. Coliform counts ranged up to 2,340 CFU/ml with 65% of the samples having coliform counts above 10 CFU/ml. Data are compared to proposed standards of identity for frozen yogurt.

#### CHEMICAL METHODS OF ANALYSIS

#### FLUOROMETRIC ANALYSIS OF ACID PHOSPHATASE IN MEATS FOR MONITORING COOKING TEMPERATURES

Richard M. Rocco, Manager, Food and Dairy Division, Advanced Instruments, Inc., Needham Heights, MA 02194

Methods are needed to monitor thermal processing requirements for

meat and poultry products. A rapid 3 minute quantitative assay for acid phosphatase (ACP, EC 3.1, 3.2) has been developed for use with water extracts of heated meat. The method is based on a previously described fluorometric substrate for alkaline phosphatase (*J. Food Protection* 53:588, 1990). Working substrate for the ACP test contains 5 mg substrate in 50 mL acetate buffer pH 4.9 with 10% dimethylformamide. Lean ground beef (*gluteus medius*) was heated to 62.8, 65.6, 68.3 or 71.1 °C in a water bath set 1.5°C above the target temperature. At target temperature, tubes were removed and immediately chilled (0-2°C). Extracts (5 g meat to 10 g water) were prepared by high-speed blending, centrifuging and vacuum filtering. A 75 µL aliquot of the aqueous meat extract was added to 2.0 mL of the working substrate in a fluorometer cuvette. The kinetic increase in fluorescence is monitored in a dedicated fluorometer at 38°C and printed after 3 minutes. Mean (N=9) and standard error mU/Kg ACP cooked beef values were 5109 ± 221 (62.8°C), 3504 ± 92 (65.6 °C), 2063 ± 55 (68.3°C), and 733 ± 25 (71.1°C). Linear regression was mU/Kg ACP = 47284 - 291.35 (X) with R<sup>2</sup> = 99.82%.

#### ANION EXCHANGE DIODE ARRAY HPLC ANALYSIS OF HEATED GROUND BEEF

Carl E. Davis\* and William E. Townsend, USDA, ARS, RRC, P.O. Box 5677, Athens, GA 30613

USDA-FSIS regulations establish thermal treatments for meat and poultry products. Changes in water-soluble heated beef muscle proteins were profiled by anion exchange diode array HPLC at several end-point temperatures (EPT). Lean ground beef (*gluteus medius*, 16 g) packed in a glass tube (25 x 150 mm) was heated to 48.8, 54.4, 60.0, 62.8, 65.6, 68.3, 71.1, 73.9, 76.7 or 79.4°C in a water bath set 1.5°C above the target temperature. At the target EPT, tubes were removed and immediately chilled (0-2°C). Extracts (5 g meat to 15 g water) were prepared by high-speed blending, centrifuging and vacuum filtering. Extracts were buffered (1:1) with 0.05 M diethanolamine (DEA), pH 8.8 and 200 µL separated by anion exchange HPLC using a 13 minute linear gradient to 0.5 M NaCl. Diode array analysis (200 to 700 nm) was used to detect separation components. A peak near 11.0 min. (N=6) had a curvilinear response to EPT with an almost linear decrease from 62.8, 65.6 to 68.3°C (R<sup>2</sup>=98.44%). Peak spectrum analysis showed principal absorbance maxims of 218 and 278 nm below 68.3°C shifting to 214 and 252 nm above 71.1°C. This procedure provides a rapid (25 min.), sensitive analytical method to characterize EPT in lean ground beef.

#### A LOW-COST TECHNIQUE FOR WATER ACTIVITY WITHOUT SPECIALIZED INSTRUMENTATION

Bernard E. Kane, Jr., East Carolina University, Greenville, NC 27858

A simple technique for measuring water activity of foods by the dew point method is described. The technique requires the use of a common thermistor temperature probe and a dissecting microscope but no specialized water activity instrumentation. Water from an ice bath is siphoned through a brass tube which pierces a styrofoam coffee cup sample chamber. Use of a water ballast provides a temperature gradient that enables precise measurements ( $\pm 0.02 a_w$  at 0.90).

The technique was used to determine whether samples of barbecued pork met the F.D.A. definition of a "Potentially Hazardous Food." It is a useful technique for screening foods in foodborne outbreak investigations by health departments and for teaching food sanitation classes.

#### DETERMINATION OF OZONE PRODUCED OXIDANTS AND BYPRODUCTS IN ARTIFICIAL SEAWATER

K.R. Schneider\* and G.E. Rodrick, Dept. of Food Science and Human Nutrition, University of Florida, Gainesville, FL 32611

If ozone is to be used for shellfish processing, it is essential to accurately measure the amount of oxidant produced and to determine whether any harmful byproducts are being formed. Amperometric titration, potassium iodide (KI) and N,N-diethyl-p-phenyl-enediamine (DPD) tests were performed to determine their ability to detect ozone produced oxidants. These methods yielded different results when bromine and ammonia concentrations were varied in an artificial seawater environment. The KI test yielded higher estimates for each sample than did the amperometric and DPD tests. Experiments examining the possible production of trihalomethanes were performed using GC/MS. More research in this area is needed if ozone assisted

deposition is to meet the increased and restrictive regulations imposed by FDA.

#### DETECTION OF ANTIMICROBIAL DRUGS THROUGH THEIR FUNCTIONAL GROUP AS COMPARED TO PHYSIO-CHEMICAL OR IMMUNOLOGICAL METHODS

Eliezer Zomer\*, Stanley E. Charm, Robert Salter, Tom Lieu and Max Gandman, Charm Sciences Inc., 36 Franklin Street, Malden, MA 02148

In microbial inhibition assays and biological receptor assays, the analyte is the functional group of the drug. Inhibition assays are widely used for drug residue analysis in the dairy, meat and feed industries. These methods measure inhibition of microorganisms by zone on agar plates or acid production by color change. Receptor assays, which are widely used by the dairy industry, use labeled analytes that compete with the drug in the matrix for binding sites (the biological receptor). While microbial inhibition assays measure the accumulating effect of all the drugs present, receptor assays measure the cumulative effect of all drugs that have the same mode of action — and thus share the same receptor moiety.

Forty antimicrobial drugs from five families (12 beta-lactams, 14 sulfonamides, 6 tetracyclines, 6 aminoglycosides and 3 macrolides) were tested by a quantitative receptor assay (Charm II Test) and a new inhibition assay (Charm Farm Test). Results were compared with immunoassays and HPLC analysis with UV spectrum monitoring.

A: Limit of quantitation by the receptor assay correlated with the limit of detection of the inhibition assay. Both met safe level requirements. B: Within a single drug family, variations rarely reached tenfold using either assay; immunoassays often exhibit one hundredfold variations. For screening purposes, an average or most common drug can be used to establish an equivalent residue screening level. C: New drugs belonging to one of the five families were detected on the receptor assay. For example, cephalosporins were detected as easily as penicillins. D: The receptor assay was more rapid than the inhibition assay (10 minutes vs. 180 minutes), as only the initial binding is measured and there is no need for growth or acid production. E: The receptor assay gave better sensitivity, as detection levels depend both on biological receptors and the specific activity of the labeled drug. F: As screening tests for a broad spectrum of antibiotics, the receptor assay and the inhibition assay were found to meet government safe level requirements, have high confidence levels and provide superior economic value over immunological or HPLC/UV methodology.

#### HEADSPACE PROFILES OF MODIFIED ATMOSPHERE PACKAGED FRESH RED SNAPPER (*LUTJANUS CAMPECHANUS*) BY GAS LIQUID CHROMATOGRAPHY

Dr. Gunnar Finne and Craig D. A. Scora\*, Laboratory Manager, Applied Microbiological Services, Inc., 201 E. Holleman, College Station, TX 77840

Red snapper (*Lutjanus campechanus*) fillets packaged in polyethylene barrier pouches backflushed with air and CO<sub>2</sub> enriched atmospheres were stored at 4°C and 15°C. At regular time intervals, the headspace within the packages was analyzed for atmospheric composition, total volatile components and total numbers and types of microorganisms were determined on the fillets.

During the logarithmic phase of growth of the organisms on the fillets, there was a linear relationship between log number of microbial populations and total integrated volatile headspace area. When stored at 15°C, the microbial population produced more volatile components per cell than during storage at 4°C.

When known spoilage organisms were inoculated onto sterile tissue, the volatile headspace profile showed specific volatile components characteristic of the inoculated organisms. Non inoculated sterile control samples did not produce any volatile headspace components, indicating that volatiles are basically produced by microbial activity. Typical components found in the headspace were, butanal, ethanol, hexanal, dimethylamine and trimethylamine.

During storage at 4°C, the microbial population within the packages containing CO<sub>2</sub> tended to shift from an initial gram negative flora to a gram positive flora. At 15°C, no such change was evident.

For fillets stored in air, there was a definite build-up of CO<sub>2</sub> within the packages. This also was true in the modified atmospheres, but to a lesser extent.

The findings of this research indicate that headspace analysis can potentially be very useful in determining the microbial activity in fresh seafoods and other raw proteinaceous foods packaged in vacuum or modified

atmospheres. This technique could find its place in regulatory procedures and processing plants. Future research should be directed toward inoculated studies with bacteria that present potential health hazards. If specific markers for such organism could be identified, standard quality control procedures and regulatory procedures and decisions regarding vacuum and control atmosphere packaged seafoods could be greatly simplified.

#### FOOD SERVICE

##### EPIDEMIOLOGIC OVERVIEW: FOODBORNE DISEASES AND THEIR SPREAD BY FOOD WORKERS

Mary Lou Fleissner, Dr. P.H., Indiana State Board of Health, 1330 W. Michigan St., Indianapolis, IN 46206

Surveillance and investigation for foodborne outbreaks is essential for understanding the cause of foodborne illness, thereby leading to implementation of control measures and prevention of future outbreaks. Prevention of future outbreaks depends on the information gathered during outbreak investigations to support recommendations for control measures either at the site of the outbreak or for implementation on an industry wide basis.

However, only a small proportion of the estimated 6.5 to 12.6 million cases of foodborne illness are reported. In addition, for a significant number of outbreaks that are investigated the etiologic agent, vehicle of transmission and contributing factors are never determined. Between 1983 and 1987, food handlers were listed as a contributing factor in 30 percent of outbreaks with a confirmed etiologic agent and for 26 percent of those for which the etiologic agent was undetermined.

Food handlers as a contributing factor in foodborne outbreaks will be reviewed by etiologic agent and food items associated with outbreaks. Two food outbreaks with food handlers as an important factor in the cause of the outbreak will be examined to illustrate the importance of the epidemiologic investigation in both determining the existence of an outbreak and identifying the contributing factors in the outbreak. Implications for control measures will also be discussed.

##### THE PEOPLE PROBLEM: FOOD EMPLOYEE HEALTH AND HYGIENE

CDR Charles S. Otto, III, Assistant Director for Technical Operations, USPHS/FDA, Retail Food Protection Branch, 200 C Street, SW - HFF-342, Washington, DC 20204-0001

Foodborne illness statistics and public perceptions are bringing renewed interest and emphasis on food employee health and hygienic practices. Current and proposed FDA Model Food Codes provide recommended standards on these critical areas of retail food protection. Hazard Analysis and Critical Control Point (HACCP) food safety principles can be incorporated in routine food establishment operations and inspections to minimize the "people problem."

##### A FOOD INDUSTRY VIEW OF THE PROBLEM AND COPING STRATEGIES

Robert E. Harrington, National Restaurant Association Technical Services Department, 1200 17th St., NW, Washington, D.C. 20036

Well-publicized outbreaks have refocused public and regulatory concern about the role of foodservice industries and food workers in prevention and control of foodborne illness. Employees are important factors as both direct transmitters and as potential *mis*-handlers. Controls should include meaningful training in the importance of correct procedures. The industry does not accept outbreaks casually, due to the devastating effects of direct and indirect costs, lost goodwill, and increased regulatory sanctions. The industry has a positive record of developing and practicing effective control strategies, in equipment, procedures, and employee training. However, the industry will continue to oppose attempts to impose controls which are not shown to be effective, or which are disproportionately focused at the retail/foodservice level. In the future, the industry will continue to upgrade employee programs to meet technological requirements.

##### FOOD SERVICE INDUSTRY VIEWS

Ed LeClair, Quality Assurance, Field and Regulatory Manager, Taco Bell Corporation, Southfield, MI

This meets the concerns of both public and health officials in regards to food safety. Customers are becoming more aware of foodborne illness issues and are demanding reassurance of food safety. To be truly successful, our customers must recognize sanitation programs as guaranteeing them safe food.

#### RETAIL FOOD MARKETING VIEWS: THE ROLE OF EMPLOYEES IN THE SPREAD OF FOODBORNE DISEASE

John W. Farquhar, Scientific and Technical Services, Food Marketing Institute, 1750 K Street, NW, Suite 700, Washington, DC 20006

Supermarkets are increasingly moving into the arena of food service. We're seeing a continuing trend toward the preparation of ready-to-eat foods in the stores, and these potentially hazardous products are being handled by an extremely transient work force.

Of particular importance is the need to convert these operations to a Hazard Analysis Critical Control Point (HACCP) based system of monitoring preparation, handling and merchandising. Other prerequisites to proper food quality/safety will also be reviewed, such as mandatory food handler training/certification, revisions to existing federal/state regulations (Unicode) and the lack of regulatory oversight of current inspection systems. Information from the new FMI Seafood HACCP Manual will be provided.

#### FOOD MICROBIOLOGY

##### THE EFFECTS OF STORAGE TIME AND TEMPERATURE ON THE GROWTH OF *SALMONELLA ENTERITIDIS* IN NATURALLY CONTAMINATED EGGS

Richard K. Gast\*, Microbiologist and C. W. Beard, USDA, ARS, Southeast Poultry Res. Lab, 934 College Station Road, Athens, GA 30605

Laying hens were experimentally infected with a phage type 13a strain of *Salmonella enteritidis* (SE). Three trials were conducted, using a total of 68 hens. Eggs laid by these hens were collected daily between the 4th and 14th days postinoculation and randomly allocated into 3 groups. One group of eggs was sampled for SE on the day of collection, one group was held for 7 days at 7.2°C before sampling, and one group was held for 7 days at 25°C before sampling.

Only 3% of the freshly laid eggs and 4% of the eggs held for 7 days at refrigerator temperature were identified as having SE-contaminated contents, whereas SE was isolated from the contents of 16% of eggs held for 7 days at room temperature. Enumeration of SE in contaminated eggs indicated greater numbers of SE in eggs held for 7 days at 25°C than in eggs from the other two groups, although most contaminated eggs in all groups contained relatively small numbers of SE (rarely exceeding 100/ml).

##### GROWTH AND PRODUCTION OF ENTEROTOXINS A AND D BY *STAPHYLOCOCCUS AUREUS* IN SALAD BAR INGREDIENTS AND CLAM CHOWDER

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Growth and production of enterotoxins A and D (SEA, SED) by two *Staphylococcus aureus* strains were determined in salad bar ingredients and clam chowder. Salad bar ingredients included lettuce, canned black olives, canned green olives, tomato, green pepper, blue cheese salad dressing, blue cheese crumbles, celery and croutons. Total *S. aureus* were determined by plate-count on Baird-Parker Agar. Enterotoxins were quantified using ELISA technique. *S. aureus* did not survive in the salad dressing, which had a pH of about 4.3. With the exception of black olives and blue cheese, *S. aureus* survived in all ingredients for more than 12 hrs. After 24 hrs. the total number of cells decreased in most of the ingredients. *S. aureus* grew well in green pepper during the first 24 hrs, reaching  $10^5$  cfu/g. However, no enterotoxins were found in green pepper. *S. aureus* also increased in moist and dry plain croutons, but there was no production of enterotoxins. *S. aureus* growth was excellent in clam chowder with cell counts exceeding  $10^8$  cfu/g after 12 hrs at 42°C. Production of SEA and SED began shortly after 3 hrs. Maximal levels of SEA and SED were 0.29 and 1.6 ng/g respectively after 12 hrs. The production of SE in BHI broth reached 21.9 and 36.3 ng/ml of SEA and SED respectively after 24 hrs at 37°C.

##### THERMAL RESISTANCE OF *LISTERIA MONOCYTOGENES* IN RAW LIQUID EGG YOLK

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The potential for *Listeria monocytogenes* contamination of raw egg yolk exists; the presence of Lm in poultry, on egg shells and in the environment of egg breaking facilities has been documented. Previous work indicates that Lm can be more thermally resistant than *Salmonella*. Further, growth of Lm in egg yolk stored within traditionally acceptable and safe temperature and time parameters (5-7°C and 7-12 days) has been demonstrated. This study was undertaken to assess the comparative thermal resistance of Lm and *Salmonella* spp. in raw egg yolk. Raw yolks from retail-purchased shell eggs were aseptically collected, pooled and homogenized. Yolks inoculated with a 48-hour culture of Lm Scott A or CA (Food Research Institute) were transferred in 1 ml aliquots to sterile 2 ml thin-walled glass ampules. The ampules were heated in a water bath to 57.2, 60.0 or 62.8°C and sampled at appropriate intervals. The samples were pour-plated on modified Oxford agar (Oxoid) and incubated. The ranges of D values observed were as follows: 144.2-151.5 seconds at 57.2°C; 55.1-101.3 seconds at 60.0°C; and 35.7-57.1 seconds at 62.8°C. These values are approximately 4 x greater than those reported recently for *S. enteritidis* and *S. typhimurium* in raw egg yolk. It is conceivable that the current processing parameters for raw egg yolk present an Lm risk concern.

##### THE USE OF BACTERIOCIN-PRODUCING *PEDIOCOCCUS* TO CONTROL POST-PROCESSING *LISTERIA MONOCYTOGENES* CONTAMINATION OF FRANKFURTERS

Elaine D. Berry\*, Graduate Student, R. W. Mandigo, and R.W. Hutkins, University of Nebraska, Lincoln, NE

The ability of a bacteriocin-producing *Pediococcus acidilactici* to control post-processing *Listeria monocytogenes* contamination of frankfurters was examined. Bacteriocin-producing *P. acidilactici* JD1-23 or its plasmid-cured derivative JD-M and a five-strain composite of *L. monocytogenes* were inoculated onto fully processed frankfurters. Without added pediococci, *L. monocytogenes* on vacuum-packaged frankfurters held at 4°C grew from an initial level of  $10^4$  CFU/g to a final level of  $10^6$  CFU/g over 60 d. Under the same conditions, high levels ( $10^7$  CFU/g) of either pediococci strain inhibited growth of *L. monocytogenes* up to 60 d, although no reduction of cells occurred. With low levels of pediococci ( $10^3$ - $10^4$  CFU/g), *Listeria* grew, although lag time was increased on frankfurters inoculated with JD1-23. In additional experiments done at 4°C and 15°C under aerobic and anaerobic (vacuum-packaged) conditions, results indicated that the bacteriocin-producing *Pediococcus* gave an additional protective effect against *Listeria* growth on frankfurters stored aerobically and at elevated temperature.

##### ANTIBACTERIAL EFFECT OF SELECTED NATURALLY OCCURRING CHELATING AGENTS ON *LISTERIA MONOCYTOGENES*

Dr. Michael C. Cirigliano\*, Manager and Principal Microbiologist/Microbiology Services and P. J. Rothenberg, Thomas J. Lipton Company, 23 Seventh Street, Cresskill, NJ 07626

The growth of *Listeria monocytogenes* (Lm) is reported to be enhanced by iron. The Listeriostatic effects of lactoferrin and lysozyme with EDTA have also been shown. We compared the Lm inhibitory effects of 4 naturally occurring chelating agents, i.e. lactoferrin, beta-lysin, conalbumin and phytate, as well as EDTA, (with and without lysozyme) using the agar gel disc diffusion method. Tryptic Soy Agar (pH 7.1) seeded with cells from stationary phase cultures of Lm strains Scott A and CA, was overlaid on a pre-poured Tryptic Soy Agar base with and without lysozyme (100 ppm). Various levels of purified test reagent were aseptically applied to sterile Taxo discs (BBL) and dried. The discs were transferred to test agar plates, incubated at 23°C, and examined for zones of inhibition. All 5 chelating agents exerted an inhibitory effect that was further enhanced by lysozyme. Both Lm strains were equally sensitive. Phytate, conalbumin and lactoferrin had the greatest inhibitory effect. Beta-lysin was also very effective, more so with lysozyme. EDTA was the least effective. The relative ability of the chelating agents with high iron binding specificity to significantly inhibit Lm outgrowth substantiates the importance of the Lm iron requirement for growth and suggests that these agents might serve as natural Lm antimicrobials in food.

## INHIBITION OF *LISTERIA MONOCYTOGENES* BY FATTY ACIDS

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The objective of this study was: (1) to determine the *in vitro* susceptibility of *Listeria monocytogenes* to fatty acids commonly present in bovine milkfat, and (2) to develop an antimicrobial system based on fatty acids for inhibition of *L. monocytogenes* in foods. In our preliminary screening of the effect of various fatty acids and monoglycerides on the growth of *Listeria monocytogenes* in Brain Heart Infusion broth (BHI) at pH 6.0, we found that monolaurin, C12:0, C18:2, CLA (conjugated dienoic isomers of linoleic acid) and C18:3 at the concentration of 10 ppm, 20 ppm, 200 ppm and 200 ppm, completely inhibited *L. monocytogenes* for 6 days at 37°C. At pH 5.0, *L. monocytogenes* was more sensitive to fatty acids at pH 5.0 compared to pH 6.0. In whole milk and skim milk, CLA had a bacteriostatic effect on *L. monocytogenes*. The length of the lag period was proportional to the concentration of CLA, and at concentrations of 50 ppm, 100 ppm, 200 ppm and 300 ppm, the lag periods were 5 hr, 9 hr, 20 hr and 48 hr, respectively, at 30°C. CLA (100 ppm) extended the lag phase for 8 days at refrigeration temperature. CLA (100 ppm) in combination with various antioxidants including BHT, BHA, alphatocopherol and ascorbate (100 ppm) further extended the lag phase of *L. monocytogenes* in milk. In comparison, monolaurin was bacteriocidal at low temperature (4°C) in skim milk, but did inhibit *L. monocytogenes* in whole milk. Our results suggest that fatty acids could be used as inhibitory agents against *L. monocytogenes* in foods.

## FACTORS IN THE CONTAMINATION OF BEEF TISSUE SURFACES BY *SALMONELLA TYPHIMURIUM* WHICH MAY INFLUENCE THE ANTIBACTERIAL ACTION OF ACETIC ACID

James S. Dickson, Research Food Technologist, USDA-ARS, Roman L. Hruska U.S. Meat Animal Research Center, P.O. Box 166, Clay Center, NE

Beef tissue surfaces were artificially contaminated with *Salmonella typhimurium* and then sanitized with 2% acetic acid. The reduction in bacterial population by the acid treatment was consistently proportional to the initial inoculum level for both tissue types. Increasing the amount of organic material in the inoculating menstra reduced the bacteriocidal effects of acetic acid on *Salmonella typhimurium* on fat tissue, although there was no change in effectiveness on lean tissue. Acid treatment sublethally injured approximately 65% of the population on both lean and fat tissue, and the residual effects of the acid resulted in a 1 log cycle reduction in bacterial population on fat tissue over 4 hr.

## EFFECTS OF INGREDIENTS ON THE SURVIVAL OF *CAMPYLOBACTER JEJUNI* IN PROCESSED TURKEY HAM

C.A. Hwang\*, Graduate Student, F.A. Draughon, B.J. Lee, H.D. Loveday and M.J. Riemann, Dept. of Food Technology and Science, University of Tennessee, Knoxville, TN 37901

The effects of selected levels of sodium chloride (1.5-2.5%), sodium erythorbate (0 and 550 ppm), and sodium tripolyphosphate (STPP) (0 and 0.5%) on the survival of two strains of *Campylobacter jejuni* and growth of spoilage bacteria were studied in vacuum and aerobically packaged turkey hams held at 4°C. As salt levels increased, the survival of campylobacters decreased significantly ( $p < 0.05$ ). A salt level of 2.0% and 2.5% resulted in optimal inhibition of campylobacters. The highest salt level (2.5%) in combination with erythorbate and STPP significantly ( $p < 0.05$ ) reduced survival of campylobacters. Survival of *C. jejuni* under vacuum packaging was significantly greater ( $p > 0.05$ ) than under aerobic packaging. Aerobic packaging of sliced turkey hams containing 2.5% NaCl reduced *C. jejuni* from approximately  $10^{6.0}$  CFU/g to below detectable limits with 6 days at 4°C.

## INFLUENCE OF MODIFIED ATMOSPHERE STORAGE ON THE COMPETITIVE GROWTH OF *LISTERIA* AND *PSEUDOMONAS* ON CHICKEN

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The purpose of this study was to determine the effects of modified atmosphere packaging (MAP) on the competitive growth of *Listeria monocytogenes* and *Pseudomonas fluorescens* on precooked chicken nuggets during refrigerated storage. The two organisms were inoculated on nuggets which were then stored under air or two high-CO<sub>2</sub> modified atmospheres (MA<sub>1</sub> or MA<sub>2</sub>) at 3, 7, and 11°C. The growth of *P. fluorescens* was inhibited by MAP to a greater extent than was *L. monocytogenes*. The effectiveness of MAP decreased with increasing temperature. Little difference was observed between MA<sub>1</sub> and MA<sub>2</sub> on the inhibition of growth of the two organisms when grown alone. However, when the two organisms were grown in mixed culture at 3°C, the growth of *L. monocytogenes* was stimulated by the presence of *P. fluorescens* in air and MA<sub>1</sub> but not MA<sub>2</sub>. This growth stimulation was not observed at the higher temperatures. *P. fluorescens* was generally not affected by the presence of *L. monocytogenes*. We conclude that under MAP conditions, *L. monocytogenes* could grow to large numbers prior to evidence of spoilage.

## METHODS FOR SELECTIVE ENRICHMENT OF *CAMPYLOBACTER* SPECIES FROM POULTRY FOR USE IN CONJUNCTION WITH DNA HYBRIDIZATION METHOD

N.J. Stern\*, Ph.D., Research Microbiologist and M.A. Mozola, Russell Research Center, USDA-ARS, Athens, GA

A DNA hybridization test initially described for use with human fecal specimens is being investigated for application to the detection of *Campylobacter* species in poultry samples. The test chemistry involves solution phase hybridization and detection by means of an enzymatically generated colorimetric endpoint. DNA probes used in the test system are targeted to unique sequences of ribosomal RNA and are specific for *C. jejuni*, *C. coli*, *C. lariidis* and *C. fetus* subsp. *fetus*. Initial experiments with pure cultures of *C. jejuni* have established the sensitivity limit of the DNA hybridization assay at approximately  $1 \times 10^6$  cells per ml. Results of experiments designed to define optimal conditions for recovery and selective enrichment of *Campylobacter* from poultry samples for use in conjunction with the DNA hybridization assay will be presented.

## THE EFFECTS OF IONIZING RADIATION ON MOLLUSCAN SHELLFISH

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A three to four log cycle reduction in bacterial numbers was observed upon exposure of oysters to ionizing radiation (60Co) at 1.0, 2.0, and 5.0 kilograys. The shelflife of irradiated oysters was also monitored. Fifty percent of the irradiated oysters were dead within 12, 10 and 7 days at 1.0, 2.0 and 5.0 kilograys of exposure, respectively. Cultures of virulent and non-virulent *Vibrio vulnificus* were quite radiosensitive as no colony forming units could be detected after 0.5 kilogray exposure.

## RESTRICTION ENZYME ANALYSIS OF CLINICAL ISOLATES OF *LISTERIA MONOCYTOGENES*

Irene V. Wesley, Microbiologist, USDA-ARS-National Animal Disease Center, 2300 Dayton Road, Ames, IA 50010

The goal of this study was to compare the restriction enzyme (RE) pattern of epidemiologically paired isolates of *L. monocytogenes*. Six sets of isolates from patients and food, including raw hamburger, ground pork, cottage cheese and jack cheese were examined. After Hha I digestion, the RE pattern of each patient isolate matched that of the incriminated food isolate. In one case, the RE pattern of a patient strain matched that of 3 of 14 isolates made from turkey frankfurters, which was incriminated in transmission. In addition, 3 pairs of *Listeria* isolates from mother-baby pairs were examined. After Hha I digestion, the maternal and neonatal RE pattern within each set matched, although each pair could be distinguished. One set of isolates, recovered from a suspect case involving human to canine transmission, however, exhibited an RE profile and CAMP test pattern of *L. innocua*. Taken together, these data support the use of RE profiling in epidemiological investigations of sporadic cases of listeriosis.

## FOOD SERVICE

### A PRACTICAL VIEW OF THE SOUS VIDE ISSUE FROM A FOOD SERVICE PERSPECTIVE

Cindy Holden, Quality Assurance Director, Shoney's, Inc., 1727 Elm Hill Pike, Nashville, TN 37210

Sous vide and in general controlled/modified atmosphere packaging (CAP/MAP) has received national attention. There has been a tremendous amount of data and information gathered and reported. The National Advisory Committee on Microbiological Criteria has established specific guidelines for sous vide manufacturers.

Mixed feelings are held by many in the food service industry. With the advent of sous vide, we (food service) may now serve a higher quality product, with half the labor force and lower equipment costs than conventional foods. However, we are also aware of the need for greater food science knowledge and training and distribution systems with adequate and affordable time/temperature indicators.

The advantage of the sous vide system coupled with advances in technology will eventually exceed our present concerns. Nutrition conscious baby boomers will influence food trends in the 1990's. As always, education of the consumer will play a key role in the success of CAP/MAP.

### FOOD SERVICE SANITATION CERTIFICATION TRAINING-THE WHYS AND HOWS

Paulette A. Gardner, SaniSafe & Associates, Inc., 4047 Rutgers, Northbrook, IL 60062

This paper focuses on the need for training and certification for foodservice managers and supervisors in sanitation. Such certification must become mandatory. Cases of foodborne illness are constantly making headlines. Foodborne illness costs the industry billions of dollars each year.

A 15 hour course covering the basics of foodborne disease and protection, sanitary facilities, food handling and management should become the minimum standard throughout the United States. Testing for proficiency should be standardized so reciprocity is available.

Certification will give professionalism to the industry. Knowledge will reduce the risk of foodborne illness.

### A SELF CARE ACTION PROGRAM (SCAP) APPLIED TO FOOD SERVICE ESTABLISHMENTS

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The Self Care Action Program (SCAP) is an effective voluntary self inspection format utilizing human proficiency and skill in managing the food related health services provided by the food service operator in a food service establishment. It will minimize errors: abusive, wasteful and faulty, of all personnel involved in the food service and related work place activities. It is intended to improve the customers health at the food consumption point which is a primary health care site.

This paper reviews the current regulatory and non-regulatory practices applied in a food service establishment and examines the major components of SCAP which include customers health status, food substances and the food environment. Finally, it discusses the format for implementation by constructing an activity diagram which include areas such as customers food intake (needs assessment), food service operators (human skill management design), menu determination, food environment control and food substance evaluation, all of which influence the customers health and well being.

### A NATIONAL SURVEY OF CONSUMER HOME FOOD PREPARATION PRACTICES

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A comprehensive 49-question survey was developed to assess consumer home food preparation practices, attitudes and perceptions of home food safety issues, as well as consumer usage and confidence in home safety information. The survey instrument was validated through a panel of food safety experts and a pretest involving 100 local households. The validated survey instrument was then sent to 2,000 randomly selected households in the

United States. Data from returned questionnaires was coded and entered into a computer for statistical analysis. The comprehensive survey results will be presented and discussed in this presentation.

### WHO PARTICIPATES IN VOLUNTARY RECYCLING PROGRAMS AND WHY?

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A study of 783 Marion County (Indianapolis), Indiana residents was conducted to determine if there are measurable demographic and behavioral differences between people who participate in a voluntary materials recycling program and those who do not.

Intrinsic reasons, such as concern for the environment (81%) and to fight litter (45%) were the overwhelming motivators for participating in a voluntary recycling program. Inadequate space to store recyclables (31%) and inaccessibility of recycling centers (25%) were the reasons most frequently given for not recycling. Chi-square tests showed no significant relationship, at the .05 level, between recycling behavior and income and education levels, awareness of the solid waste crisis, and willingness to perform source separation if curbside pickups were available.

## MICROBIOLOGICAL METHODS

### ISOLATION OF *CLOSTRIDIUM PERFRINGENS* BY AEROBIC AND ANAEROBIC PROCEDURES FROM GROUND BEEF

Mohammad S. Ali\*, Graduate Student and Daniel Y.C. Fung, 264 Weber Hall, Kansas State University, Manhattan, KS 66506

Two procedures for isolation of *Clostridium perfringens* from ground beef were compared: aerobic procedure used routinely for isolation of *C. perfringens* from foods and another anaerobic procedure, in which all bacteriological procedures are performed inside the Anaerobic Glove Box. Twelve ground beef samples inoculated with three strains of *C. perfringens*, 16 ground beef samples incubated at 23°C for 24 hr, and 41 fresh ground beef samples were compared by these procedures. Fung's Double-tube method was used for enumeration of *C. perfringens* from these samples. Inoculated and incubated samples did not show any significant difference in *C. perfringens* counts enumerated by either procedure. Among 41 fresh ground beef samples, 21 (51%) samples were positive for *C. perfringens* by the anaerobic procedure and 20 (49%) by aerobic procedure. It was concluded that the conventional aerobic procedure was adequate for enumeration of *C. perfringens* from ground beef samples.

### RECOVERY OF MICROORGANISMS FROM GROUND BEEF BY HOMOGENIZING WITH HAND ROLLER OR STOMACHER

Mohammad S. Ali\*, Graduate Student and Daniel Y.C. Fung, 264 Weber Hall, Kansas State University, Manhattan, KS 66506

A new method for homogenizing a ground beef sample was used and compared to conventional method using a stomacher in recovering microorganisms. The new method consisted of putting sample and diluent in a stomacher bag, and rolling the roller over the bag for 2 minutes. The recovery of microorganisms was determined by aerobic plate counts (APC) and enumeration of *Clostridium perfringens* from 10 fresh ground beef samples. *Clostridium perfringens* were also enumerated from ten samples incubated at 23°C for 24 hr and 12 samples inoculated separately with three strains of *Clostridium perfringens*. There are no differences in the APC and *Clostridium perfringens* counts in fresh, inoculated and incubated ground beef samples using the hand roller and stomacher methods. The roller method has several advantages over the stomacher method of homogenizing including simplicity and reduced cost, easy to use in an anaerobic glove box, easier for field use, and less danger of polyethylene breakage during homogenization.

### A DIFFERENTIAL-SELECTIVE MEDIUM AND SIMPLE ATMOSPHERE FOR RECOVERY OF *CAMPYLOBACTER JEJUNI*

N.J. Stern\*, B. Wojton and K. Kwiatek, Richard Russell Agricultural Research Center, USDA-ARS, POB 5677, Athens, GA 30613

We developed a productive, selective-differential medium for isolation of *Campylobacter jejuni* from chicken carcasses. The medium (Campy-Cefex; CC) consisted of Brucella agar, 5% lysed horse blood, 0.05% ferrous sulphate, 0.05% sodium pyruvate, 0.02% sodium bisulfate and antibiotic supplements of 35 mg/l sodium cefoperazone and 200 mg/l of cycloheximide. A total of 41 chicken carcasses were rinsed, and samples were plated onto CC, CCDA and Campy-BAP media. CC proved as productive and selective as the other media. By reading plates for translucent colonies, CC allowed for easier differentiation of *C. jejuni* from breakthrough flora. We also tested 7 isolates of *C. jejuni* in microaerobic (5% O<sub>2</sub>, 10% CO<sub>2</sub>, 85% N<sub>2</sub>) and dry ice generated atmospheres. The mean log<sub>10</sub> cfu generated, using the same cultures and medium, were 2.07 and 1.81 for the microaerobic and dry ice atmospheres, respectively. These two developments allow for simplification of materials and methods required to isolate *C. jejuni* from foods.

#### OPTIMIZED ENRICHMENT METHODS AND SELECTIVE MEDIA FOR RECOVERY OF *CAMPYLOBACTER JEJUNI* FROM BROILER CHICKEN CARCASSES

Eric Line\* and N.J. Stern, Food Science Dept., University of Georgia, Griffin, GA

We compared three enrichment methods (Doyle & Roman, 1982; Park & Sanders, 1989; Hunt & Radle [FDA], unpublished), with different sampling times (mid- and end-point incubation) and various dilutions of enrichment culture for productivity in the isolation of *Campylobacter jejuni* from 50 retail chicken carcasses. Using the above indicated enrichment cultures, we subcultured onto three *Campylobacter* selective media (Campy-BAP—[Blaser et al., 1979]; CCDA—[Bolton et al., 1984]; and CC—[Stern et al., 1990]) to compare yields of the organism. The highest yield (43/50) of *C. jejuni* from these carcasses was derived by using the 24 h enrichment culture of Hunt & Radle diluted 1:100 before plating onto any of the three selective plating media. When all carcass analyses were combined, *C. jejuni* was recovered from 49 of 50 broilers. This study indicates the optimum approaches for the recovery of *C. jejuni*, as well as the high incidence of the organism in broiler carcasses.

#### SPOILAGE RATE COMPARISONS FOR GROUND TURKEY AND GROUND BEEF

N.J. Stern\*, C.E. Lyon, M.T. Musgrove, J.A. Dickens and R.L. Wilson, Richard Russell Agricultural Research Center, USDA-ARS, POB 5677, Athens, GA 30613

We compared the spoilage rates of ground turkey and ground beef. Clean muscle tissue of the two livestock species were ground in a hygienic manner, providing initial mesotrophic counts (72 h at 25°C) in the range of ca. 10<sup>2-3</sup> cfu/g. Moisture, fat and protein content for the ground products were similar. Each ground product was subjected to the following treatments: 1) uninoculated controls, 2) low level of turkey flora, 3) high level of turkey flora, 4) low level of beef flora, 5) high level of beef flora. Three replicate analyses were performed on the products, held at 5°C in air-permeable plastic bags, using five subsamples (20-25 g) for each of the 5 analysis times over 10 days of storage. At completion of storage, bacterial counts varied from 10<sup>1.5</sup> to 10<sup>9.2</sup> cfu/g, with the turkey control product at the lower end of the range. Our findings indicate no significant difference between the spoilage rates of the two ground products, regardless of treatment or origin of species.

#### COMPARISON OF METHODS FOR MOLECULAR EPIDEMIOLOGY OF *LISTERIA MONOCYTOGENES*

Andrea O. Baloga\*, Research Assistant and S.K. Harlander, University of Minnesota, Department of Food Science & Nutrition, 1334 Eckles Avenue, St. Paul, MN 55108

DNA fingerprinting and ribosomal RNA typing procedures were developed for classification and molecular epidemiological analysis of *Listeria monocytogenes* implicated in foodborne illness outbreaks. Total cellular DNA from over 100 strains of *Listeria* was digested with the restriction endonuclease *Hind*III. Following agarose gel electrophoresis, DNA fragments were subjected to Southern blot hybridization with a digoxigenin-labeled cDNA probe transcribed from *Escherichia coli* 16S and 23S rRNA. Banding patterns were used for typing 28 clinical isolates, five of which were epidemiologically related product-patient pairs from four independent outbreaks. Ribotyping differentiated *L. monocytogenes* from other *Listeria* spp.

as well as other foodborne contaminants. DNA fingerprinting is a relatively simple and reproducible method which is more discriminatory than ribotyping, serotyping, and multilocus enzyme electrophoresis for epidemiological tracking of *Listeria* spp.

#### EVALUATION OF REAGENTS FOR USE IN RAPID METHODS OF ANALYTICAL FOOD MICROBIOLOGY

P.I. Peterkin\*, Research Scientist, A.N. Sharpe and E. Todd, Bureau of Microbial Hazards, Health Protection Branch, Tunney's Pasture, Ottawa, Ontario, Canada K1A 0L2

An automated method has been developed for the evaluation of molecular reagents useful in rapid methods of analytical food microbiology, against a large number of species or strains. The system is based on the use of the hydrophobic grid-membrane filter (HGMF), and a commercial image-analyzer, the HGMF Interpreter. Examples discussed will include the evaluation of indoxyl- $\beta$ -D-glucuronide for the enumeration of *Escherichia coli*, the evaluation of polyclonal and monoclonal antibodies for a *Salmonella*-specific reagent, and the screening of DNA sequences during the development of a DNA probe for *Listeria monocytogenes*.

#### DEVELOPMENT OF AN ENZYME-LINKED ANTIBODY PROCEDURE FOR DETECTION OF *SALMONELLA* USING HYDROPHOBIC GRID MEMBRANE FILTERS.

Ewen Todd\* and J. MacKenzie, Bureau of Microbial Hazards, Health Protection Branch, Sir Frederick G. Banting Research Centre, Ottawa, Ontario, K1A 0L2, Canada

A library of 586 serovars of *Salmonella* representing 11 sero groups on hydrophobic grid membrane filters (HGMFs) was used to determine the best of 46 monoclonal and polyclonal antibodies to *Salmonella*. For polyclonals no pretreatment was necessary, but for the monoclonals boiling HGMFs for 10 s at either pH 1 or 13 was essential to expose the appropriate epitopes. After staining the HGMFs with an enzyme-linked antibody (ELA) procedure, two antibodies showed great promise for detecting *Salmonella* strains. These were then used for isolation of *Salmonella* from foods using non-selective pre-enrichment, followed by enrichment with tetrathionate brilliant green at 35°C, filtration of dilutions through HGMFs, and incubation of these on EF18 medium overnight. After replication of the incubated HGMFs the originals were tested by ELA. If any grid cells were stained, corresponding colonies were picked from the replicate HGMFs grown on Hektoen agar.

Of 117 food, feed and environmental samples tested (28 artificially inoculated) 51 were positive by both the HPB culture method and the ELA method. Therefore, the sensitivity of our method is at least comparable with the present culture procedure. In addition, presumptive reactions are obtained earlier, false positives are fewer and the picking of positive colonies easier.

#### MONITORING THE HYGIENIC STATUS OF SURFACES

J.T. Holah, Campden Food and Drink Research Association, Chipping Campden, Glos. U.K.

The requirement in the food industry for an assessment of the hygienic status of surfaces in a time relative to process control has led to the development of rapid methodology. Such techniques include direct epifluorescent microscopy (DEM), the direct epifluorescent filter technique (DEFT) and the measurement of ATP, from both microbial and total sources. The accuracy of these rapid methods was compared to traditional techniques including swabbing and contact plates (both laboratory prepared and commercial kits) by assessing each method's ability to enumerate population ranges of bacteria grown as biofilms on stainless steel surfaces. Results showed that DEM was easily the most accurate and all other techniques were therefore compared to this method. Traditional techniques were shown to be accurate at surface populations of >10<sup>5</sup> bacteria/cm<sup>2</sup> and were therefore only useful in estimating gross surface contamination. The variation for these techniques at population levels likely to be found after cleaning was generally  $\pm$  2 log orders. The swabbing based rapid methods DEFT and ATP, were shown to be no less accurate than traditional techniques, but have the advantage of producing a result in minutes. The practical attributes of the various techniques assessed is also discussed.



## A COMPARISON OF CALIBRATION DATA FOR CONDUCTANCE MICROBIOLOGY USING SPIKED MARGARINE AND DAIRY PRODUCTS AND NATURALLY CONTAMINATED PRODUCTS

Barry Vermilyea, Jeanine Wellinghoff\*, Debbie Belden and Donna Knox, Land O'Lakes Spreads Operations, 2001 Magadore Road, Kent, OH 44240

A method for the rapid quantitative detection of aerobic flora and Enterobacteriaceae in margarine, butter and pasteurized cream utilizing automated, conductance monitoring was studied. Successful use of automated, conductance methods require extensive comparisons of results obtained by this technique with conventional agar plating methods. To ensure a broad range of CFU values for calibration purposes, samples of butter, margarine and pasteurized cream were spiked with populations of naturally occurring aerobic flora as well as specific Enterobacteriaceae species. The correlation coefficient (r-value) between conventional agar plating and automated conductance values in naturally contaminated samples was 0.90. Using pass/fail values of <100 CFU/gm for Enterobacteriaceae and <5000 CFU/gm for aerobic flora, 6-15 hours respectively were required for detection using the conductance methods.

## GROWTH CHARACTERISTICS OF 228 SALMONELLA ISOLATES IN TETRATHIONATE BRILLIANT GREEN BROTH, M BROTH, AND MN BROTH AT 35°C AND 42°C

Michael S. Curiale\*, Dawn McIver, Theresa Sons, Luanne M. Fanning, Wendy Lepper, Dwayne Ford, Kim M. Rowe, David J. Evanson, Russell S. Flowers, Silliker Laboratories, Inc., 1304 Halsted Street, Chicago Heights, IL 60411

Incubation temperatures of 41-43°C have been proposed for the selective enrichment culture step for several of the rapid *Salmonella* methods. The higher temperature improves the selectivity of the medium. For cultural isolation the ratio of viable salmonellae cells to competitor cells is of greater importance than cell density, thus selectivity is of greater value than growth promotion properties. However, the rapid methods require high cell density, in addition to a favorable ratio, for detection. These methods generally employ a short selective step followed by a longer nonselective step to achieve detectable levels. Detectable levels for this study were defined as  $1 \times 10^6$  viable cells per ml based on the typical sensitivities of the rapid methods. Two hundred and twenty-eight common and uncommon *Salmonella* strains were cultured at 35°C and 42°C for determination of viable count. In M broth incubated at 35°C or M broth with 10 µg/ml novobiocin incubated at 42°C, all 228 isolates achieved the detectable level within 24h. In tetrathionate brilliant green, 16% of the strains either failed to grow in the medium or were highly variable. To determine maximum growth temperatures, some of the strains were cultured at 35, 37, 39, 41, 43 and 45°F in tetrathionate brilliant green broth. Higher cell titers were obtained for 41°F cultures than for 43°F cultures and no growth was observed at 45°F. Results suggest that the incubation in nonselective medium at elevated temperatures is acceptable, but incubation in tetrathionate enrichment for 24h above 41°F may be counterproductive.

## COMPUTERS IN FOOD PROTECTION

### FDA'S NEW ELECTRONIC INSPECTION SYSTEM AND FDA PRIME CONNECTION

CDR Charles S. Otto, III, Assistant Director for Technical Operations, USPHS/FDA, Retail Food Protection Branch, 200 C Street SW - HFF-342 Washington, DC 20204-0001

A new integrated electronic inspection system for food protection programs is being developed for FDA. Based on the new retail-level food protection code, this system provides for management of food establishment data, on-site data entry and generation of a distinctive report. The integrated system has unique features which provide for establishment risk analysis to determine optimum allocation of inspection resources. The FDA PRIME CONNECTION, through toll free or local calls, provides electronic access to retail food protection, milk safety, shellfish sanitation and other technical materials issued by the Center for Food Safety and Applied Nutrition.

### EPI INFO VERSION 5.0

Kevin Sullivan, Centers for Disease Control, 1600 Clifton Rd. MS C08, Atlanta GA 30333

Epi-Info is a "Word Processing, Database, and Statistics System for Epidemiology on Microcomputers." This public domain, IBM microcomputer-compatible software package has been developed through the collaboration of the Centers for Disease Control and the World Health Organization, with 10,000 copies distributed in over 70 countries. Using this software an investigator can develop a questionnaire, enter the data onto computer, analyze the data, and write a report. In addition, the software allows for more complex database applications (e.g., relational database features) and epidemiologic analyses. In this presentation various features of Epi Info are demonstrated using sanitation-related examples. Information on how to obtain the software is also provided.

## NATIONAL PARK SERVICE, PUBLIC HEALTH AND COMPUTERS

Capt. Allen W. Kingsberry, Director of Public Health, National Park Service/USPHS, Washington, DC

PC's and laptop computers are invaluable to the NPS Public Health Program. They are used for word-processing, databases, and food-service inspections. Battery-operated computers and printers make field inspection work faster and easier. In addition to food inspections (Foodspex System), databases are maintained for drinking water and for radon in NPS Housing.

## INDUSTRY APPLICATIONS OF COMPUTERS IN FOOD PROTECTION

Tom Chestnut, Dee Clingman and Bennett Armstrong\*, Manager, Quality Assurance, General Mills Restaurants, Inc., P.O. Box 593330, Orlando, FL 32859-3330

In developing the Computerized Inspection Program for our Quality Assurance staff, three objectives were established:

1. To develop a means to deliver to restaurant management the most legible, and consistent quality assurance report that would allow them to follow-up on food safety and sanitation concerns effectively.
2. To implement a telecommunications program to provide a means to transfer information and reports to the Corporate office, and to provide communication links between all Quality Assurance Managers (recalls, reporting, Interpretations, ECT.) throughout the North American Hemisphere.
3. To implement a computer system that could be further expanded to incorporate program management functions. This would include tracking restaurant reports by Quality Assurance Managers, specific operational divisions, and to tabulate food safety trends that need to be addressed on a Corporate, Divisional, or Regional level.

After printing the report, all the inspection information is "saved" onto floppy disks. Weekly the computer is "backed-up" using the software program to save the information. Monthly a disk is sent to the Corporate office.

In addition to the daily accessibility and communications that are utilized in the Telemail package, we have developed several forms that are used within the Telemail software. (Schedules, Supplies, and Activity reports, to mention a few).

Advantages are positive responses from restaurant operations on the clarity, accuracy, and consistency. From a management standpoint it has given us significantly more consistency among and between Quality Assurance Managers. The telecommunications system has offered us unsurpassed timeliness of reports and other administrative functions. Disadvantages are initial costs of equipment, maintenance, and insurance.

The computerized inspection report has offered us a superior means to communicate, educate, and motivate restaurant management to improve food safety and sanitation conditions in each restaurant.

## THE POWER OF PERSUASION

Paul Sisk, Software Publishing Corporation, 111 East Touhy Ave. #460, Des Plaines, IL 60018

An entertaining and informative look at business presentation preparation and the power of a persuasive message headline the briefing offered by Software Publishing Corporation. Our speaker, Paul Sisk, will present an exciting program using techniques found in Harvard Graphics and the SPC family of products.

Emphasis will be placed on getting your message across by utilizing the

appropriate forms of graphics including charts, drawings, and screenshow abilities found within your personal computer.

## PERSPECTIVES ON AMERICAN AND EUROPEAN FOOD PROTECTION ISSUES

### MICROBIOLOGICAL FOOD SAFETY-AN OVERVIEW OF THE EUROPEAN ISSUES

Dr. M.F. Stringer, Campden Food and Drink Research Association, Chipping Campden, Gloucestershire, England GL55 6LD

During the past five years there has been tremendous growth in the European food market with a vast range of products available to the consumer through retail and catering outlets. This overview paper will provide an up-to-date appraisal of the microbiological food safety issues in Europe with respect to legislation and codes of manufacturing practice. Emphasis will be given to:

1. **MICROORGANISMS:** particularly the emerging pathogens capable of growing at low temperatures; the major UK and European initiatives on predictive microbiology.
2. **NEW AND NOVEL PROCESSING TECHNOLOGIES:** the current issues with respect to pasteurization and low-heat treatment processes; microwaves; sous-vide; aseptic and ohmic heating.
3. **SHELF-LIFE AND TEMPERATURE CONTROL IN THE FOOD CHAIN:** requirement for shelf-life assessment; temperature control legislation.
4. **QUALITY MANAGEMENT:** appraisal of the requirements associated with quality control/assurance procedures, inspection and quality management systems such as BS 5/50/EN 29000/ISO 9000 with particular emphasis on product liability and due diligence.

### THE NATIONAL ACADEMY OF SCIENCES REPORT ON SEA-FOOD SAFETY

Cameron Ray Hackney\*, Associate Professor, and the Committee on Evaluation of Safety of Fisheries Products, Virginia Polytechnic Institute and State University; Dept. of Food Science, Blacksburg, VA 24061

The overall conclusion of the NAS study is that most seafoods available to the U.S. public are wholesome and unlikely to cause illness. However, as with any food, areas of risk do exist. For the most part, these risks were associated with specific practices or species harvested from specific locations. The major risk of acute illness is associated with the consumption of raw bivalves, ciguateric fish from tropical reefs and temperature abused dark fleshed finfish species. One fifth of the seafood consumed in the U.S. is derived from recreational or subsistence fishing, which is not subject to health based controls. Over half of the seafood consumed is imported and it is important that domestic and imported products have the same level of control. Most current health risks (acute and chronic) associated with seafood originate in the environment and cannot be identified by organoleptic inspection. Inspection at the processing level will not greatly reduce risks; control of risk should be at the point of harvest. Any inspection system should be based on the HACCP concept and be at the state level.

### ISSUES AND ACTIVITIES FACING THE NATIONAL CONFERENCE ON FOOD PROTECTION

Ellen Thomas, Vice Chair, Conference for Food Protection, Kraft General Foods, 801 Waukegan Road, Glenview, IL 60025

The Conference for Food Protection is an organization structured to allow regulators, academicians and industry to identify concerns, and develop and implement practices which ensure food safety.

### THE NATIONAL CONFERENCE ON INTERSTATE MILK SHIPMENTS-MILK SAFETY ISSUES AND ACTIONS

Alfred R. Place, Chairman, NCIMS, New York State Department of Agriculture & Markets, Albany, NY 12235

The National Conference on Interstate Milk Shipments is a Federal-State Cooperative Program for Certification of Interstate Milk Shipments. It plays a key role in the nation's milk safety program and in facilitating

movement of milk in interstate commerce. The conference actions to deal with the issue of animal drug residues in milk have been important in assuring consumer confidence that milk is safe.

### RAPID METHODS FOR SALMONELLA: GLUT OR GLUTTONY

### CONCEPTS AND CONSIDERATIONS IN DESIGN AND DEVELOPMENT

Russell S. Flowers, Ph.D., President, Silliker Laboratories, 1304 Halsted Street, Chicago Heights, IL 60411

The genus *Salmonella* is a large and diverse group of organisms consisting of over 2,000 serovars and many different biotypes. Further, the genus *Salmonella* is very closely related to other genera in the family *Enterobacteriaceae*, with both biochemical and antigenic similarities. First, methods for detection must detect the variety of salmonellae and a minimum of non-salmonellae. Second, the methods must be sensitive, allowing detection of the lowest number of organisms that can be detected by a reference culture method. Sensitivity, inclusivity, and specificity (exclusivity) are essential and should be validated prior to beginning comparative studies against a reference method. Other desirable characteristics include timeliness, user friendliness, low cost, and provision for automation and data acquisition by computer.

### EVALUATION AND VALIDATION: THE AOAC COLLABORATIVE STUDY PROCESS

Geraldine Allen, US Food and Drug Administration, 200 C Street, SW, Washington, DC 20204

Numerous methods for the rapid detection of *Salmonella* are now on the market. Occasionally, some of these methods, available as rapid test kits, are marketed without a rigorous comparison to existing official methods. There are so many of these methods that standardization and comparison are essential. One organization providing a vehicle for this standardization of microbiological, as well as other analytical, methods is the Association of Official Analytical Chemists (AOAC). This independent, international organization has the primary objective of testing and validating methods of analyses. The mechanism by which a method is validated by the AOAC is the collaborative study. The steps involved in this validation process will be presented. Moreover, pitfalls to be avoided, both before and after AOAC approval, will be discussed. Although the collaborative study is a time-consuming and costly undertaking, the advantages of using AOAC-approved methods will be provided.

### RAPID METHODS APPLICATIONS: FACTS AND FALLACIES

Nelson A. Cox\*, Research Microbiologist, and J.S. Bailey, USDA, Agricultural Research Service, Russell Research Center, Athens, GA 30613

Regulatory and consumer pressure, establishment of baseline data and critical control points for HACCP, and an overall increased concern of legal ramifications will contribute to future increases in microbiological testing of foods. By 1995, it is estimated that 10-12 million salmonellae tests will be run annually on foods in the U.S. With only 15 to 25% of the food microbiology market in the U.S. currently using some rapid pathogen test, the market is still maturing. What was a rapid method 10 years ago is no longer rapid and is certain to change in the future. Ideally, more rapid, inexpensive, user friendly tests that will be able to recognize the presence of multiple pathogens in a food in one day or less are needed. In reality, some laboratories will probably require multiple technologies to meet the needs of a diverse market place, while others may not require rapid methods at all to meet their individual objectives.

### WATERBORNE MICROORGANISMS

### CRYPTOSPORIDIUM PARVUM - A NEWLY RECOGNIZED WATERBORNE PATHOGEN

Robert McMahon, Laboratory Director, Massachusetts Testing Laboratory, Div. of Microbac Labs, 202 Bussey St., Dedham, MA 02026

*Cryptosporidium parvum* is an enteric protozoan that causes waterborne illness in humans. Symptoms in a healthy person include diarrhea, vomiting,

abdominal cramps and a low grade fever for 2-14 days. In immunocompromised individuals, especially those with AIDS, the symptoms are severe and persist up to six months with a high degree of mortality. *Cryptosporidium* has recently been implicated in swimming associated illness, as well as an outbreak in a filtered public water supply. With the possible exception of ozone, the use of disinfectants alone cannot be expected to inactivate *Cryptosporidium* oocysts in water. Immunofluorescent antibody staining techniques are used to identify *Cryptosporidium* in water. A review of recent literature is given.

#### CHARACTERIZATION OF PLASMIDS FROM *PLESIOMONAS SHIGELLOIDES* ISOLATED FROM LOUISIANA BLUE CRABS

Jae Joong Kim\*, Research Assistant and D.L. Marshall, Dept. of Food Science, LAES, Louisiana St. University, Agri. Center, Baton Rouge, LA 70803

Infections due to *Plesiomonas shigelloides* have been well documented, but the role of this organism in causing foodborne disease has not yet been determined. Since little is known about the genetics of this organism, the aim of this study was to isolate and characterize plasmids from *P. shigelloides*. Three different selective media, MacConkey agar, *Salmonella-Shigella* agar, and a modification of inositol-brilliant green-bile salt agar (IBB), were used for isolation of the organism from freshly harvested Blue crabs. Of these media, IBB agar was most satisfactory for distinguishing between *P. shigelloides* and the related species *Aeromonas hydrophila*. Five suspect isolates were confirmed using the API 20E system. All confirmed isolates were resistant to streptomycin, kanamycin, ampicillin and carbenicillin and carried three plasmids. The approximate size of the plasmids were 2.5, 3.6 and 7.5 kb as determined by gel electrophoresis. Banding patterns produced by restriction enzyme generated fragments of the plasmids indicated a high degree of similarity among the isolates.

#### SURVIVAL AND CULTURABILITY OF *VIBRIO VULNIFICUS* AND RESUSCITATION OF THE VIABLE BUT NON-CULTURABLE FORM IN ARTIFICIAL SEAWATER MICROCOSMS

Wafa J. Birbari\* and G. E. Rodrick, Department of Food Science and Human Nutrition, Univ. of Florida, Gainesville, FL 32611

The apparent decrease in viability of *Vibrio vulnificus* observed under stressful conditions may not be due to cell death, but rather a change into a viable but non-culturable state (VBNC). To monitor the change in culturability upon starvation, *V. vulnificus* cells were incubated at various temperatures in artificial seawater (ASW) microcosms. Total cell counts, direct viable counts, and media plate counts (HI, CPC, TCBS) were determined at different time intervals. *V. vulnificus* cells survived starvation when incubated at 25°C and 37°C in ASW and could be recovered after 11 weeks. When incubated at 4°C for 28 days *V. vulnificus* went into the VBNC state. These same VBNC cells were then resuscitated by incubating the microcosms at 30°C for 24 hr. and could be recovered on selective media.

#### ENVIRONMENTAL SURVEY ON BACTERIAL DISTRIBUTION IN CATFISH PONDS

Cheong-kit Leung\*, Graduate Student, Yao-wen Huang and Oscar C. Pancorco, Dept. of Food Science & Technology, University of Georgia, Athens, GA 30602

Channel catfish (*Ictalurus punctatus*) which had been fed feed containing 26% (diet 26) and 38% (diet 38) protein with restrict and satiety feeding methods were analyzed for the microorganisms on the fish surface and viscera. Water and sediment samples from the ponds were also collected. All the samples were analyzed for *Sireptococcus*, *E. coli*, *Aeromonas hydrophila*, *Pseudomonas aeruginosa*. However, fish samples were also analyzed for *Listeria monocytogenes* and psychrotrophs. There was no significant difference ( $p < 0.05$ ) in the Listerial counts in all cases. The *Aeromonas* in the viscera of diet 26 had a significantly higher count ( $p < 0.05$ ) than the other regions where as for diet 38, the sediments had a significantly higher count than the others. There was no significant difference in the psychrotrophic count between the fish surface and the gut except for diet 38 with restrict feeding method. The *E. coli* count for different regions were not significantly different from each other except the diet 26 of satiety feeding method where the sediment had a significantly higher count.

#### WATER QUALITY OF WELLS ON POULTRY FARMS IN TENNESSEE

F.A. Draughon\*, H.C. Goan, T.N. Burcham, H.P. Denton, and J.R. Jared, University of Tennessee, P.O. Box 1071, Knoxville, TN 37901-1071

This study was undertaken to learn more about the current water quality of wells on poultry farms in Tennessee. A survey form for each location was prepared to evaluate number of broiler houses, condition of wells, etc. Water samples were taken for determination of coliform, fecal coliform, fecal strep, total aerobic bacteria, *Salmonella* and nitrate from 113 locations across Eastern Tennessee. Fecal coliforms exceeded 100 per 100 ml water at 9 locations. Total coliforms exceeded 100 per 100 ml water at 14 locations. *Salmonella* was detected in three wells. Presence and level of fecal coliform or fecal strep did not correlate well with presence of *Salmonella*. Aerobic bacterial counts ranged from 0 to log 4.5/ml. After "shock chlorination" of one of the most heavily contaminated wells, no fecal coliforms were detected.

#### SURVIVAL OF *LISTERIA MONOCYTOGENES* IN SEVERAL WATER SYSTEMS

M. K. Amin\*, Research Associate and F. A. Draughon, University of Tennessee, Ag. Engineering Department, P.O. Box 1071, Knoxville, TN

Survival of two strains of *L. monocytogenes* in deionized distilled (D.D.) water, physiological saline (0.85% NaCl), phosphate buffer (0.6 mM), artificial sea water, water from Tennessee River and chlorinated tap water at 6°C and 24°C was investigated. In tap water with 1.5 ppm free residual chlorine, no *Listeria* cells were recovered within 30 min. of inoculation. Viable *Listeria* cells were rapidly reduced in all water samples stored at 24°C and after 14 d, no cells were recovered in most samples. Survival of *Listeria* in water samples stored at 6°C ranged from 49 d in D.D. water to more than 70 d in phosphate buffer.

#### SPOTLIGHT ON SOLID WASTE MANAGEMENT REGULATIONS IN KENTUCKY

#### IMPLEMENTATION OF NEW LANDFILL REGULATIONS AND PASSAGE OF "SENATE BILL 2"

George F. Gilbert, Jr., P. E., Acting Manager, Solid Waste Branch, and the Honorable C. Gregory Higdon, Majority Whip, Kentucky Senate, Commonwealth of Kentucky, Frankfort, KY

A discussion will be held on the passage and implementation of solid waste management programs in Kentucky. The "New Landfill Regulations" went into effect May 9, 1990, and the Senate Bill 2, "Omnibus Garbage Control Statute" was signed into law on February 26, 1991.

#### A ROUND UP OF ASEPTIC PROCESSING ISSUES

#### CRITICAL DESIGN CONCEPTS FOR ASEPTIC PROCESSING EQUIPMENT AND SYSTEMS

Richard Szyperski, Cherry Burrell Process Equipment Division, 10300 Rumson Way, Louisville, KY 40299

Design concepts used in the manufacture of equipment and systems used in aseptic processing will be discussed. Attention to what changes in equipment design is needed in order to process under aseptic conditions will be presented. Emphasis will be on seal areas and ability to sterilize. After looking at individual pieces of equipment, how they are put together in the form of an aseptic processing system will be discussed. Not only is it critical that the individual pieces of equipment be designed correctly, the system design itself needs to be carefully looked at to insure trouble free processing.

#### PACKAGING AND PACKAGE MACHINE DESIGN REQUIREMENTS FOR ASEPTIC PRODUCTS

Sava Stefanovic, Pure-Pak, Inc., 8550 Ladd Road, P.O. Box 800, Walled Lake, MI 48088-0800

A general approach to the design of aseptic packaging systems will be covered. This applies to both the manufacturer and the user because

it will specify to the manufacturer what needs to be done and give the user higher reliability on the performance of the product. Information shall be shared on what the philosophy should be to maintain a reliable system.

#### **ESTABLISHMENT OF PROCESSES FOR HOMOGENEOUS AND NON-HOMOGENEOUS PRODUCTS TO BE PROCESSED ASEPTICALLY**

Rakesh K. Singh, Purdue University, Department of Food Science, 1160 Smith Hall, West Lafayette, IN 47907

All the aseptically processed and packaged foods must be processed to a level of commercial sterility so that they can be marketed unrefrigerated. Details of the thermal process designed to result in a shelf stable product must be provided to the appropriate US regulatory agency (FDA or USDA) prior to commercial production. Critical considerations for proper thermal process design include, but are not limited to, fluid to particle heat transfer, particle residence time distribution, appropriate lethality value selection, monitors and controls, and proper design and implementation of biological validation tests. There may also be product and equipment specific considerations. This presentation will cover overview of the above mentioned topics along with the processing system sterilization, maintenance of sterility, establishment of the process schedule, and identification of the critical factors.

#### **VALIDATION OF ASEPTIC OPERATIONS**

V.N. Scott\*, Associate Director, Microbiology Division, D.T. Bernard, A. Gavin III, B.D. Shafer, K.E. Stevenson, J.A. Unverferth, and D.I. Chandarana, National Food Processors Association, 1401 New York Avenue, NW, Washington, DC 20005

Validation of aseptic operations begins with a design review. Once the equipment is installed microbiological challenge testing should be conducted to delineate the limits for critical factors and to confirm the adequacy of pre-production sterilization cycles, package sterilization etc. After sterilization processes for product and equipment have been established, inoculated packs of product should be conducted for confirmation of proper system operation. The automatic controls and safety devices for both processing and packaging systems should also be challenged to test for proper function. Finally, commissioning trials are used to obtain final assurance that the entire aseptic system is performing adequately.

#### **THE FOOD PROCESSING ENVIRONMENT: A CRITICAL CONTROL POINT FOR MICROBIOLOGICAL HAZARDS**

#### **MANAGEMENT OF MICROBIOLOGICAL RISKS IN THE FOOD PROCESSING ENVIRONMENT: IDENTIFYING AND EVALUATING HAZARDS**

Damien Gabis, Silliker Laboratories Group, Inc. 1304 Halsted Street, Chicago Heights, IL 60461

Many food processing environments are critical control points for prevention of microbial contamination of foods. Pathogens and spoilage microorganisms multiplying in niches in product contact and non-contact areas can be carried into finished product that is exposed to the environment during processing. Identification of hazardous growth niches is often accomplished through visual observation of the plant, equipment, manufacturing practices, and cleaning operations, but microbiological sampling and testing of the environment permits identification and quantitation of specific microorganisms. Prevention of microbial growth in the processing environment requires a broad approach that begins with hygienic design and construction of the plant and continues through to the selection, design, manufacture, and installation of the equipment in the system. Once the plant is in operation, the environment will be controlled through good operating procedures and effective sanitation programs. As the plant and equipment age, preventive maintenance and hygienic building and equipment repair practices and procedures become more important for elimination and control of growth niches. The fundamentally important factor to control microbial multiplication in the environment is workers. Effective training of food processing plant workers from all departments is essential for control of environmental contamination. Ongoing in-service training and encouragement of the work teams by management are important to motivate and teach the workers correct procedures to control the environment.

#### **THE ROLE OF PROCESS AND FACILITY DESIGN AND CONSTRUCTION IN CONTROLLING MICROBIOLOGICAL HAZARDS IN FRESH FOODS**

Cynthia S. Wilbrandt, Manager of Fresh Foods Technology, A. Epstein and Sons International, Inc., 600 W. Fulton, Chicago, IL 60661-1199

Fresh, preservative-free chilled foods require special attention in both preparation and the environment in which the foods are prepared in order to minimize microbiological contamination and maximize safe product shelf life.

Fresh foods are most sensitive to microbial contamination and thus represent an ultimate challenge to both the process and the facility design engineers.

This talk will focus on the critical issues and operations involved in chilled food production and how facilities can be designed to ensure product integrity through isolating processing activities, properly designing HVAC systems and air flow patterns, and utilizing appropriate materials and methods of construction.

#### **ROLE OF MAINTENANCE AND REPAIR IN MICROBIAL RISK MANAGEMENT**

Richard W. Tweeten, Tweeten Consulting, Suite 106, 402 E. Roosevelt Road, Wheaton, IL 60187

A well managed and properly funded preventive and predictive maintenance program will substantially reduce risk of contamination by reducing "breakdown" maintenance procedures. Proper training and discipline of maintenance personnel is essential to a successful program. Certain management tools are available for the implementation and ongoing activities of maintenance department. A review of current process and cleanup procedures may help to reduce repair and maintenance costs.

#### **MICROBIOLOGICAL RISK CONTROL THROUGH PROPER CLEANING AND DISINFECTION PRACTICES**

Mark J. Banner, Diversey Corporation, Wyandotte, MI

The maintenance of proper hygiene in any facility producing and/or handling foods is one of the most basic necessities for the production of safe and quality foods. Poor practices at any step along the production scheme can potentially increase the risk of microbiologically induced foodborne illness and/or food spoilage. There is, however, no single hygiene program which fits all of the many types of production and processing facilities. The cleaning procedures in a dairy, for example, will differ from those in a processed poultry producer. In fact, even manufacturers of the same type of food, e.g. fluid milk, often may use different cleaning practices and chemicals. The reasons for this variability relate to the factors which must be considered when selecting cleaning and sanitizing chemicals. The purpose of this presentation will, therefore, be to discuss the practical approach that is used for the selection of detergents and sanitizers for the control of microorganisms in food production and preparation.

#### **THE HUMAN FACTOR - MANAGEMENT OF MICROBIOLOGICAL RISKS THROUGH THE WORK FORCE: THE ROLE OF EDUCATION, TRAINING, AND HIRING PRACTICES**

Jeffrey J. Ryan, Mid-America Dairymen, Inc., 3253 E. Chestnut Expressway, Springfield, MO 65802

The concept of Hazard Analysis Critical Control Points or HACCP is approaching twenty years old in its first published format. Briefly stated, the HACCP concept is a preventative maintenance program designed to closely monitor and maintain control of materials, methods, machines, manpower and the environment. Established control and documentation in each of the aforementioned areas reduces the probability of unacceptable risks to food safety. All too often the manpower component of HACCP is overlooked or ignored, resulting in a paper program that does little to enhance the safety of a finished product. As managers or coordinators of HACCP programs, our initial task is to understand and accept the fact that people in all levels of the operation are the most important critical control points in a food processing facility. Education and training that fosters dedication, determination and drive of the manpower component is essential for a dynamic and effective HACCP program.

## LABORATORY SAFETY

### LABORATORY SAFETY—A RISK PERSPECTIVE

Robert Y. Nelson, Ph.D., CIH, Associate Professor, Department of Occupational and Environmental Health, University of Oklahoma Health Sciences Center

To do better today than yesterday should be the goal of all health and safety programs. Understanding the potential risk within the laboratory environment and how to reduce the potential of an accident is the intent of this presentation. In spite of the gathering evidence everywhere that chemical laboratory workers are subjected to greater environmental risks than the general population, safety awareness and training continues to be a haphazard activity. Education is the central theme to the operation and acceptance of a good laboratory safety program. OSHA's laboratory standard is only a starting point to an acceptable laboratory safety program.

### SAFETY IN THE LABORATORY AS IT APPLIES TO MICROBIOLOGY

Virginia Scott, Associate Director, Microbiology, National Food Processors Association, 1401 New York Avenue, NW, Washington, DC 20005

Food laboratories may handle foods contaminated with pathogenic microorganisms. The use of good laboratory and biosafety practices can reduce the risk of exposure to a very low level. Biosafety practices relating to sample handling, containment (biological safety cabinets), disinfection and decontamination, laboratory waste, and personnel practices will be discussed.

### IMPLEMENTATION OF OSHA'S LABORATORY STANDARD

Karen E. Carr, Senior Quality Specialist, Ralston Purina Company, Checkboard Square, St. Louis, MO 63164

Discussion of practical programs to implement the OSHA Lab Standard in an analytical laboratory.

- Identifying Hazardous Chemicals
- Personal Protective Equipment
- Fume Hood Monitoring
- Employee Training
- Medical Surveillance
- Exposure Monitoring
- Spill Response and Waste Disposal
- The Chemical Hygiene Plan as a Dynamic SOP

### UPDATE OF THE STANDARD METHODS FOR THE EXAMINATION OF DAIRY PRODUCTS CHAPTER ON LABORATORY QUALITY ASSURANCE AND SAFETY

J.L. Heady, P.J. Hickey, L.J. Maturin\*, Ph.D., A/Chief Laboratory Quality Assurance Branch, FDA and M.B. Trost (H.M. Wehr. Tech. Comm.), FDA-Center for Food Safety, 6502 S. Archer Road, Summit-Argo, IL 60501-1933

Safety should not be viewed as an abstract concept but as an integral and vital component of a laboratory's operation. Safety in the laboratory starts with commitment from each individual involved with the operation of the laboratory from the technical staff to management. Safety policy should be established by management (with input from the laboratory technical staff) in a written program, such as a manual, which is readily available to all employees (must read and follow). The written program must be a viable, dynamic document that is easily amended and/or changed to reflect current laboratory practices.

### WATER IN FOOD PROCESSING

#### WATER QUALITY - PROBLEMS IN FOOD PROCESSING

John Rushing, Ph.D., Food Science Extension Specialist, North Carolina State University, Raleigh, NC 27695-7624

Adequate quantities of affordable and high quality water are necessary for the siting of any food processing plant. Water is a resource used for

fluming, cleaning, processing, and as an ingredient. Focus is not only on adequate supplies of water for the plant but on the impact the use and discharge of the water. New developments and ideas are required for dealing with these issues now and in the foreseeable future.

### THE COST OF NOT DOING BUSINESS

Perry Fisher, Campbell Taggart, Inc., PO Box 660217, Dallas, TX 75266-0217

A successful food company manages all aspects of its business in a profitable manner. Managing waste water involves prevention, controlling organic loading and flow; cost control, managing surcharges and permit limits, paying for treated flows, not total purchased water and monitoring sampling; compliance with permits and participating in establishing permit or ordinance limits; and seeing that limits are science based. Failure to do any of these increases the costs of doing business, hence the cost of "not doing business."

### WASTEWATER ISSUES ASSOCIATED WITH CLEANING AND SANITIZING CHEMICALS

Dr. Bruce Cords and Richard L. Bakka\*, Manager, Technical Affairs, Klenzade, A Service of Ecolab, Inc., St. Paul, MN

Cleaning and Sanitizing chemicals can impact upon the treatment needs of wastewaters and wastewater quality. Although the prime objective of a sanitation program must be food safety, consideration should also be given to environmental safety.

Several issues related to cleaners and sanitizers in wastewater will be reviewed. These will include pH, BOD/COD contributions, biodegradability, phosphates, toxicity and water usage. Current alternatives will be presented.

### POLLUTION PREVENTION IN FOOD PROCESSING

Robert Carter, Environmental Protection Agency Region 4, P.O. Box 27687, Raleigh, NC 27687

An overview of EPA's Pollution Prevention Program and Strategies as they affect the Food Processing Industry. Non regulatory assistance available to industry will be identified.

### RESEARCH OVERVIEW OF WATER RECYCLING OPPORTUNITIES FOR THE POULTRY INDUSTRY

Brian W. Sheldon, Professor of Food Science, North Carolina State University, Box 7624, Department of Food Science, Raleigh, NC 27695-7624

Federal poultry inspection regulations call for a water supply used in processing poultry that is ample, clean, and potable. The luxury of having unlimited supplies of inexpensive quality water is quickly declining across the United States. Some municipalities providing water and sewer service to poultry processors have increased their charges ninefold over the past 25 years. Forecasters project a tenfold increase in water and sewer charges for some areas of the country over the next 5 to 10 years. With regional water shortages, pollution problems, and new policies on pricing which recognize the economic value of water, daily water conservation, and recycling practices by all poultry processors will become a necessity to reduce operational costs. The objective of this presentation is to provide an overview of past and current research on reconditioning and/or recycling of poultry process water. The presentation will also address the esthetic and safety concerns over reuse of food process waters for direct food product contact.

### ROLE OF UNIVERSITIES IN FOOD PROCESSING ENVIRONMENTAL ISSUES

Dr. Roy E. Carawan, Department of Food Science, North Carolina State University, Raleigh, NC 27695-7624

Universities have a unique role in helping the food processing industries fulfill their environmental responsibilities. This role requires a careful evaluation and review of the respective missions of universities and food companies. There are a number of ways in which universities can interact with the food

processing industry concerning environmental issues. The objectives of university-industry interactions may include: 1) Teaching undergraduates and graduates to understand how environmental issues relate to food processing, 2) Teaching food industry personnel to appreciate how environmental issues relate to each company's role (in the food industry and the community) and each employee's job, 3) Expanding the frontiers of knowledge by conducting basic research, 4) Intellectual nurturing of emerging concepts by providing necessary information and guidance, 5) Updating, compiling and providing easy access to available knowledge, and 6) Developing competent facilities and adequate facilities to address emerging environmental issues.

Developing centers with specific missions could provide universities with consistent and compiled information to better assist the food industry by identifying problems and implementing solutions. Active and enthusiastic cooperation between universities and companies will facilitate environmentally responsible food processing.

#### POSTER SESSION

##### EFFECT OF PACKAGING ON SHRIMPS (*PENAEUS* SPP.) QUALITY DURING ICE STORAGE

Yao-wen Huang\*, Keith W. Gates and Kuoakuo Kuoadio, Dept. of Food Science and Technology, University of Georgia, Athens, GA 30602

Shrimp (*Penaeus* spp.) were either PVDC overwrapped, vacuum packaged with EVA bag or vacuum skin packaged and stored on ice for three weeks. Sample shelf-life was determined by pH, ammonia production, TBA value, moisture loss, psychrotrophic count and sensory attributes. pH, ammonia production and psychrotrophic count increased as the days of storage increased regardless of packaging materials. However, no significant differences in moisture loss among different packaged samples were found throughout the entire holding time. TBA value was not a good chemical index for shrimp spoilage. Although no significant difference in sensory scores was found, psychrotrophic bacterial counts revealed that shelf life of vacuum skin packaged shrimps had four days longer than that of vacuum packaged samples.

##### A HAZARD ANALYSIS CRITICAL CONTROL POINT (HACCP) PROGRAM FOR THE PRODUCTION OF IMITATION CRAB

Rose M. Schroeder\* and Jack R. Matches, University of Washington Institute for Food Science and Technology, HF-10, Seattle, WA 98195

Surimi based imitation seafood products have been gaining in popularity in the United States since the late 1970's. In response to the increased popularity of seafood products as well as increased consumer awareness of food safety, the United States congress is investigating the use of mandatory inspection and certification for the production of seafood products. The Hazard Analysis Critical Control Point (HACCP) system is also being considered as a means of surveillance and certification throughout the seafood industry. This paper describes how the HACCP techniques can be applied to the production of imitation crab products. The microbiological quality of surimi is reviewed, and microbial population data of the analog product throughout production is presented.

##### BACKGROUND LEVELS AND RADIATION DOSE YIELDS OF O-TYROSINE IN CHICKEN MEAT

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The measurement of o-tyrosine in poultry meat is a promising method for postirradiation dosimetry of poultry. Background levels and radiation dose yields of o-tyrosine have been determined in individual and in pooled samples of chicken meat. In 18 individual samples, the most frequent background level (60% of the cases) was between 0.05 and 0.15 ppm (wet weight, 70% moisture). In pooled samples of 10 chickens, the background levels were  $0.120 \pm 0.03$  ppm (wet weight). The background levels were not significantly affected either by storing at refrigerator temperatures or by freezing and thawing the samples. The radiation dose response curve was linear, with a slope of  $0.127 \pm 0.02$  ppm (wet weight)/kGy. Although there was some variation in the intercept, the slope was the same in all samples. These data indicate that o-tyrosine level can be used to determine the absorbed dose in chicken meat irradiated at doses no lower than 1 kGy.

##### H<sub>2</sub>O<sub>2</sub> INDUCED FREE RADICAL DAMAGE ON *E. COLI*

H.S. Basaga,\* F.T. Bozoglu and A. Kassab, Dept. of Sci. Education, Dept. of Food Eng. Middle East Technical University, 06531-Ankara/Turkey

Previous workers have characterized *E. coli* lethality by H<sub>2</sub>O<sub>2</sub> at two modes of killing, the first occurring at concentrations below 2mM and the second at concentrations higher than 10 mM. In our study we have generated OH radicals via Fenton reaction and investigated the site of damage caused by the radical itself. At low concentrations of H<sub>2</sub>O<sub>2</sub> the OH radical scavengers, thiourea and DMSO did not significantly effect the survival of *E. coli*, however, at high concentrations of H<sub>2</sub>O<sub>2</sub>, the survival of *E. coli* was markedly reduced by the above mentioned scavengers. Effect of thiourea on the lethality of H<sub>2</sub>O<sub>2</sub> was more pronounced than that of DMSO.

Metal chelators, such as EDTA and 2,2-bipyridyl reduced the lethality of H<sub>2</sub>O<sub>2</sub> when used with a high concentration of H<sub>2</sub>O<sub>2</sub> whereas the same chemicals did not significantly effect the survival of the microorganism when used in combination with low concentration of H<sub>2</sub>O<sub>2</sub>, indicating different toxic species and/or sites of damage occurring at two different modes.

##### GROWTH MODELING OF PROTEOLYTIC STRAINS OF *CLOSTRIDIUM BOTULINUM*

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Predictive models for growth of proteolytic *Clostridium botulinum* in temperature abused foods were developed. Spore mixtures of three A and three B strains were inoculated (0.9-5.4 log CFU) into broth media of varying pH (5.0-7.7) and NaCl (0-3%) and incubated (15-35°C) for 60 days. Time for visible growth was noted and a four-factor response surface equation derived. The importance of headspace oxygen levels was determined in 1% agar made with varying pH, NaCl levels, and added reductant (0.3% Na thioglycolate). Inoculated tubes were incubated (15-35°C) with 0% oxygen (nitrogen), 10% oxygen or 20.9% oxygen (air). The times for appearance of visible colonies were not affected by oxygen levels. However, the distances from the surface that the spores grew varied from 1 to 46 mm. This illustrates some potential situations for clostridial growth and toxin formation in packaged foods.

##### IN VITRO INHIBITION OF *SALMONELLA TYPHIMURIUM* AND *ESCHERICHIA COLI* O157:H7 BY AN ANAEROBIC GRAM-POSITIVE COCCUS ISOLATED FROM THE CECAL CONTENTS OF ADULT CHICKENS

Arthur Hinton\*, Jr., Donald E. Corrier and John R. DeLoach, USDA, ARS, FAPRL, Route 5, Box 810, College Station, Texas 77840-9594

The ability of a bacterium isolated from the cecal contents of mature chickens to inhibit the growth of *Salmonella typhimurium* and *Escherichia coli* O157:H7 *in vitro* was determined. An anaerobic Gram-positive coccus was isolated that inhibited the growth of both enteropathogens on media containing either 0.25% glucose, 0.25% lactose, or 2.5% lactose (wt/vol). Growth of *S. typhimurium* or *E. coli* O157:H7 was not inhibited on media containing glucose or lactose it produced significantly (P<0.05) higher concentrations of lactic and acetic acid than when it was grown in media without the added carbohydrates. The inhibition of the enteropathogens was related to the production of high concentrations of lactic and acetic acid from the carbohydrates by the anaerobic coccus.

##### SURVIVAL OF FOOD-ASSOCIATED PATHOGENS FOLLOWING SONICATION

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The survival of three species of food-associated bacterial pathogens (*Listeria monocytogenes*, *Clostridium perfringens* and *Salmonella typhimurium*) in a sonication water bath was studied. The bacteria were suspended in brain heart infusion (BHI) and sonicated for 30 min at 20°C. For *Clostridium* and *Salmonella* the log number of colony forming units (CFU) decreased by 2 in 15 min and by 3 to 4 in 30 min. *Listeria* were not affected by the sonication. *Salmonella*, suspended in skim milk medium, were still killed, but the decrease in number was not as great as in BHI. Neither *Listeria* nor *Clostridium* were killed in skim milk. Comparison of survival following sonication with *Pseudomonas aeruginosa* and *Lactobacillus casei* indicates that gram negative bacteria were more readily killed by low intensity sonication than gram positive bacteria.

## FATE OF SALMONELLA AND LISTERIA MONOCYTOGENES IN COMMERCIAL, REDUCED-CALORIE MAYONNAISE

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Two new varieties of commercial low-calorie mayonnaise, i.e., cholesterol-free reduced-calories (CFM) and reduced-calorie (RCM), made with different levels of acetic acid (0.1, 0.3, 0.5 or 0.7% in aqueous phase) were evaluated to determine the survival characteristics of *Salmonella* or *Listeria monocytogenes* inoculated at ca.  $10^6$  CFU/g. The initial pH of the products ranged from 3.9 to 4.3. Mayonnaise was incubated at 23.9°C for up to 2 weeks. No *Salmonella* (per 100 g) was detected at 48 h in either variety of mayonnaise made with 0.7% acetic acid in the aqueous phase. No *L. monocytogenes* (per 100 g) was detected at 14 or 10 days postinoculation in CFM or RCM, respectively, made with 0.7% acetic acid in the aqueous phase. Results indicate these new varieties of mayonnaise, when formulated with 0.7% acetic acid in the aqueous phase, will inactivate  $>10^7$  *Salmonella* and  $>10^4$  *L. monocytogenes* per gram within the 72-h holding time required for regular mayonnaise made with unpasteurized eggs.

## ANTIMICROBIAL ACTIVITY OF SUCROSE, LAURATE, EDTA AND BHA ALONE AND IN COMBINATION

Anthony Sikes\* and S. Whitfield, U.S. Army RD & E Center

Sucrose laurate (SL), EDTA (E) and BHA(B) were evaluated alone and in combination at several concentrations, e.g., 0.05, 0.1 and 0.25 % (w/v), for antimicrobial activity against several foodborne bacteria in trypticase soy broth and a model food system. Results showed that the combination, SLEB, was the most effective inhibitory agent. Both gram-negative and -positive foodborne bacteria were sensitive to SLEB over a temperature range of 10-35°C; however, gram-positive organisms were the most sensitive. Results also showed that as the fat content of the model food system increased, the inhibitory activities of SLEB decreased. SLEB may have some use in low-fat food systems.

## MICROBICIDAL EFFECTIVENESS OF GLUCOSE OXIDASE ON CHICKEN BREAST SKIN AND MUSCLE

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Treatment of seafood with glucose oxidase (GOX) has been found to extend the product shelf life. Use of GOX as a possible means to inhibit growth of microorganisms on processed poultry was evaluated in this study. Muscle and skin portions of chicken breast were inoculated with either *Pseudomonas aeruginosa* or *Salmonella typhimurium* and subjected to either: (1) 60 seconds dip in 2 units of GOX without glucose (GLC) addition; (2) 60 seconds dip in 2 units of GOX with 4% GLC addition. Control groups were dipped in sterilized distilled water. Each section was analyzed microbiologically. The microorganisms were not significantly inhibited by either enzyme treatment. Therefore, a GOX enzyme treatment has little potential for extending the shelf-life of chicken.

## PERFORMANCE OF A DNA HYBRIDIZATION METHOD WITH ABBREVIATED ENRICHMENT IN THE DETECTION OF ESCHERICHIA COLI IN NATURALLY CONTAMINATED FOODS

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The performance of a 24 hr enrichment method developed for use with a DNA hybridization assay (Colorimetric GENE-TRAK *Escherichia coli* Assay) was evaluated. Following sample homogenization, 3 ml aliquots of sample were transferred to sterile capped tubes containing 1 ml 4x Brain Heart Infusion broth and incubated at 35°C for 4 hr. The entire 4 ml were transferred to 6 ml Tryptose Phosphate broth and incubated in a 42°C water bath for 20 hr. A total of 150 samples were analyzed for the presence of naturally occurring *E. coli* by both the DNA hybridization method and a conventional Most Probable Number (MPN) method. There were 31 total positive samples. The DNA hybridization method detected 29 positive samples and the MPN method detected 20 positive samples. The DNA hybridization assay, used in conjunction with this 24 hr enrichment procedure, provides an

accurate, rapid alternative to the conventional MPN method for the detection of *E. coli* in foods.

## USE OF AGAR DIPLSLIDES FOR HYGIENE MONITORING IN A BAKERY

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Agar diplslides are designed for the rapid and convenient determination of the microbiological status of finished food products, raw materials and the food processing environment. A study was performed in a bakery to evaluate the suitability of Hygicult diplslides for in-house determination of the microbiological quality of various raw materials and finished products. Samples were tested in parallel by standard microbiological methods for total aerobic count and Enterobacteriaceae and by Hygicult-TPC and Hygicult-E diplslides. Criteria were established for comparing results from conventional testing with those from diplslides, and using these parameters test samples were grouped into "good/acceptable" and "poor/unacceptable" categories. A total of 125 samples were analyzed. Results showed 89% overall agreement between Hygicult diplslides and conventional methods. These results indicate that Hygicult diplslides are useful for the in-house analysis of raw materials and finished bakery products.

## COMPARISON OF TWO ENZYME IMMUNOASSAYS FOR THE RECOVERY OF SALMONELLA FROM FOODS

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Several test kits using enzyme immunoassay, DNA hybridization, hydrophobic grid membrane filtration, and immunodiffusion procedures have been developed for the rapid detection of *Salmonella* from foods. In this study, 2 enzyme immunoassays (the *Salmonella*-Tek™ and the Report™) were compared to FDA's *Bacteriological Analytical Manual* (BAM) method for the recovery of *Salmonella* from 2 low-moisture foods. Foods were either contaminated in the dry state or serial 10-fold dilutions of *Salmonella* were inoculated into the post enrichments. Of 220 replicates inoculated in the dry state, the *Salmonella*-Tek™, the Report™, and the BAM method recovered 151, 150, and 152 positive replicates, respectively. There was one false negative reaction by the *Salmonella*-Tek™ and 4 false negative reactions by the Report™. For the replicates inoculated at the post enrichment step, approximately 1-10 cells were needed to give a positive response by either assay. Preliminary results show that there were no major differences in recovery of *Salmonella* between the 2 immunoassays and the BAM method.

## AN EVALUATION OF THE CONDUCTIMETRIC METHOD FOR TOTAL MICROBIAL ACTIVITY, COLIFORMS, AND YEAST/MOLD OF SPICES AND SEASONINGS

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Many spices and herbs are antimicrobial and/or antimycotic. Traditional analysis often involves dilutions to neutralize these effects. Since there is no need to do serial dilutions when analyzing samples using conductance microbiology, it was necessary to neutralize product inhibition by choosing the correct diluent and/or modifying the conductivity mediums. Nineteen naturally contaminated spices and seasonings were analyzed for total microbial activity, coliforms, and yeast/mold. Four diluents were evaluated. Modified Lethen Broth, B.A.M. M67, performed the best giving the fastest detection time when compared to the other diluents. Results were available 2-3 days faster using conductance microbiology compared to traditional plating methods.

## INCIDENCE OF BRUCELLA IN MILK AND THE FAT CONTENT IN CAJAME COUNTY

Martha E. Diaz-Cinco\* and Berenice Duarte-Leon, C.I.A.D., A.C. Apdo. Postal 1735, Hermosillo, Sonora, Mexico

145 milk samples were analyzed for the ring test, fat content and *Brucella* detection. 128 cows' and 17 goats' milk samples were analyzed. For the fat quantification the Babcock test was used (Kosikovsky, 1982), ring test according to S.A.G. 1975, and the detection of *Brucella* by S.S.A. 1987, Alton

G.G. 1975, Corbel 1985 and Farrel 1974. The fat content for the cow's milk was  $3.59 \pm 0.3858$  and goats milk  $3.88 \pm 0.81$ . 10 samples were positive for the ring test and 1 (10%) of them was positive for the detection of *Brucella*. 5 cows' samples were positive to *Brucella*: 2 *Brucella abortus* biotype 8, 2 *Brucella melitensis* biotype 1 was isolated from goats' milk. The association between fat and ring test and fat *Brucella* isolation was very low ( $P > 0.05$ ). Spearman's correlation fat-*Brucella* isolation and fat ring-test was not significant. The incidence of *Brucella* in cows' milk was 3.8% and in goat's milk 5.8%.

#### DEVELOPMENT AND EVALUATION OF A NITROCELLULOSE MEMBRANE LIFT METHOD TO IDENTIFY SALMONELLAE ATTACHED TO CHICKEN SKIN

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Salmonellae attached to chicken skin were isolated and identified using a nitrocellulose membrane method to lift the bacteria from the skin. After direct incubation of the membrane on XLD agar overnight at 37°C, appearance of black colonies on the white membrane was considered a positive presumptive test for salmonellae. Immunostaining of black colonies on the membrane using enzyme conjugated salmonella-specific antiserum was then performed to confirm the black colonies were salmonellae. This technique can be used to identify salmonellae contamination of chicken skin in less than 24 hr and was shown to be more sensitive than commonly used swabbing or washing techniques.

#### NO OBSERVED EFFECT LEVEL, SAFE CONCENTRATIONS, MILK RESIDUES AND CONCERNS FOR MILK SAFETY

John W. Hallberg\*, E. J. Robb, C.C. Miller, The Upjohn Company, 9690-190-40 7000 Portage Road, Kalamazoo, MI 49001

Extensive toxicology, metabolism and residues studies are conducted in the determination of safe concentration for an FDA approved new animal drug for use in animals producing meat and milk. Residue concentrations at or above the safe concentration are considered unsafe for human consumption and violative whereas concentrations below this level are safe for human consumption and non-violative. Safe concentration is calculated using a formula including the lowest No Observed Effect Level (NOEL), average human body weight (60 kg), a daily food consumption factor (500 gm), and a safety factor (100x-1000x). The NOEL is determined by conducting a variety of toxicology studies in multiple species of laboratory animals. These studies may include sub-chronic and chronic feeding studies, teratology studies, multi-generation reproduction studies and other more specialized studies depending on the compound. The highest level which causes no effect is determined in each study. The lowest of these levels determines the NOEL in the most sensitive test system and is used to calculate safe concentration. If the metabolism profile of the drug in the target species is found to be qualitatively similar to that of the most sensitive lab animal, the toxicology profile may be considered applicable to man since it demonstrates that the lab animal used for the toxicology testing was exposed to the same residues as would the human consuming food products from a treated food producing animal. Tolerance of the drug is determined by identifying a marker residue which is easily measured and is predictive of the total residues that can only be measured with complicated radio-labeled studies. This display will illustrate the determination of NOEL and safe concentration for two new antibiotics (ceftiofur and pirlimycin). The results of these calculations are a proposed 0 day withdrawal for milk and meat for ceftiofur and a proposed 36 hour milk withholding for pirlimycin. Currently very rapid sensitive methods are available which can detect antibiotics in milk at levels well below tolerances accepted by the FDA. This can result in suspicion of violative residues and the discarding of milk which is safe and non-violative.

#### VIDEO THEATER

#### FOOD QUALITY, FOOD SAFETY AND YOU! AN EDUCATION PROGRAM FOR SUPERMARKET DELI DEPARTMENT WORKERS

Robert B. Gravani\* and Donna L. Scott, Cornell University, Department of Food Science, Stocking Hall, Ithaca, NY 14853

A comprehensive videotape training program for supermarket deli/fresh-prepared food department employees was planned, developed and produced on a grant from the U.S. Department of Agriculture. The objectives of this project are to:

- Provide key information about food safety and sanitation to employees in retail food stores;
- Stress the important role that deli workers play in assuring the quality, safety and wholesomeness of foods prepared, handled, stored and sold to customers from these departments; and
- Relate the workers' vital role in food safety to their equally important role as knowledgeable sales people.

This audiovisual training program will be shown at the video theater during the IAMFES Annual Meeting.

#### FOOD SAFETY: FOR GOODNESS SAKE, KEEP FOOD SAFE

W.S. LaGrange, Department of Food Science & Human Nutrition, Iowa State University, Ames, IA 50011

Personal hygiene, sanitation, and time and temperature control are the key factors for food safety during food preparation and service. A 1991 VHS video titled *Food Safety: For Goodness Sake, Keep Food Safe* addresses and illustrates the all important factor of personal hygiene and sanitation for food safety. About 75% of all foodborne illnesses are caused by mistakes people make in food preparation and service. It is very important that all food service personnel be made aware of their important role in food safety.

This 15-minute video may be obtained from Media Resources Center, 121 Pearson Hall, Iowa State University, Ames, Iowa 50011. A check made out to Iowa State University for \$35.60 will bring you a copy of this video and a copy of an accompanying one page brochure titled "Tips for Food Service Personnel."

#### THE BULK MILK HAULER - PROTOCOL AND PROCEDURES

W.S. LaGrange\*, Department of Food Science and Human Nutrition, Iowa State University, Ames, IA 50011 and John Hill, Iowa Department of Agriculture, Des Moines, IA

The bulk milk hauler is very important in raw milk quality. The hauler must determine if the milk in each farm bulk tank is of appropriate quality to be pumped into the bulk truck. The hauler must also use sanitary and accurate methods in determining the quantity of milk in each farm bulk tank. A Universal Sample also must be obtained from each farm bulk tank. This sample must represent all the milk in the bulk tank, taken in a sanitary manner and cared for properly until all route samples are taken to the milk plant.

A 10 minute 1990 video titled "The Bulk Milk Hauler - Protocol and Procedures" is available from Media Resources Center, 121 Pearson Hall, Iowa State University, Ames, Iowa 50011. This video illustrates the procedures that a bulk milk hauler must follow in picking up milk on the farm and in delivering the truck load of milk to the dairy plant. This video is accompanied by a one-page 3-fold brochure that explains the procedures the milk hauler should follow at the dairy farm and at the milk plant. A check list of equipment and supplies the hauler needs in the truck prior to beginning the milk route is listed.

This video and a copy of the brochure can be obtained for \$35.60 with a check made out to Iowa State University and mailed to the Media Resources Center.



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## **Procedures to Implement the Hazard Analysis Critical Control Point System (72 pp.)**

This manual was developed for use by food safety/regulatory officials and food industry personnel charged with assuring food safety. The HACCP system is designed to ensure food safety by reducing the likelihood of foodborne illness. It accomplishes this goal by identifying the hazards and assessing the risks of contamination associated with food products as they pass through the phases from production to consumption.

The manual provides step-by-step instructions to develop, implement and refine the HACCP system in the food processing and foodservice sectors. These procedures include:

- Assignment of Responsibilities
- Evaluation of Operations for Hazards and Risks
- Measurement of pH Level of Foods
- Collection of Samples
- Analyses of Measurements
- Determination of Critical Control Points
- Monitoring and Recording of Data at Critical Control Points
- Selection and Training of Staff
- Measurement of Time-Temperature Exposures
- Testing of Samples for Pathogens
- Measurement of Water Activity ( $a_w$ )
- Flow Diagrams of Food Production Process
- Establishment of Control Criteria
- Verification of HACCP System's Effectiveness

The Procedures to Implement the Hazard Analysis Critical Control Point System manual is available exclusively from the International Association of Milk, Food and Environmental Sanitarians. To order, Contact IAMFES at 800-369-6337 (U.S.) or 800-284-6336 (Canada).

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# Coming Events

1991

## November

- 4-5, Confectionery Production Technology**, sponsored by The Center for Professional Development, will be held in Atlanta, GA. For more information call (908)613-4535; to register by phone call (908)613-4500.
- 4-7, The Science of Ice Cream Manufacturing**, sponsored by the University of California, will be held at the Food Science and Technology Department, Cruess Hall, UC Davis Campus. For further information contact James Lapsley, Program Director, University of California, Davis, CA 95616-8598; (916)757-8692.
- 6, Food Industry Sanitation and Food Safety Workshop**, presented by the University of California Cooperative Extension, will be held at the Anaheim Plaza Resort Hotel, 1700 S. Harbor Blvd., Anaheim, CA. For more information contact Heidi Fisher, Food Science and Technology, University of California, Davis, CA 95616; (916)752-1478.
- 6-7, Chocolate Production Technology**, sponsored by The Center for Professional Development, will be held in Atlanta, GA. For more information call (908)613-4535; to register by phone call (908)613-4500.
- 6-9, The Fundamentals of Selling & Merchandising** will be held at the Holiday Inn, Chicago, IL. For more information contact the International Dairy Foods Association, 888 Sixteenth Street, NW, Washington, DC 20006; (202)296-4250.
- 7-8, Consumer Focus - The '90's**, San Francisco, CA. Contact: Phillip Olivetti, NFPA, Claims Dept., 1401 New York Avenue, NW, Washington, DC 20005, (202)639-5946.
- 11-14, Industrial Refrigeration Workshop West**, sponsored by the University of California, will be held at the Food Science and Technology Department, Cruess Hall, UC Davis Campus. For further information contact James Lapsley, Program Director, University of California, Davis, CA 95616-8598; (916)757-8692.
- 12, Warehouse Sanitation**, sponsored by the American Institute of Baking, will be held at the Industry Hills Sheraton Resort, One Industry Hills Parkway, City of Industry, CA. For more information call AIB at (913)537-4750 or (800)633-5137.
- 13-14, Alabama Association of Dairy & Milk Sanitarians Annual Meeting** will be held in Birmingham, AL. For more information call or write Tom McCaskey, Department of Dairy Science, Auburn University, Auburn, AL 36849; (205)844-1518.
- 13-15, The Extended Shelf-Life of Foods**, sponsored by The Center for Professional Development, will be held in Chicago, IL. For more information call (908)613-4535; to register by phone call (908)613-4500.
- 13-15, Starch Technology**, sponsored by The Center for Professional Development, will be held in East Brunswick,

NJ. For more information call (908)613-4535; to register by phone call (908)613-4500.

- 15-17, National Automatic Merchandising Association Financial Management Seminar** will be held at the Las Vegas Hilton Hotel, Las Vegas, NV. For further information contact NAMA Convention Department at (312)346-0370.
- 18-20, International Association of Biological Standardization (IABS)** will hold its 22nd Congress and Exposition on "Characterization and Standardization of Purified Biologicals" in San Francisco, CA. For more information, contact Crest International, 940 Emmett Avenue, #14, Belmont, CA 94002. Telephone (415)595-2704 or outside California (800)222-8882, and by fax, (415)595-3379.
- 19, Warehouse Sanitation**, sponsored by the American Institute of Baking, will be held at the Sheraton Atlanta Airport Hotel, 1325 Virginia Avenue, Atlanta, GA. For more information call AIB at (913)537-4750 or (800)633-5137.
- 18-21, Baking Technology**, sponsored by The Center for Professional Development, will be held in East Brunswick, NJ. For more information call (908)613-4535; to register by phone call (908)613-4500.
- 20, Tennessee Association of Milk, Water and Food Protection Fall Meeting** will be held at the Ellington Agricultural Center, Nashville, TN. For more information, please contact Dennis Lampley at (615)360-0157.
- 21-22, Establishing Hazard Analysis Critical Control Point (HACCP) Programs**, Davis, CA. Contact: Sharon Munowitch, University Extension, University of California, Davis, CA 95616-8727, (916)757-8899.

## December

- 3-5, Microbiology and Engineering of Sterilization Processes** to be held at the St. Paul Campus of the University of Minnesota. For further information contact Dr. William Schafer, course coordinator, Department of Food Science and Nutrition, 1334 Eckles Avenue, St. Paul, MN 55108, (612)624-4793.
- 3-5, Good Manufacturing Practices (GMP) for the Food Industry**, sponsored by The Center for Professional Development, will be held in East Brunswick, NJ. For more information call (908)613-4535; to register by phone call (908)613-4500.
- 4-6, Introduction to Food Processing Systems**, UC Davis, Davis, CA. Contact: Sharon Munowitch, University Extension, University of California, Davis, CA 95616-8727, (916)757-8899.
- 9-11, Food Microbiology**, sponsored by The Center for Professional Development, will be held in East Brunswick, NJ. For more information call (908)613-4535; to register by phone call (908)613-4500.
- 9-12, Better Process Control School**, UC Davis, Davis CA. Contact: Sharon Munowitch, University Extension, University of California, Davis, CA 95616-8727, (916)757-8899.

1992

## January

•**6-17, Ice Cream Short Course, 100th Anniversary**, will be held at the J.O. Keller Conference Center, The Pennsylvania State University, 306 Ag. Administration Building, University Park, PA 16802. For further information call (814)865-8301 or FAX (814)865-7050.

## February

•**3-6, Freezing Technology Short Course**, sponsored by the University of California-Davis, Davis, CA. Contact: Sharon Munowitch, University Extension, University of California, Davis, CA 95616-8727, (916)757-8896.

•**9-12, Pacific Fisheries Technologists 43rd Annual Meeting** to be held at the Sheraton Hotel, San Pedro, California. For further information, contact: Pamela Tom, Food Science & Technology Dept., University of California, Davis, CA 95616-8598. Telephone: (916)752-3837; FAX: (916)752-4759.

•**10-12, National Mastitis Council 31st Annual Meeting** to be held at the Crystal City Hyatt in Arlington, Virginia. For more information contact Anne Saeman, Director of Operations, National Mastitis Council, 1840 Wilson Blvd., Suite 400, Arlington, VA 22201, Phone: (703)243-8268, FAX (703)243-8268.

•**12-13, Dairy and Food Industry Conference** will be held at The Ohio State University, Department of Food Science and Technology, 2121 Fyffe Road, Columbus, Ohio 43210-1097. For more information contact John Lindamood at (614)292-7765.

•**28, Baking Industry Sanitation Standards Committee Annual Membership Meeting** to be held at the Chicago Marriott Hotel, Chicago, IL. For more information, contact the BISSC headquarters at 401 North Michigan Avenue, Chicago, IL 60611; (312)644-6610.

## March

•**16-18, Food Product Development/Ingredient Technology**, sponsored by the University of California-Davis, Davis, CA. Contact: Sharon Munowitch, University Extension, University of California, Davis, CA 95616-8727, (916)757-8896.

•**16-19, Better Process Control School**, sponsored by the University of California-Davis, Davis, CA. Contact: Sharon Munowitch, University Extension, University of California, Davis, CA 95616-8727, (916)757-8896.

•**23-27, Midwest Workshop in Milk, Food and Environmental Sanitation** will be held at The Ohio State University, Department of Food Science and Technology, 2121 Fyffe Road, Columbus, OH 43210-1097. For more information contact David Dzurec at (614)292-7723.

## April

•**12-15, Application of Predictive Microbiology and Computer Modeling Techniques to the Food Industry (SIM**

**International Workshop)**, will be held at the Hyatt Regency Hotel, Tampa, FL. For information, contact Dr. Robert L. Buchanan, Microbial Food Safety Research Unit, USDA-ARS-ERRC, 600 East Mermaid Lane, Philadelphia, PA 19118, call (215)233-6620, FAX (215)233-6581.

•**25-29, The Sixth Conference for Food Protection** will be held at the Tremont Plaza Hotel, Baltimore, MD. For further information contact Leon Townsend, Executive Secretary, Conference for Food Protection, 110 Tecumseh Trail, Frankfort, Kentucky 40601, (502)695-0253.

## May

•**3-6, Centennial Conference of the Ice Cream Short Course** to be held at the J.O. Keller Conference, The Pennsylvania State University, 306 Ag. Administration Building, University Park, PA 16802. For further information call (814)865-8301, FAX (814)865-7050.

•**4-6, Food Processing Automation Conference**, sponsored by the Food & Process Engineering Institute, will be held at the Hyatt Regency, Lexington, KY. For more information, contact Jon Hiler, Conference Manager, FPEI, 2950 Niles Road, St. Joseph, MI 49085-9659; Phone (616)429-0300, FAX (616)429-3852.

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

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109	122	135	148	161	174	187	200	213	226	239	252	265	278	291	304	317	330	343	356
110	123	136	149	162	175	188	201	214	227	240	253	266	279	292	305	318	331	344	357
111	124	137	150	163	176	189	202	215	228	241	254	267	280	293	306	319	332	345	358
112	125	138	151	164	177	190	203	216	229	242	255	268	281	294	307	320	333	346	359
113	126	139	152	165	178	191	204	217	230	243	256	269	282	295	308	321	334	347	360

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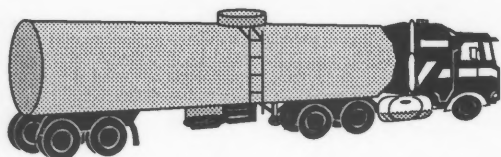
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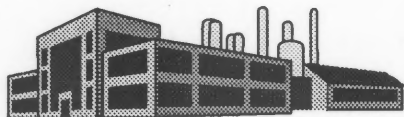
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