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FOOD PROTECTION TRENDS

SCIENCE AND NEWS FROM THE INTERNATIONAL ASSOCIATION FOR FOOD PROTECTION

FEBRUARY 2003

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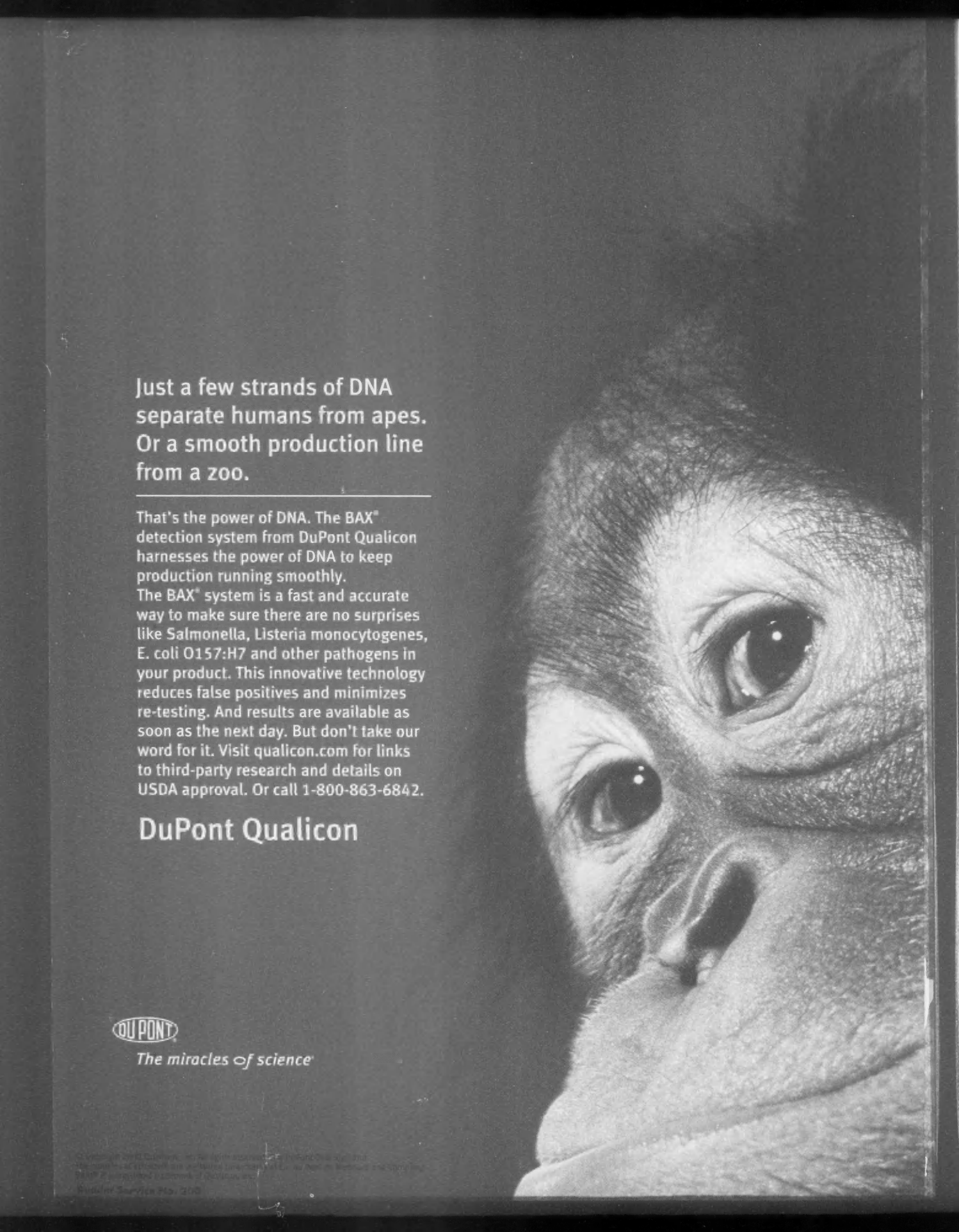
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USDA Meat and Poultry Hotline Provides Information in Spanish – 1.800.535.4555

The USDA Meat and Poultry Hotline is now providing safe food handling information in Spanish.

According to Hotline Manager Bessie Berry, "we recognize that we have many special populations within the United States. Providing information in Spanish is just one of the many efforts we make to reach diverse groups."

Spanish-speaking people calling the Hotline now have the option of receiving recorded messages in Spanish, or speaking with a Spanish-speaking food safety expert.

Recorded messages include a variety of topics, including the basics of safe food handling.

To access the recorded messages or speak with a food safety expert in Spanish, just call 800.535.4555.

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FOOD PROTECTION TRENDS
SCIENCE AND NEWS FROM THE INTERNATIONAL ASSOCIATION FOR FOOD PROTECTION

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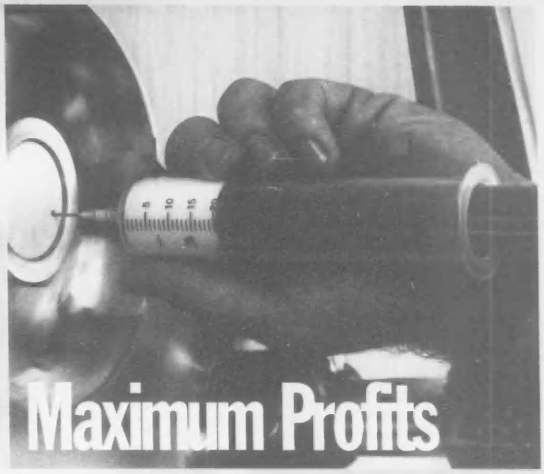
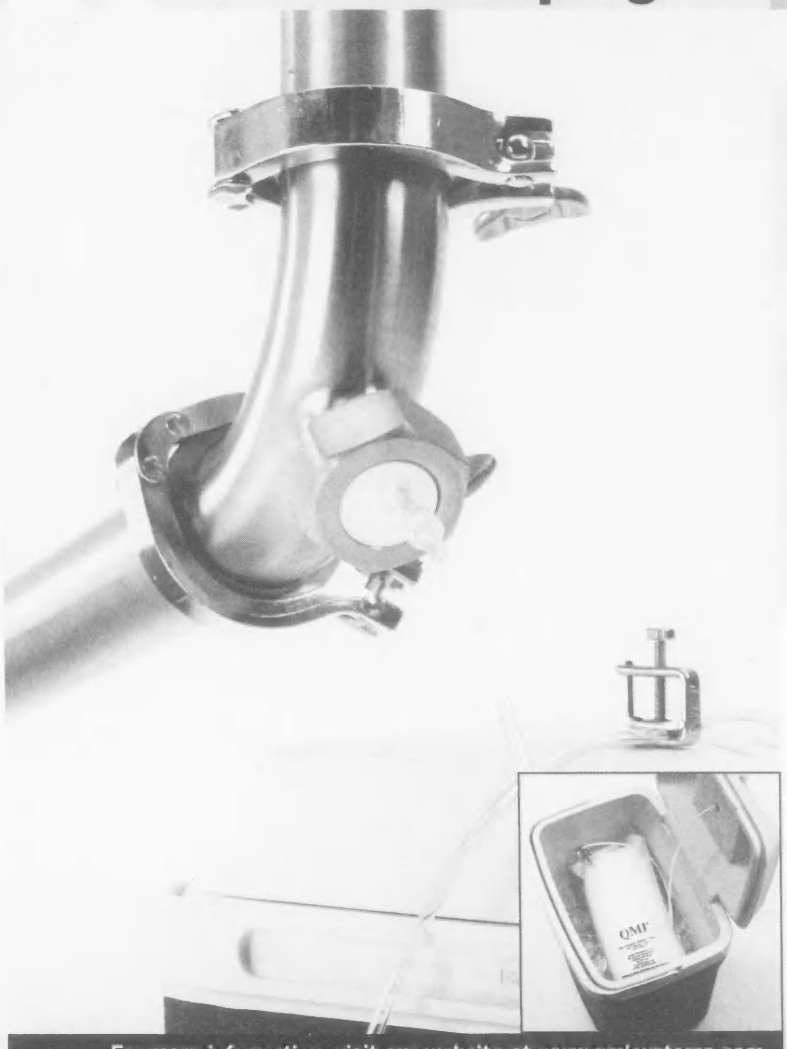


Staphylococcus aureus



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"THOUGHTS FROM THE PRESIDENT

By ANNA M. LAMMERDING
PRESIDENT

"The goal of delivering the highest quality science possible is to serve the needs of our readers"

While attempting to undertake my semi-annual office clean-up, which tends to occur around the time when..."I CAN'T FIND ANYTHING ANYMORE!", I came across an article I had clipped from a newspaper a year ago, which alleviated some of my frustration with the task ahead. The item was about global warming, and how a "lucky fluke" provided the first direct evidence that the build-up of atmospheric greenhouse gases has disrupted the Earth's natural thermostat. What caught my interest was, what was that lucky fluke? Turns out it was the discovery of actual data, satellite measurements of the Earth's heat radiation in 1970 which had "apparently got lost in somebody's cupboard," until three years ago (someone tidying up their office found it?). Of note is that these satellite readings had been mislaid for 30 years within the US space agency, NASA. I figure, well, if it can happen to them... it can happen to anybody.

I do know I have in my "archives" a January 1955 issue of the *Journal of Milk and Food Technology*, the forerunner of this publication. It reminds me of how IAFP began, where we have been, and where we are going.

The mission statement of IAFP is *to provide food safety professionals worldwide with a forum to exchange information on protecting the food supply*. Key to this mission is making sure that our publications, the *Journal of Food Protection* and this, our general membership publication, *Food Protection Trends*, are of the highest quality possible. Our scientific editors, John Sofos, Mike Davidson, Joe Frank (*JFP*) and Bill LaGrange (*FPT*) put in endless hours making sure that happens. The journal management committees, chaired by Isabel Walls (*JFP*) and Christine Bruhn (*FPT*), provide advice and guidance on publication issues. Without our Editorial Staff of David Tharp, Lisa Hovey, Bev Corron, Didi Loynachan, Donna Bahun and Pam Wanninger, none of it would come together! However, we also acknowledge that the high quality of our publications could not happen without three other groups of people — authors, peer-reviewers, and readers.

The quality of scientific research and authoritative review articles printed each month relies on the quality of the research and expertise of scientists who submit manuscripts for consideration for publication. In the field of microbiological food safety, *JFP* is regarded as the leading publication, and it continues to have an increasing worldwide readership. This would not happen if the articles published were not of current, high quality science, which reflects on the high standards of the authors' scientific endeavors. In 2002, we received 500 manuscripts for *JFP*. In all cases we strive to ensure that authors receive an efficient and unbiased assessment of their work, and try to publish papers promptly after acceptance. In 2002 the overall acceptance rate for unsolicited papers to *JFP* was 65%, and the average time from acceptance to publication was 180 days. In last month's issue, Editor Bill LaGrange gave similar statistics for *FPT*.

Underlying the very foundation of scientific excellence and integrity is the peer-review process. For this, we rely on the members of our editorial boards, all dedicated voluntary reviewers who spend substantial time and effort to provide rigorous, thorough assessments of each manuscript submitted. The expertise and willingness of each of these individuals contribute critically to the quality and success of both *JFP* and *FPT*.

The goal of delivering the highest quality science possible is to serve the needs of our readers. Ideally, you, our readers get value not only from the timely articles in your own area of specialization, but also from the breadth of all the scientific

research appearing each month in *JFP*, and the current events and articles published in *FPT*. To make our information more readily available to our readers, the full text of articles published in *JFP* are available online for members, and anyone visiting our Web site (www.foodprotection.org) can access abstracts of scientific articles published in both *JFP* and *FPT*, as well as the full text editorials and association news published in each month in *FPT*.

Now, back to quasi-organizing my office... with a little more motivation, although it is highly unlikely that something as interesting as NASA's satellite readings might be lurking in the back of a file cabinet drawer!

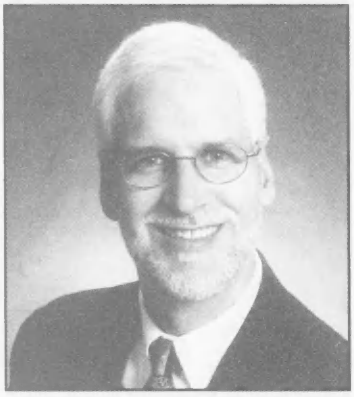
"COMMENTARY"
FROM THE EXECUTIVE DIRECTOR

Have you ever wondered how to be a part of the program at IAFP's Annual Meeting? Do you have a desire to become more active at the Annual Meeting? Would you like to further the Association's efforts to "Advance Food Safety Worldwide"? In this month's column, we want to explain how to get on the Annual Meeting program and give you ideas on how to proceed with each of the above questions.

There are a number of ways to become an active component of the program at IAFP's Annual Meetings. Two main breakdowns of program content are available, symposia and technical papers. Technical papers are further broken down into oral presentations or poster presentations. Now lets look deeper at the process for each successful technical submission.

A call for abstracts (for technical papers) is issued during the fall each year. The due date for abstract submission is normally early in January (January 6 this year). Authors may choose between an oral and a poster presentation when they submit their abstract. Immediately after the deadline, the Program Committee reviews each submitted abstract for a number of qualifying elements. This year there were over 400 abstracts submitted, so the Program Committee really had their work cut out for them to review this increased quantity of papers!

Accepted abstracts are grouped with similar topics to create sessions for either oral or poster presentations. This too, is the work of our Program Committee. We should mention the tremendous amount of work and detail that the Program Committee sifts through to prepare each Annual Meeting program. At this time, I want to thank the entire Program Committee for their dedicated work and offer special thanks to Lynn McMullen and Gary Acuff, the Committee's chairperson and vice chairperson.



By DAVID W. THARP, CAE
EXECUTIVE DIRECTOR

"There are a number of ways to become an active component of the program at IAFP's Annual Meeting"

That gives a short summary of the process to enter the program with a technical paper. Now let's take a look at the symposium process. The timeline for submitting a symposium starts much earlier than with technical papers. Symposium proposals for IAFP 2003 were due at IAFP 2002. Symposia for IAFP 2004 will be due to the Program Committee by Sunday, August 10 in New Orleans.

First off, it might be good to review what makes up a symposium. A symposium is an organized, half-day session that emphasizes a central theme relating to food safety. A symposium normally consists of six 30-minute presentations. Symposium topics can center on a common food safety issue of general interest or it could be a discussion of research results in a given specific area. Topics are open to many formats and issues, but whatever the topic, we again call upon the Program Committee to review each proposal submitted for relevance to the IAFP audience. The Committee also must filter through the many submissions to eliminate duplication and make suggestions for strengthening the proposed session.

Shortly after symposium proposals are reviewed, the Committee chairperson notifies the organizer of the disposition of their submission. In the case of accepted symposium, the organizer may be asked to make minor revisions to their topics or speaker list. Organizers must then submit a finalized symposium proposal prior to the January Program Committee meeting. At that time, the Program Committee arranges the symposia and technical papers to construct the Annual Meeting program.

I hope that this description has helped you understand the two types of program content for IAFP's Annual Meeting. You are welcome to contact me if you have any questions about the process. Better yet, you may contact Bev Corron here at the IAFP office as she works closely with the Program Committee and the submission process.

Through involvement at the IAFP Annual Meeting, you will be "Advancing Food Safety Worldwide"!

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ARTICLES

Food Protection Trends, Vol. 23, No. 1, Pages 114-129

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International Association for Food Protection

Providing an Adequate Supply of Microbiologically Safe and Palatable Food and Drinking Water: Contribution of a European Vertically Integrated Approach to Educating Professionals and Consumers — Part 2

D. A. A. MOSSEL,[1*] G. P. MORRIS,[2,3] C. B. STRUIJK,[1,4] J. M. COWDEN,[2] and L. M. BROWNING[2]

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INTERNATIONAL COORDINATION

Any food safety initiative limited to a local or even national forum is likely to fail, because many food items are routinely imported from other countries, including distant and developing ones. Primary commodities of animal origin, including red meats, poultry, dairy and egg products and marine foods, are generally acknowledged as consistently, although sporadically and erratically, contaminated with an array of enteric pathogens *(6, 21, 50, 53, 88)*. Consequently, in international trade, these staple foods receive special attention. However, a great many foods of vegetable origin have also been identified as sometimes carrying dangerous contamination, not only by unacceptable mycotoxin levels, but also, and more frequently, by enteric pathogens (Table 1). This is unsurprising, as these products are exposed to fecal contamination from such sources as rodents, birds, and silage *(85)*. In addition, vegetables and some fruits are, unfortunately, frequently "freshened" by "night soil," i.e., irrigated with sewage and marketed without any subsequent decon-

A peer-reviewed article.

*Author for correspondence: Phone 31.30.2.933.019;
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TABLE 1. Examples of products of vegetable origin associated with outbreaks of intestinal or systemic infectious diseases in man

	Major pathogens transmitted
Alfalfa sprouts	*Salmonella*; *E. coli* O157:H7
Apple cider	*E. coli* O157:H7
Apple juice	*E. coli* O157:H7; *Cryptosporidium parvum*
Bean sprouts	*S. saint-paul*
Breakfast cereals	*S. agona*
Cantaloupe	*E. coli* O157:H7; *S. poona*
Chocolate	*S. eastbourne*, *napoli*, *nima*, Typhimurium
Coconut	*S. paratyphi* B, *typhi* and a broad range of enteritis strains
Frozen baby maize	*S. brunei*
Fruits (soft)	*Cryptosporidium parvum*, hepatitis A virus
Onions	*Clostridium botulinum* type A, *Cryptosporidium parvum*
Orange (fresh) juice	*S. muenchen; Shigella flexneri*
Peanuts	Exotic serotypes of *Salmonella*
Radish sprouts	*E. coli* O157:H7
Raspberries	*Cyclospora cayetenensis*; calicivirus
Salad vegetables	*E. coli* O157:H7; *Listeria monocytogenes*; *Shigella sonnei*, *Cryptosporidium parvum*, *Cyclospora cayetenensis*
Soya flour	*S. tennessee*
Spices	*S. oranienburg*, *weltevreden*
Tomatoes	*S. baildon*, *javana*, *montevideo*
Vegetable sprouts	*B. cereus*, *S. muenchen*, *S. saint-paul*
Watermelon	*S. javana*, *Shig. sonnei*

Source: Mossel & Struijk, 2000 *(58)*

tamination processing. More generally, as colony counts of *E. coli* demonstrate, produce is not infrequently handled without sanitary care *(7)*.

Imports can be brought under control by using the generally applicable principle of vendor assurance, also termed 'safe sourcing' or proactive supply management. This practice relies on regional compliance with ACoPs, introduced, as part of longitudinally integrated safety assurance (LISA) scenarios, by Lord Plumb of Coleshill in 1989 *(54)*, to be addressed in the next section. The strategy, directed particularly towards more remote suppliers, is schematized in Table 2. Unsurprisingly, unsatisfactory results are initially common. Overseas providers can benefit, then, from assistance offered by their customers. Such assistance is exemplified by those instances in which a client assists a supplier in adopting improved hygiene and/or refrigeration or freezing regimes, to their mutual benefit.

Often the introduction of a decontamination step, also termed a 'pathogen reduction' procedure *(66)*, is made mandatory *(14, 15, 20, 21, 23, 31, 36, 76)*, clearly *in addition* to the usual excellent hygiene practices, *(83)* and *not* as an alternative to them. This decontamination step is inescapable because of the seemingly uncontrollable contamination of raw red meat and poultry, even in regions with good hygiene and adequate refrigeration *(6)*. The same applies to frozen marine foods, which are very widely traded internationally *(18, 28, 40)*. Vegetable staples are also appropriate candidates for decontamination processing *(74, 78a, 79, 90)*, as documented in Table 1.

Unfortunately, the need for such an intervention step, even when explicitly in addition to, and not instead of, meticulous adherence to sophisticated sanitation throughout, has often been disputed. Its efficacy in health protection has been demonstrated by recent epidemiological data *(65)*, while the agents used are free of any adverse health effects as, for instance, lactic acid *(15, 21, 76)*. Hence the opposition to introduction of a pathogen reduction step outside the dairy industry, where it was adopted some eight decades ago *(92)*, is entirely unfounded.

TABLE 2. Monitoring strategy applicable to the acceptance of imported foods, processed for safety abroad

Phase 1. Survey on the present condition of merchandise

Request, and examine upon receipt, a representative number of samples, with a minimum of 25, drawn at random from a production of about 1,000 units, manufactured, stored and shipped in accordance with Codex Alimentarius Codes of Good Manufacturing and Distribution Practices (GMDPs), other procedures agreed by consensus as appropriate, or processsing technologies designed specifically for a particular situation or commodity.

- If all samples pass a refereed examination procedure, proceed to phase 2.
- If one or more samples fail to pass, inform shipper (i) that importation cannot be pursued at present; but (ii) that the survey will be repeated as soon as an audit has demonstrated that substantial improvements have been made.

Phase 2. Audit of foreign processing operation

Send a group of independent acknowledged experts in the area of food processing and safety to the exporting country, with the brief to check that applied GMDP-procedures can ensure a safe exported product under the prevailing conditions in the area of operation.

- If the report substantiates compliance: start importation, with the proviso of phase 3.
- In case of *minor* deficiencies, recommend adequate remedial changes, (1) validate their application and (2) verify their impact.
- Upon ascertaining *substantial* failures: suggest radical improvements and revert to phase 1.

Phase 3. Trial importation

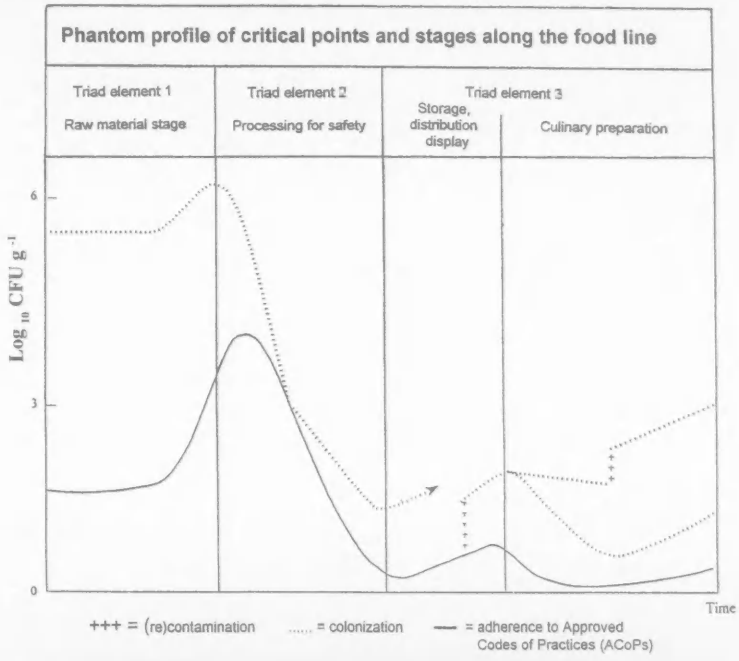
- Stipulate that consignments must be accompanied by a certificate, issued by the exporting country's Public Health Authority, that the Practices developed during phase 2 have indeed been meticulously adopted.
- Upon arrival of such consignments, examine some ten samples, drawn at random from each production lot, by the procedure referred to under phase 1, and accept or refuse importation, depending on the results.

TABLE 3. Essential differences, with respect to health impact, between chemical and microbiological hazards in foods

Parameter	Disease triggered by	
	Toxic constituents	Infective or toxinogenic organisms
Distribution in commodity	As a rule entropic (homogeneous)*	Erratic (strongly 'stratified' in nests)
Concentration flux as function of time	Virtually constant in 'recalcitrant' toxicants, which constitute the majority	Permanent and perennial in non-sporing organisms
Patient-to-other-person transmission	Nonexistent	Always realistic hazard
Sequelae ('complications', i.e., subsequent morbid effects, different from main syndrome)	None	Frequent and serious, particularly, but far from exclusively, in immunodebilitated consumers (YOPIs)
Protection by previous exposure to same agent	None	Variable, affected by pathogenic agent and attributes of consumers

*The dioxin contamination catastrophe in Europe (1999) demonstrated that in some instances, particularly adulteration of commodities, severe stratification may mar the reliability of analytical data; cf Stark et al. (2002). Food Control 13:1–11.

FIGURE 1. The Wilson Triad: Longitudinally integrated assurance of microbiological integrity of foods



BOX 1.

Use in safety assurance of the process parameter: Integrated Pathogen Reduction Level (IPRL)

$IPRL = \Lambda \cdot \Delta$

Λ = lethality = $\frac{N_0}{N_p} = f(t/T; pH, \alpha, a_w, c)$

Key:
- N_0 = colony count in raw material, g^{-1}
- N_p = colony count immediately after processing, g^{-1}
- t/T = time/temperature profile of exposure to lethal heat
- α = activity of antimicrobial constituents, naturally occurring or added
- a_w = water activity
- c = condition of exposed cells

Notes: Take account of 'biodiversity', *i.e.* Gaussian spread of response of individual cells within a population of a target taxon.

Range in practice, necessitated by virulence attributes, 10^2 - 10^{12}.

Δ = extent of post-decontamination change of cfus = $(1 + \rho N_p) \frac{N_f}{N_p}$

Key:
- ρ = extent of recontamination
- N_f = ultimate post-processing pathogen colony count g^{-1}

Notes: When $\rho = 0 \Rightarrow \Delta = \frac{N_f}{N_p}$, >1 as a result of proliferation, or <1 in case of spontaneous decline.

Range in practice: 10^{2} - 10^{-2}

When GMDP is meticulously followed: $\Delta = \leq 1$

Assess IPRL adequacy, by calculating whether N_f does not exceed TSL = tolerable safety limit in the food, *i.e.* exposure by ingestion corresponding to satisfactorily minimized hazard.

THE LONGITUDINALLY INTEGRATED FORWARD CONTROL MAXIM

The crucial contributions of HACCP, particularly its longitudinal integration: principles

The strategies previously described that some purchasers use to assist their suppliers to comply with the above addressed ACoPs provide an excellent example of the best practice in the pursuit of food safety, with regard to preventive intervention. In spite of this approach having been advocated by leaders in public health since the beginning of the 20th Century *(47, 53, 73, 91)*, practices remained rooted in a retrospective market surveillance and inspection policy, borrowed from chemical food hygiene, where, as documented before, it had been effective (Table 3).

The challenge posed by supplying astronauts with unconditionally safe foods finally prompted Bauman *(4)*, in the late 1960s, to introduce a "forward control approach" termed HACCP: Hazard Analysis leading to Control of Critical Practices. Upon the start of a new millennium, this new strategy became almost universally accepted *(51)*. Nonetheless, it is vital that it be applied in accordance with Lord Plumb's maxim, introduced earlier, i.e., in longitudinally integrated fashion *(8, 23, 54, 84)*. Colloquially, this has been termed "from the farm gate to the consumer's plate." It is, in retrospect, surprising that it took the food sector so long to recognize that 'a chain is no stronger than its weakest link' *(48)*, as this concept had been expounded in crystal-clear terms as early as the 1930s, in what is known as the 'Wilson Triad.'

TABLE 4. Algorithmic formulation of the seven principles of HACCP: hazard analysis, allowing control of practices with adverse microbiological effects, all along the lines, from the raw material to the commodity, as ingested by the public

Principle 1

Conducting a hazard analysis, taking into account:
* Target pathogens and their FSO-based tolerable safety limits
* The applying food product ecosphere: intrinsic, processing, implicit and extrinsic determinants

Principle 2

Identification of 'critical points':
Practices whose lack of control would result in intolerable contamination,colonization and/or production of enterotoxins, and hence constitute a potential hazard; integration of results to *hazard characterization*

Principle 3

Design of HACCP-Plan;
Elaboration of performance criteria: ranges of numerical values of all limiting or elimination factors, aiming at ensuring longitudinally integrated control of characterized hazards

Principle 4

Process Validation:
Monitoring the adequacy in practice of the designed measures of intervention, as contained in the tentative HACCP-Plan

Principle 5

Elaboration, introduction and validation of *corrective actions,* in case validation has revealed residual structural or incidental hiatuses that had gone *undetected* in the previous *audit*

Principle 6

Verification of compliance, i.e, adherence to the *ultimately adopted specific Code of Practices:* gauging the microbiological condition of expertly drawn, transported and examined — mostly for levels of marker organisms — end product samples against Guidelines, e.g., *Food Safety Objectives*

Principle 7.

Documentation and record keeping mandatory for each of the six elements

The Triad includes, as illustrated in Fig. 1 *(57),* in element (1) vigilance over raw materials. When their bacteriological condition is poor, intensified processing, adversely affecting nutritional and sensory attributes,will be called for. Also, part of the activity of thermostable enzymes of microbial origin may remain and cause post-process amylolytic, lipolytic and proteolytic deterioration — not exactly food integrity; in element (2) effective processing-for-safety, as in the pasteurization of dairy and egg products and fruit juices; and in element (3) meticulous post-manufacturing control of recontamination (harder to avoid when environmental infectious pressure is elevated as a result of the introduction of severely contaminated raw materials) and recolonization. This element 3 consists of two distinct logistic phases, management of compliance with ACoPs by the trade and by consumers, respectively.

Essential HACCP elements not to be neglected

It is of decisive importance that all information and experience obtained in later stages of the production and distribution chain are passed on without delay to supervisors and line staff responsible for the previous steps in the manufacturing process. This applies particularly to breaches in HACCP strategies, identified by instrumental or microbiological-analytical inspection; *vide infra.* The classical example of this strategic conduct in ensuring the microbiological safety and quality of foods is constituted by Lord Plumb's vendor assurance policy, an essential element of the LISA strategy, addressed before.

The HACCP strategy in its present form (Table 4) may, in principles 3, 4 and 5, as in Wilson Triad element 2, call for attention to substantially reducing pathogen loading of a given commodity, as addressed in the previous section. A broad variety of previously elaborated, as well as innovative, technological interventions exist to achieve this objective. Heat processing, as in milk pasteurization, is the most frequently applied technology. Today it is common practice to rely on *performance criteria,* rather than on end product monitoring. The required intensity of decontamination thus results from the assessment and management of risk (Box 1). If correctly applied, the pro-

BOX 2.

Longitudinally integrated prevention strategy required in the management of bovine prion-induced NV Creutzfeldt-Jakob disease in man

At the farm

- meticulous avoidance of mixed feeds containing compounds of bovine or ovine origin, or accidentally contaminated by such materials;
- vigilance with respect to the first clinical signs and symptoms of BSE; when there is any suspicion, immediate consultation of a veterinarian;
- culling to the extent and the type prescribed by legislation, or as instructed by a veterinarian *ad hoc*.

Around and in the slaughter house

- expert veterinarian inspection of animals on the hoof for suspect signs and symptoms;
- careful decapitation, evisceration and carcass splitting to discard risk material, followed by its immediate incineration;
- when required by legislation, or by *ad hoc* veterinarian order, quarantining carcasses, until found negative by immunodiagnostic testing.

Along the meat processing chain and meat products trade

- strict auditing for total avoidance of incorporation of risk material in meat products;
- retrospective monitoring, by adequate spot tests, of nationally manufactured, comminuted meat products;
- vigilance with respect to all comminuted meat products imported from regions not under jurisdiction of the importing country, or otherwise putatively suspect of spreading prions.

TABLE 5. The pathogen column of the 'menu', in its application to risk characterization

- Not infrequently the problem is which pathogens to include in the test battery; and, e.g., how to proceed with respect to enteric viruses, parasites and prions. *(1)*
- When pathogens *are* at all present in foods processed for safety, their levels may be as low as 1 CFU per 10 kg, making Λ- estimates most inaccurate. *(6)*
- Even when reliable sensitive SOPs are available, or within reach, e.g., the CEN set, testing is relatively expensive and may require at least a few days to complete. *(9)*
- On the other hand, expertly elaborated boundary tests for marker organisms provide, rapidly and cheaply, credible information about attained overall reduction in consumer exposure. *(52)*

cessing-for-safety strategy will also control any more recently identified ('emerging') enteropathogens, even if they have unusually elevated resistance or virulence *(58)*, in as much as the parameter "lethality" introduced in Box 1 *(94)* allows many degrees of freedom.

A notorious exception is constituted by the prions, associated with transmissible spongiform encephalopathy *(44, 69)*. Their unusually elevated thermal resistance *(3, 71)* requires prophylaxis by the achievement of asepsis rather than elimination. A strategy for effective consumer protection is outlined in Box 2. Identification of prion-contaminated animals offered for slaughter has become within reach by virtue of very recently developed tests on blood and urine specimens. Illegal incorporation into meat products of parts of cows that may be infected with prions, due to non-adherence to Good Slaughter Practices, can be revealed by molecular diagnostics *(39, 43, 49, 62, 80)*.

VALIDATION AND VERIFICATION ACTIVITIES

Rationale for monitoring, once an HACCP strategy is embraced

HACCP, as set out in Table 4, explicitly includes *on-the-line monitoring of processes* and their *performance* by operational audits contained in principles 4 and 6, allowing early detection and subsequent correction of hiatuses in the processes. These may result from (i) a lack of identification of critical practices that escaped attention in the experimental design of the process; (ii) failure to validate measures of intervention adopted for their rectification; (iii) incidental malfunctioning of apparatus and/or controls; or

TABLE 6. Factors adversely affecting the validity of negative results of testing foods processed-for-safety for pathogenic organisms

1. Foods processed-for-safety according to the Wilson Triad are paucimicrobial; hence the levels of pathogenic bacteria will be very low, i.e., less than 1 CFU per 1–10 kg of food.
2. In addition, contamination with pathogens of such food bears a most stratified character, calling for elaborate techniques for obtaining an aliquot that may be considered representative for the distribution of the pathogen, however erratic this may be.
3. In foods processed-for-safety, particularly those marketed in dried form, non-sporing pathogens will always have incurred sublethal cytological and physiological damage. This calls for a resuscitation step, whose validity, i.e., restoring full vitality of the target, is not infrequently hard to establish empirically.
4. The detection of bacterial pathogens is, in essence, marred by the rather frequent occurrence of biotypes with an aberrant biochemical pattern. Notorious examples are H_2S-negative or lactose-positive variants within the genus *Salmonella*.
5. Methodology for the examination of foods for viruses and parasites is still in an active stage of development, while some goals may be hard to attain by means other than advanced molecular microbiological techniques.

FIGURE 2. Obstacles to the adoption of innovated, improved methodology for the microbiological examination of food samples

Results of a survey on reasons why an innovated or improved procedure had not been adopted:

- New method not known
- 'Do not change a winning team'
- Substantial investment required
- Lack of time to assess advantage
- New method not, though classical SOP has been, elaborated in own laboratory

Data from Dr. H. Van der Zee, personal communication (1998)

(iv) employee or supervisor failure. Although the monitoring relies primarily on visual and instrumental inspection, it has been demonstrated that it must be supported by *product* examination *(19, 37, 81)*. This is crucial to identify safety issues that have gone undetected by auditing.

There is generally no obstacle to the adoption of such process validation procedures. On the contrary, procedural verification by sample monitoring has been much debated and even disputed. It is common practice, however, to appraise the success or failure of *all* clinical and public health interventions by laboratory examination. Examples might be examination of blood samples in the management of diabetes, hypertension or hypercholesteraemia, or performance checks in milk pasteurization and water purification. It would therefore be illogical to deny food safety assurance the well-established benefits of verification by sample inspection *(77)*.

A second area where there is a compelling argument for sample monitoring is in ensuring microbiologically safe raw materials so as to avoid possible contamination within the entire food operation (Wilson's Triad, element 1). This constitutes a crucial element in Plumb's longitudinally integrated approach to food safety, as expounded previously *(54)*. This principle, recognized through vendor assurance (*vide supra*), calls for incoming materials to be inspected by well-designed microbiological-analytical spot checks.

Finally, government agencies, as a rule, exercise their food inspection activities by visual and instrumental auditing, relying on the use of checklist procedures. Here, as in the internal auditing referred to previously, it is imperative to support verdicts of apparently flawless operations by expertly elaborated, simple labora-

BOX 3.
Composition of YOPI Group within the General Population of Consumers

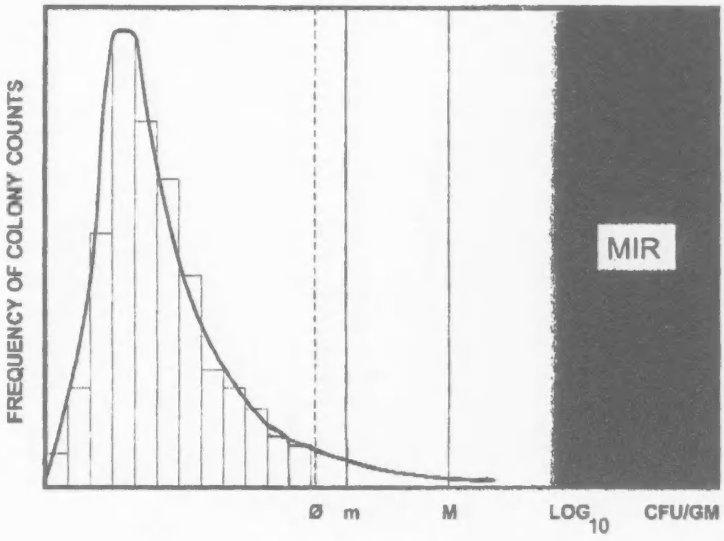
Group 1 — physiological variation in sensitivity through stages in life

The young, old, pregnant.

Group 2 — weakened immune system

Congenital, resulting from antecedent disease, iatrogenic.

FIGURE 3. Frequency distribution plot of colony counts obtained on a collection of food samples



The empirical assessment of reference ranges ('standards') for foods, relying on surveys on the microbiological condition of samples, drawn from consignments, that were manufactured, stored and distributed under prescribed good conditions (ACoPs), which had been validated previously, both as such and with respect to strict adherence by the corporations, from whose production lines the specimens were drawn

Legend:	Φ	= 95th percentile
	m	= reference value proper
	M	= maximal count expected under conditions of adherence to ACoPs
	CFU	= colony forming units
	MIR	= minimal infective range

tory tests to verify that all critical practices have indeed been brought under control. Otherwise, it is impossible for health inspectors to consistently identify less-obvious hiatuses in HACCP-strategies, that are nonetheless prone to cause food-transmitted diseases of microbial etiology if they are not effectively checked by appropriate laboratory procedures.

Good laboratory practices: crucial for high quality monitoring

A number of precautions must be observed if examination of specimens for any purpose is to remain relevant and be repeatable, so as to avoid discrepancies in results obtained in different laboratories, which erode the credibility of the profession *(78)*.

Target organisms

These should be limited to, and chosen from, those of ecological significance in a particular food *(38, 56)*. Only a small number of taxa should be sought, using expertly designed tests appropriate for process efficacy assessment. As documented in Table 5, 'pathogen hunting' is rarely appropriate, except in support of epidemiological investigations of outbreaks *(1, 26, 58)*. However, often a Presence or Absence test for pathogens constitutes a part of a standard or specification, in spite of the very slight significance of negative results of such a search (Table 6) *(59)*. In this instance, as elsewhere, the use of marker organisms rather than pathogens is a common procedure in food microbiology. The rationale of the practice is presented in Table 7. Markers should always be well-defined taxonomically. For instance, misleading designations such as 'fecal coliform' are to be avoided, because a substantial part, and often even the majority, of organisms recovered by procedures used for their detection are of non-fecal origin *(10, 29, 55, 67, 95)*.

In many instances, a certain correlation can be established between CFU-numbers of markers chosen as surrogates for organisms of health significance, termed index organisms *(52)*, and their ecologically related pathogens *(25, 42, 87, 89)*. This calls

BOX 4.

Steps in the Empirical Assessment of Microbiological Food Safety Objectives

Stage 1

Select and validate an appropriate number of food production and distribution operations by way of accurate auditing for meticulous compliance with applying ACoPs*. If available, use Codex Alimentarius 'Hygiene Codes.'

Adapt or improve Practices as required to attain ACoP adherence.

Stage 2

Examine an adequate number of representative samples for the criteria to allow verification of food integrity**, as derived from ecological studies on the food under review. Account for the fate of the target organism between production and consumption.***

Plot the results as a frequency distribution function of the type of Figure 3. Determine the parameters m and M of the mathematical theorem of Bray et al. (1973). [9a].

Stage 3

Option 1 — None of the collected data obtained by risk analysis and characterization as in stage 2 penetrates into the area exceeding M. The established distribution curve in this situation constitutes the scientific basis for FSOs, provided with their m, and M parameters.

Option 2 — One or more of the data obtained for crucial criteria penetrates into the > M-zone. In that case a breach, probably minor, in longitudinally integrated safety assurance, has been missed during auditing. This must consequently be identified and rectified. Subsequently Stage 2 is to be repeated, until the situation of Option 1 has been achieved.

*Approved Codes of Longitudinally Integrated Practices, defined as expertly elaborated and validated.

**Integrity of a food includes safety and, in addition, nutritional and sensory quality.

***Ecological parameters encompass: (i) growth or inhibition/devitalization of target during storage and distribution; (ii) the food being ready-to-eat (RTE), rather than always heated at pasteurization level before consumption.

for the use of the ecological determinant factor, (ϵ) which is the reciprocal of the abundance of the pathogen among the index group; cf. Table 7. Sometimes there is no pressing need for index markers, and simpler tests for indicator markers (Table 7) suffice. Elevated numbers of the latter, even without a clear connection with pathogens, but selected upon ecological investigation of their validity, may point to process failure *(52)*, and hence may also be useful in monitoring food production for safety *(12, 32)*. Actually, the Diary Industry has almost entirely relied on the use of a boundary test for coliaerogenes bacteria to verify compliance with ACoPs and thus succeeded in assuring the microbiological safety of their products.

Selection of procedures

General Guidelines. Even when the targets are agreed upon, the choice of methods to be used to assess compliance with ACoPs has often bred controversy. Many practicing food microbiologists, regardless of their level of competence, are not particularly eager to abandon methods they are accustomed to (Fig. 2). Others obsessively strive to improve sensitivity, selectivity and productivity of methods developed by others. Such endeavors wrongly suppose that a perfect method will ultimately be attained — "method tweaking". As a matter of fact, an ideal method is always beyond reach, because target organisms, as well as 'background' associations that interfere with the detection or enumeration of the targets, are in a constant state of flux. This affects phenotypically and genotypically determined attributes of species on which the selection and identification of the ultimate target rely. A solution to this difficult situation may be the following.

When monitoring serves to substantiate conformity with microbiological acceptance criteria, agreed upon between vendors and buyers, discrepancies between results obtained for the same specimen in different laboratories, as addressed before, must be avoided at all costs. Consequently, it is important to adhere to rigorously standardized SOPs, e.g., those of CEN in Europe *(9, 75)* or AOAC *(33)* and APHA *(17, 22)* in the Americas. These methods are highly repeatable. However, because of the compromises inherent in the manner in which they are accomplished in attempts to save resources, such SOPs do not always ensure maximal recovery of target organisms.

BOX 5.

The Triad version of the "precautionary principle" in consumer protection strategies

Semantics

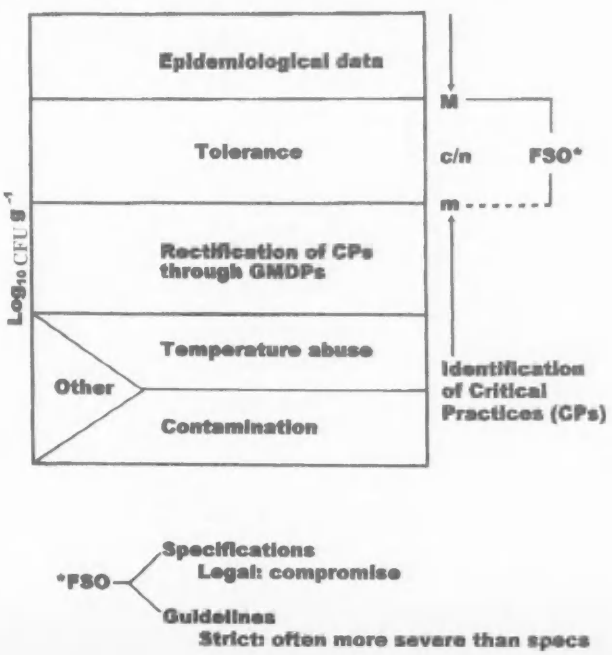
The validity of the noun "Principle" has been disputed. A much better designation would be Precautionary Consumer Protection Policy, which can be described as in the following Triad.

Components of the Triad

1. Absence of available evidence for a health hazard cannot be taken as evidence that there is no health risk from exposure. The margarine dermatopathy ('Planta disease'), and congenital malformations associated with thalidomide and diethylstilbestrol, as well as febrile enteritis outbreaks caused by bean sprouts and unpasteurized apple juice, are among the many episodes in which no indications of disease potential were noticeable until after human exposure.
2. In the absence of convincing evidence of no tolerable health risk being associated with exposure, when only circumstantial indications point to a putative health hazard, it would be prudent to conduct investigations whose results would allow conclusive decisions for consumer protection.
3. In instances where a robust, peer-reviewed risk assessment has revealed no evidence of any adverse health effects, it would be scientifically incorrect and ethically reprehensible to force an intervention directed at an illusory health hazard.

FIGURE 4. Empirical Determination of food safety objectives

Sources: Epidemiological surveys and line studies on plants, having adopted applying ACoPs



For internal auditing by manufacturers or caterers, the actual prevailing microbiological condition of products has to be known as accurately as possible, to avoid deficiencies before foods reach the market. This can be achieved, but will often call for more sensitive methods, which are correspondingly more laborious and costly. However, to avoid unpleasant surprises eventually, it is wise to move resources towards this goal. Enhanced sensitivity is particularly crucial when the foods being monitored are those that are to be ingested by consumers with decreased defense against infections, known as YOPI individuals (Box 3), who constitute a sizeable part of the population in many countries *(41, 58, 93)*.

Precautions to avoid missing debilitated surviving cells. There is a pressing need to take account of sublethally injured cells. Irrespective of which analytical strategy is chosen, every procedure should include a so-called resuscitation step. This allows cells to regain full vitality even after being impaired by processing to the extent that they have lost the capacity to grow freely on the selective-diagnostic media designed for their detection or enumeration.

Because such impaired populations will retain their virulence *(13, 45)*, in a hospitable environment they produce the same morbid effects as unimpaired ones. Failing to include sublethally stressed population fractions in a monitoring procedure will consequently lead to a substantial under-estimation of the risk of contracting enteric disease upon ingestion of the food in which they obtained a footing. The same applies when spoilage agents are enumerated in foods to estimate the ultimate date of their organoleptic integrity when stored under accurately defined conditions *(56)*.

TABLE 7. Rationale for the application of marker organisms in the microbiological monitoring of foods and water, with the purpose of verification of validated compliance with HACCP-based, approved codes of practice (ACoPs)

Definition

A marker is defined as an organism, or group of organisms, whose response in a food or drinking water reflects the fate of a target taxon, as it is affected by technological interventions aiming at its elimination or inhibition.

Boundary tests for appropriately selected markers may thus supplement or eventually substitute for direct searches for pathogens, in commodities processed-for-safety.

Classification

Index organisms are defined as those whose detection at certain levels implies the potential presence of physiologically, but particularly ecologically, related pathogens. The latter occur at very much lower concentrations than the index organisms in the raw material subjected to processing.

Indicator organisms are those whose detection in pre-determined numbers suggests a failure of a process aiming at decontamination or otherwise improving integrity. This is defined as including safety and quality of a food or water supply.

Quantification of index markers

Pass levels for index marker organisms are expressed as Minimal Marker Ranges of Concern (MMRs), derived from Ecological Determinants, termed ε-factors.

These are defined as the reciprocal of the abundance of the target pathogen within the index group. Hence: abundance $\alpha = N_{pathogen} / N_{index}$ $\Rightarrow \varepsilon = N_{index} / N_{pathogen}$. The ecological determinant has been chosen to avoid the use of negative exponents throughout.

Quantification of indicator markers

Acceptable Quality Levels (AQLs) for indicator organisms are derived from pilot studies. These aim at balancing the extent of elimination, devitalization or inhibition of given target organisms against virtually negligible loss of nutritional or sensory qualities of the food or water supply so processed.

Ingram, M. [postnum.], 1977. Lancet II: 1425.

TABLE 8. Ecological classification of foods in terms of intrinsic colonization resistance

Group 1:	commodities offering ample opportunities for microbial proliferation after processing, e.g., pasteurized milk;
Group 2:	foods with certain, although limited, intrinsic antimicrobial properties, e.g., cured meat products;
Group 3:	products in which the possibilities for microbial proliferation are remote, including foods with a reduced a_w, low pH and intrinsic antimicrobial protection, such as fermented sausage. In such products, prepared according to Good Manufacturing and Distribution Practices (GMDPs), *growth* of any surviving pathogenic bacteria is only possible as a result of dramatic changes in the intrinsic antimicrobial attributes, though rather long *survival* is an often observed phenomenon.

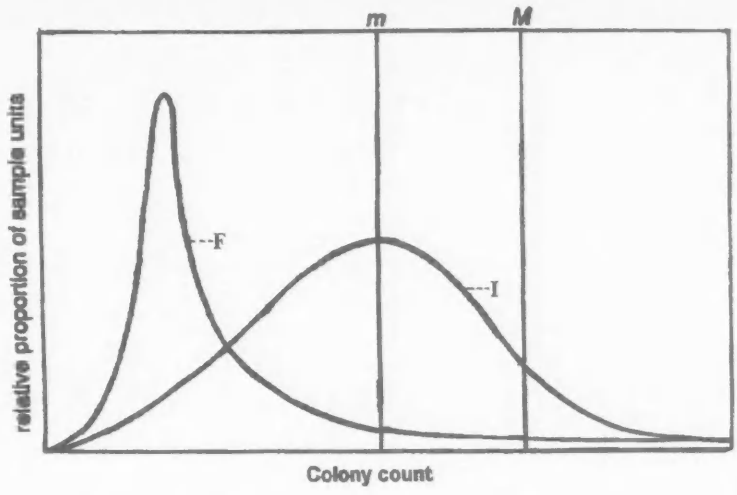
The pivotal role of scientifically sound numerical criteria

Essentials of elaboration of guidelines. In all biological monitoring, reference ranges *(59)* that allow an objective and repeatable evaluation of the analytical data are indispensable. In food science, such ranges are termed "food safety objectives" (FSOs, [35]). These are derived from surveys on a sufficient number of samples, drawn from operations that have previously been carefully audited for compliance with the applying ACoPs. Data obtained from such surveys are plotted in a frequency distribution graph (Fig. 3). The parameters M and m of such functions are gauged against Tolerable Safety Limits (TSLs) for a particular pathogen or an appropriate marker in every particular food. Specific TSLs are calculated relying on qualitative and quantitative risk characterization and its management, as illustrated by Box 4 and Fig. 4. Such endeavors have to take account of the most vulnerable segment of the consumer population, the YOPIs, as addressed before.

In instances where TSL-estimates are still pending, a precautionary consumer protection policy [PCPP – *(34)*] is commendable. This approach was initially called the Precautionary Principle *(11)*, a term that gave rise to confusion. Adoption of the PCPP means, for instance, that when a pathogen or marker organism level indicates a possible threat to human health, intervention measures should be taken, even if cause/effect relationships have not yet been fully established, as documented in Box 5 *(11)*.

Initial surveys frequently reveal a substantial proportion of samples whose colonization penetrates into the zone exceeding M of Fig. 3,

FIGURE 5. Construction of Curves, allowing Assessment of FSOs



I = frequency distribution obtained in initial audit, F = *ditto* upon having rectified critical practices

TABLE 9. Classification of the major potentially hazardous foods in risk categories determined by being exposed or not to culinary heat treatment (CHE), resulting in the elimination of non-sporing bacteria

Class I products: invariably ingested without CHE

* Pasteurized milk, fermented milks, cream filled pastry, soft cheeses, bavaroises, ice-cream, fish mousses;
* Cooked and fermented meat products: sausages, hams, meat, chicken and egg pies, patés, etc.; sandwich meats;
* Carpacios, pickled fish products, 'tartar' meats;
* Salad vegetables, breakfast cereals.

Class II products: as a rule ingested without CHE, though Health Authorities discourage this practice

* Oysters;
* Raw fish dishes;
* Filet Américain;
* Raw egg-nog.

Class III products: always exposed to CHE

* (Mechanically deboned) meats, poultry, fish, crustaceans, eggs;
* Refrigerated pasteurized meals of extended durability ("sous vide" products);
* Pizzas, quiches, etc.

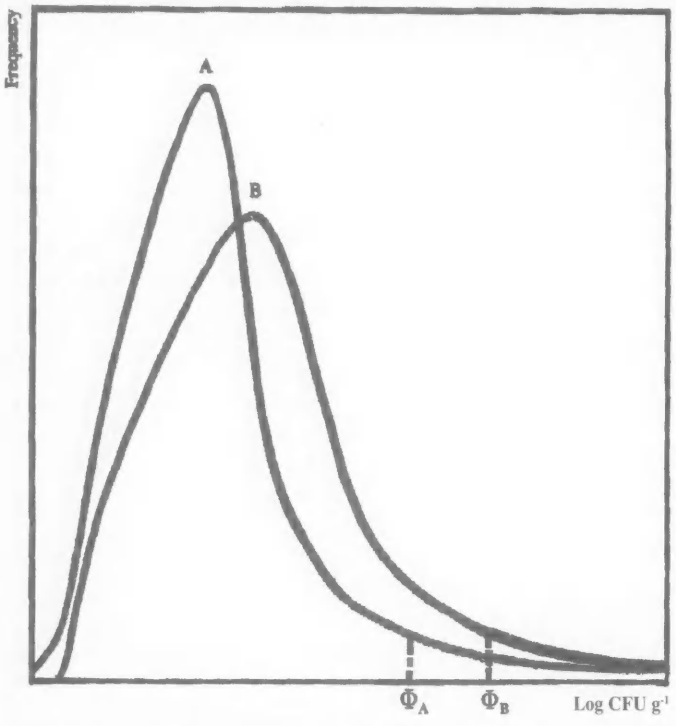
although no evidence of deficiencies had been ascertained in the previous auditing. It goes without saying that such results mandatorily prompt a meticulous review of actual compliance with the ACoP. Any hiatuses identified in this second audit (Fig. 5) call for immediate rectification, followed by verification that intervention was indeed efficacious this time *(59)*. Subsequently, valid FSOs can be established.

The mandatory twinning of criteria and methods. Obviously, SOPs used for verifying compliance in practice should be the same as those earlier applied for elaboration of criteria. This is the first example of the dependence of consistent use of reference values on methodology. Similarly, when no adequate method of resuscitation had been adopted previously in a SOP, upon introduction of an effective repair step all data will shift to the right; cf. Fig. 6. This does not necessarily cause data to penetrate into the zone beyond M. At any rate, a new hazard characterization analysis has to be conducted *(6, 12)*, to assess whether the new data point to a satisfactory situation or call for readjustment of one or more steps in manufacture, distribution or storage.

Taking into account the fate of target organisms. It should be emphasized that reference ranges and food safety objectives apply to the commodity as *ingested*. Consequently, the fate of any pathogen in a particular food between production and consumption (Wilson's Triad, element 3) should be taken into account, a process that calls for profound ecological awareness *(38, 56, 64, 70)*.

It is critical in deriving TSLs to know whether a target organism can grow, or will rather be prevented from development in a particular food under customary conditions of storage and distribution; cf. Table 8.

FIGURE 6. The effect of improved enumeration methodology on the position of frequency distribution functions used for elaborating FSOs



Legend: A = data obtained with original SOP; B = *ditto*, with improved methodology
Φ = 95th percentile

Attention should also be paid to the effect of recontamination of previously safe foods *(16, 27, 46, 63, 72, 82)*, a phenomenon that is all too often ignored or overlooked. It is noteworthy that long periods of survival of low CFU-numbers of pathogens are not infrequently observed *(24, 86)* in processed foods with intrinsic antimicrobial attributes, whether survivors of decontamination processes or recontaminants. Surviving pathogens constitute a source of contamination of, and subsequent proliferation in, more hospitable foods. Such situations call for constant vigilance and, where required, control scenarios, relying on an ecological approach known as preventive microbiological modeling *(70)*.

Finally, TSL-values also very much depend on whether or not a food is heated before being consumed (Table 9). RTE-products (i.e., ready-to-eat) constitute a very vulnerable category. Taking into account the combinations of the two ecological parameters of Tables 8 and 9 has resolved e.g. the disputes of quite different FSOs for, e.g., *Listeria monocytogenes*, in different foods.

A rational, ecology-based proposal was: a negative boundary test in a representative sample of 25 g for all perishable RTE-foods, and not exceeding 10^2 CFU g^{-1} in rapidly listericidal products.

Use of criteria in practice. For most pathogen/food interrelations, excellent sets of competently determined FSO guidelines are available in Europe *(5, 30)*. When such numerical criteria are applied to day-to-day monitoring for any of the three purposes outlined earlier, and counts obtained are significantly in excess of preset levels, this should not be taken lightly. On the contrary, obtaining such data calls for immediate feedback to those responsible for production, storage or retail vending.

Reporting of unacceptable results should be phrased in a way that patrons, who are mostly only marginally trained in microbiology, can understand the data supplied, so that they are motivated to intervene without delay. To that end, analytical results should be accompanied by recommendations for the identification and elimination of the hiatuses that have led to such results. Finally, it is mandatory to verify subsequently that measures taken to rectify the situation have been applied effectively and led to the necessary improvement of the microbiological integrity of the commodity under investigation.

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International Association for Food Protection

Effective Food Security Plans for Production Agriculture and Food Processing

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SUMMARY

A model for developing a food security program derived from Hazard Analysis Critical Control Point (HACCP) principles, along with implementation strategies and developmental approaches, is presented here. Models applicable to production agriculture, food processing, food distribution, or food service that interface with current HACCP (e.g., for fishery products: 21 Code of Federal Regulations Part 123), good manufacturing practices (GMP) (21 CFR Part 110) and recall programs (21 CFR Part 7) are presented.

INTRODUCTION

The events of September 11, 2001, focused the nation's and the world's attention on terrorism and the threat of future terrorist acts. Until the recent mail attacks involving anthrax, the media's focus on bio-terrorism has involved the potential use of biological weapons (weapons of mass destruction) by international terrorist organizations. However, as we are now all well aware, the use of pathogenic agents that cause anthrax or other diseases on even a relatively small scale can rapidly overwhelm the response mechanisms in place to deal with such perceived threats.

Even though weapons of mass destruction remain a potential threat, they are not the major risk to food systems or to the public at large because they are relatively difficult to stabilize, transport and effectively disseminate on a large scale. A simpler and more likely form of attack involves limited or individual use of pathogens developed specifically for biological warfare purposes, as well as common bacterial foodborne or zoonotic agents. Zoonotics are animal diseases [(e.g. anthrax (*Bacillus anthracis*), plague (*Yersinia pestis*) and rabbit fever (*Franciscella tularensis*)] that can be transmitted to humans. Other possible risks involve economic terrorism targeted at a specific commercial entity or industry segment, involving the real or

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threatened introduction of an animal or plant pathogen (or its genetic material) into a production or agricultural facility. This would also include the actual or threatened introduction of genetic material(s) into products.

The impact of small strategic attacks

Groups with limited resources could perpetrate an attack employing any of these agents. As seen with the anthrax "mail bombs" in October 2001, even limited small-scale terrorist activities can rapidly saturate the emergency response and medical facilities of a community. The response to the anthrax "mail bombs" in Washington, D.C., New York, and Florida tied up investigative and response agencies across the nation. Because of enhanced screening and treatment, mail deliveries to Washington D.C. remained slow even one year after the anthrax scares. Some affected government offices remained closed as of January 2002 and have received expensive sanitation treatments with chlorine dioxide and other agents. Precautionary responses to numerous false alarms across the nation, such as the anthrax scares in Nevada, employed large number of police, fire and hazardous materials response teams.

To further complicate matters, acts of bioterrorism may occur without being detected by authorities or without being detected in a timely manner. What many individuals consider the only real recent case of intentional mass food poisoning in the United States occurred in September 1984. In this case, members of the Rajneeshee cult contaminated salad bars with *Salmonella* (*Salmonella* Typhimurium) in the small regional hub of The Dalles, Oregon, a city on the Columbia River. Over 1,000 individuals reported symptoms, with 751 confirmed cases *(17)*.

Despite several laboratory confirmations of the same pathogenic strain, two confirmed outbreaks (September 9 and 25), reported illnesses from individuals who had eaten at ten separate restaurants, and suspicions advanced by local authorities *(17)*, the Deputy State epidemiologist concluded in his November 1984 report that there was no evidence to support the hypothesis that the outbreak was the result of deliberate contamination. Instead, the epidemiologist stated that the contamination "could have occurred where food handlers failed to wash their hands adequately after bowel movements and then touched raw foods." This misconception received further support from the Epidemic Intelligence Service of the U.S. Center for Disease Control and Prevention, in its report issued in January 1985, which stated that it, too, "was unable to find the source of the outbreaks and that food handlers were probably to blame." Because workers preparing the food at the affected restaurants had fallen ill before most patrons had and because some minor violations of sanitary practices had been detected at a few restaurants, food handlers "may have contaminated" the salad bars, the CDC concluded. Again the CDC asserted that there was "'no epidemiologic evidence' to suggest that the contamination had been deliberate" *(17)*. It was not until September 16, 1985, a year after the outbreaks, that law enforcement officials conducted a criminal investigation of the incident, and then only after the leader of the Raneeshees alerted officials that rogue members of his group had deliberately perpetrated this act of bioterrorism.

Definitions

Terrorism is commonly defined as the use of force or violence against persons or property in violation of criminal laws, for the purpose of intimidation, coercion or ransom *(13)*. The intent of terrorism is to cause property damage, physical injury, or economic damage to people or to an entity such as a corporation or research institute. *Biological terrorism* or "*bioterrorism*" involves the use of etiologic or biological toxin agents in a terrorist act. The term *bioterrorism* has commonly been applied to acts of ecoterrorism as well, because ecoterrorism often involves biological targets (e.g., plots of allegedly genetically modified crops) or ecosystem issues (e.g., forest practices, bio-diversity, sustainable agriculture). In response to terrorist threats to the food supply, antiterrorism and counter-terrorism strategies will be employed. *Antiterrorism* covers defensive measures used to reduce the vulnerability of individuals and property to terrorist acts, while *counter-terrorism* refers to offensive measures to prevent, deter, and respond to terrorism. The current buzzword "bio-defense" is used to encompass both "anti" and "counter"- terrorism activities.

Motivation and Likely Perpetrators

The threat of a food-tampering incident involving harmless materials (or no materials) can be as effective as a real attack. Simply claiming that a product has been purposely contaminated with dangerous material is sufficient to precipitate an extensive product recall with the associated adverse publicity, short-term economic loss and longer-term loss of market share and the resultant economic impact *(4, 5)*. For example, a Class I recall is required when there is " a reasonable probability that the use of or exposure to a violative product will cause adverse health consequences or death" (21 CFR §7.3(m)(1))*(8)*.

The most likely perpetrators of terrorist activity targeting the food industry have a variety of different motivations. The motivation can range from economic (targeted to financially impact a specific commercial entity or industry segment) to political (making a "statement," influencing the outcome of an election, or forcing a particular political outcome) to malicious mischief (the infamous "copy-catter").

The most probable perpetrators are groups promoting causes with a degree of public support. Many individuals engaged in food terrorism may initially have been well-intentioned activists from animal rights, consumer protection, and environmental protection movements. Still others may come from groups threatened by innovation. Commonly, bio- or eco-terrorists are anarchist factions tied directly or indirectly to mainstream groups that reasonably and peaceably strive to promote their political causes *(19)*. These "spin-off" terrorist factions typically form loosely organized, fluid networks or cells with anonymous memberships. They carefully research their targets and employ increasingly sophisticated tactics for directed attacks. Their motivation is directed towards the elimination of real or imagined injustices. Facts are irrelevant and normally do not inhibit the activities of these extremist factions.

Threats from terrorists and terrorist groups against food research, production and processing are increasing. Actions by these groups can be extremely well organized and orchestrated, commonly employing both overt and covert methodology to damage or destroy property or commerce, threaten public health and safety, and threaten, torment or injure people *(14)*.

Examples of targets and strategies

The types of attacks terrorists have directed against the food industry to date range from false statements or accusations to overt acts designed to destroy property, information and communication systems, crops, animals, and people *(19)*. Product tampering (real or hoaxes) and vandalism have proven to be particularly "productive" in terms of perpetrator notoriety and economic damage to targets. Such food terrorism is directed against perceived injustices, and although their actions are not necessarily encompassed within the realm of conventional terrorist activities, the results often are. On a larger scale, attacks against a country's crops and livestock remain a viable aggressive weapon in the strategic planning of many governments, particularly those with reduced conventional weaponry.

Objectives of food terrorism include the desire to severely impact a company and put it out of business by affecting the stock price or product availability or marketability in a malicious way; a program directed towards the elimination of a specific food, ingredient or agricultural practice; prohibition of the importation of competing crops, research or development in a particular area; and pressure to erect trade barriers.

Many food terrorism methods are cheap and simple, such as flooding a company by mail, phone or electronically with harassing correspondence or repeated requests for information, filing consumer complaints, and entering tampering threats. Other tactics may include spurious complaints to regulatory agencies, media "tips," frivolous law suits, boycotts, lock-outs, and publicity stunts. Unfortunately bombings, fire, product tampering including poisonings, crop destruction, vandalism, or the threats of all of these, and finally targeted harassment of employees, suppliers and customers, are tactics that are also becoming all too commonly employed.

Natural resource-based industries, agriculture, and the associated processing industries have been popular targets of bio- or eco- terrorists. There seems to be no segment immune to attack. Some extremist groups are violently opposed to the development of natural resources, others to the "imprisonment and exploitation" of animals and the use of meat and fur. Food and agricultural companies have also been targeted for using or developing genetically modified organisms. Specific targets include primary producers, processors, distributors, retailers, shareholders, consumers, vendors/suppliers and researchers. Corporations, in particular, are considered by most terrorist groups to be nonstate and/or metastate entities and therefore legitimate targets of aggression in their own right based on this alone *(4)*. Universities are deemed culpable through their association with private corporations or corporate foundations. Government research facilities are targeted by groups seeking to make a political "statement" against an unpopular governmental policy, or for the alleged failure of a governmental agency to take certain types of action that would further the causes of their group.

Thousands of products each year are subject to malicious tampering and accidental contamination that would precipitate a product recall or market withdrawal *(14, 19)*. Food, beverages, pharmaceuticals, agricultural chemicals, fertilizers, pest control media, and genetically modified crops are among the products more commonly affected. Activities have been directed specifically against organizations that support or that are being directly involved with biotech-

nology *(5, 6, 7)*. Food contamination cases and precautionary recalls are looming possibilities and are a major motivating force behind the stringent process controls and quality assurance procedures in the food industry. However, crisis management planning will take on different twists as food becomes more political, as international markets grow, and as price sensitivity increases *(14)*.

CURRENT LEVEL OF READINESS

Most organizations are ill prepared to deal with tampering incidents, let alone other manifestations of bioterrorism. Issues of product liability, insurance coverage, crisis management and maintenance of business viability are of critical concern. A focus here, and in recent conferences, is on analyzing an organization's risk before an incident occurs, utilizing best practices to avoid a tampering or contamination event, formulating and instituting a crisis management and communication plan, conducting a cost-benefit analysis for transferring the risk through insurance coverage, conducting product recalls, litigating a tampering or recall case, and forensic accounting to quantify losses and analyze claims *(1, 15, 16)*.

High profile consumer product tampering incidents from the 1980s made companies aware of new risks; however, we have unfortunately entered a brave new world of well organized, internationally based targeting of organizations and of products in and related to the food industry. Recent conferences have addressed techniques for monitoring open-space research, covert sensor technology, and crime prevention training *(1)*. According to the FBI, domestic crime targeting biotechnology is the emerging anti-technology crime of the new millenium *(9)*. However, techniques and tools for protecting and monitoring open-space research areas and facilities are limited *(9)*.

Although twenty-two states have recently passed legislation increasing the penalties for malicious acts directed at food and agricultural facilities, the effectiveness of these laws is yet to be seen *(3)*. In the past legislative session, numerous bills were introduced into Congress regarding food security and bioterrorism (*see for example* Public Health Security and Bioterrorism Response Act of 2002). The Food and Drug Administration (FDA) has introduced guidance documents *(11, 12)* which will most likely evolve into *de facto* regulations governing food security. The net effect to the food industry will be increased regulation and operating costs, both directly and indirectly, as a result of this new bio-terrorism bill and recent events.

The objective of this work was to develop strategies for recognizing potential hazards, as well as measures that could be taken as part of a food safety program to reduce the danger of intentional product contamination, using a framework already widely adopted in the food industry. Programs are applicable to production, food processing and food service facilities and are derived from familiar HACCP principles. Personal safety, preventing the kidnapping of employees and/or their families, and defenses against armed attacks are not included within the scope of this paper. Rather, the focus of the present work is directed towards protecting the integrity of the food produced and the systems employed in its production. However, there are many overlapping elements between food safety and a program to safeguard employees and facilities, such as controlled access .nd limitation of opportunity, and the approach outlined here could be extended into this area of security as well.

DEVELOPMENT OF A FOOD SECURITY PLAN BASED UPON HACCP PRINCIPLES

Each organization is uniquely situated and should develop a sensible, individualized security plan for managing the risk of terrorism. Because different units and locations will most likely have different risks, each should be evaluated separately. Critical factors for developing a plan will include evaluating specific hazards, determining the relative risk, and evaluating economic realities associated with managing this risk. There is a strong parallel between developing a preventive strategy for a terrorist attack and the elements of a Hazard Analysis Critical Control Point (HACCP) plan (see for example, 21 CFR Part 123). The emphasis here, as with HACCP, is placed on *preventive* and not *reactive* measures. HACCP is a systematic approach to the identification, evaluation, and control of food-safety hazards *(2)*.

Fundamental to an effective security plan is that it be built upon a foundation that includes and integrates an effective HACCP plan, Good Manufacturing Practices or GMPs (21 CFR Part 110), and Sanitation Standard Operating Procedures (21 CFR Part 110; 21 CFR §123.11).

Evaluating security risks and identifying hazards

Initially, a company or organization should complete an analysis of its facilities and operations to identify significant hazards, estimate the potential exposure to a particular hazard, and evaluate the risks of an occurrence. This analysis should not

be limited to just the production facility or to the time of peak operations. The evaluation should cover the entire scope of operations, including suppliers, receiving, processing lines, sub-contracting facilities, materials and goods-in-process holding, packaging, warehousing, rolling stock, distribution, and physical plant, as well as research center, farm and/or ancillary site security. Raw materials and distribution handled by common carrier or third parties should also be evaluated. Water sources and supplies may well be of specific concern, particularly if water is used as an ingredient or comes into direct contact with consumable products. In effect, a "chain-of-custody" should be employed from the farm to the table.

As with HACCP, a team should be used to develop the plan. In larger organizations, this may actually consist of a series of teams formed within identifiable units. Regardless of the structure, good leadership and a comprehensive integration of recommendations of the team or teams are critical factors, as is buy-in of the resultant program by both management and employees at all levels.

Managing the risk – preventive measures

Because it will probably be impossible to eliminate all hazards, a reasonable procedure must be instituted to manage them. Probably the best strategy is to develop preventive or risk control measures that would reduce or eliminate any significant hazards. As part of this, points in an operation that are critical for controlling the identified security risks should be developed. These points may change during the course of a day, or seasonally. They may also shift with product manufactured, as well as with suppliers, distribution systems or end user. Then, a monitoring procedure should be established for these risk control points (similar to what may already be in place for monitoring critical control points in a HACCP plan). Along with these protocols should be corrective actions (again, similar to those of a HACCP program). A plan for verifying the effectiveness of the preventive and risk controls measures in a food security plan should also be included. The use of forms such as the "HACCP Hazard Analysis Worksheet" or the "HACCP Plan Form" *(10)* may be of benefit in some cases. See also Appendix 1.

SUGGESTED STEPS FOR DEVELOPING A SECURITY PLAN

Here is an approach for developing a security plan based upon HACCP principles:

1. Develop a comprehensive flow chart(s) depicting an operation from primary production or receiving to consumption by the end user.
2. Examine each element to determine whether there are significant food security hazards and evaluate the likelihood of the risk of these hazards.
3. Determine the points in the operation that are critical for managing a specific risk. These could be locations, processes, functions, or times when the operation is at greatest risk.
4. Develop and institute preventive or risk control measures to reduce these hazards to acceptable levels.
5. Where appropriate, establish critical limits or restraints that are not to be violated or breached without a resulting corrective action being initiated and completed.
6. Develop monitoring procedures for each critical point in the security plan. Monitoring is a systematic periodic activity to ensure that critical controls are in place and have not been breached or compromised in any way. Test to see that the monitoring procedures, which should be in writing, are working and "workable" for the operation.
7. Develop a procedure similar to a corrective-action program under HACCP to fix security problems or failures that occur if a critical control has been breached or compromised. Ensure that the problems are fixed by rigorously retesting the system and its risk monitoring procedures. Then revise the security plan to include any changes to the critical controls and/or monitoring procedures and to reduce the likelihood that a similar breach would happen again. Corrective actions may also include the prompt notification of appropriate authorities and the execution of ancillary steps such as an evacuation, lockdown or similar activity.
8. Periodically test or verify the security program to ensure that it works. Verification programs should be written as confidential protocols. Revise written protocols when the operation or any key features of it change. A change in operation procedures, product form, suppliers, distributors, etc. may introduce or remove hazards

and require that the plan be revised.

9. Above all, adequate and comprehensive records must be developed. These records should be handled as confidential. They should also be maintained to record monitoring, preventive measure, deviations, corrective action, and verification activities. Supporting documentation should also be incorporated into the records. These might include outside agency notification protocols, hazardous material information, media protocols, an employee notification plan, response team information, and recall procedures. Supervisory personnel, on a timely basis, must systematically and periodically review these records. The inclusion of superfluous and unnecessary documentation should be avoided.

AN APPLICATION

A simple example is presented (Appendix 1) of how a security plan is developed for two related elements (procurement of raw materials and transportation-in) for a food manufacturing operation, using these principles.

Surveying site

A good digital camera, access to plant plans, and aerial photos are excellent tools for use in developing a security plan. Aerial photos may be obtained specifically for the operation, or access to them may be obtained through the local county assessor's office and sometimes through County Extension Offices. Aerial photos may also be available off the web from a number of state, federal and private sources. Consider using them, particularly since they are also readily available to terrorists, who are not bashful about employing such technology.

Specific suggestions

The key to a successful program is vigilance by management and all employees. Training is critical. A clear standard operating procedure must be developed and followed both for day-to-day operations, for suspicious incidents or individuals, and for actual attacks. The problems arising from an actual attack would be similar to what may already be included in a crisis management plan. If product safety is at issue, recall procedures would need to be followed. As with recall programs, individual farms, companies, or research institutions should periodically use exercises and drills to test whether a security plan is current, workable and effective.

Unfortunately, cost will often be the controlling factor in development of a food security program, since it is impossible physically and financially to guard against every eventuality. Not all of the recommendations included here will be appropriate, practical, or economical for every individual entity. As with HACCP, food safety programs will be market driven.

Farming operations

A farmer might well require certifications from seed, feed, livestock, fertilizer, pesticide and herbicide providers and periodically seeking third-party verification. We recommend that a grower avoid stockpiling hazardous materials, keeping the amount on site to a minimum, and that growers secure stores and applicator equipment. Bin locks or other tamper-evident device(s) should be placed on feed bins and the security of water delivery systems should be evaluated.

Growers should develop monitoring and tracking protocols for harvests until these products are safely transported and stored within a warehouse. To the extent practical, access to croplands and livestock should be controlled and restricted to appropriate personnel. Surveillance equipment is also an option; the cost of such equipment has decreased markedly in recent years. Access to animals at auctions and sales barns should be restricted, and direct contact with animals should be tightly controlled. Consideration should also be given to compartmentalizing livestock operations, improving hand washing/sanitation facilities, providing or improving clothes changing facilities for employees, improving equipment cleaning operations when animals are to be transported between two locations, and requiring foot and vehicle sanitation dips at critical access locations as ways of controlling the spread of a disease.

The water and air supply

Additional preventive measures concerning the safety of the water supply used within a food processing operation should be considered. Evaluating the security of wells, hydrants, storage and water handling facilities, whether these are on-site or controlled by a municipality, are prudent measures. Even if water is from a municipal source, responsibility for the integrity of this supply ultimately falls upon the production facility. Normally the water is the responsibility of the operation from the meter on, but question should be brought to the supplier if liability is an issue. Many water suppliers are notoriously negligent in implementing even the most basic security practices. Unse-

cured wells, stand-pipes, reservoirs, and pumping stations are often open to public access. Consider checking water quality more frequently regardless of its source. Locating an alternate source of potable water, providing for additional on-site storage in case of emergency, or providing a backup water purification system may be also be desirable *(11)*. Precautions should also be taken to ensure that air entering the operation is not contaminated. This could include securing access and a routine examination of air intake points for physical integrity *(11)*.

Letters of guarantee

Food processors should request letters of guarantee from suppliers and require protected transportation of ingredients. It would be prudent to revisit inspection programs for incoming supplies and ingredients, including packaging materials, labels, and supplies used within the production facility and office. Specifically, processors should not accept unordered ingredients/shipments or product received in opened or damaged containers. They should require tamper-proof packaging or shipping containers as well as numbered seals, and they should ensure, as part of their recall program, that any specific lot of an ingredient can be tracked, from receipt through production to final product and distribution. Working with suppliers and common carriers can ensure that they have instituted appropriate food security programs. An audit program in this area, similar to one that may already be in place as part of an existing food safety or food quality program should be developed and should include periodic inspections of vendors, including their distributions systems.

Distribution and transit

Controls during distribution and transit are important. Preventive measures could include expanded use of tamper proof seals of containers with enroute monitoring. The seal alphanumerics should be communicated electronically, separate from the shipment itself, and with the numbers and seal integrity should be verified prior to opening the container and retransmitted to the supplier upon receipt. Off loading should be conducted under controlled conditions, with periodic testing a must. The integrity of finished products (including reconciling the amount received with amount ordered) should be controlled during storage and distribution *(11)*. Where appropriate, tamper proof or tamper evident packaging, at several levels, may be advised.

EMPLOYEE AND CONTRACTOR SCREENING

Employee and contractor screening has become increasingly important critical civil rights issues will control how screening will evolve at the national level. Where appropriate, a criminal background check should be conducted as a condition of employment. Contractors who have relatively open access to the facility (e.g., outside cleaning crews and pest inspectors) should be held to the same standards as employees. These checks can be expensive and, unfortunately, do not give complete data. A suggestion might be that the Immigration and Naturalization Service, or other appropriate agency, expand and refine the current employment eligibility program to provide a national and local agency check and report the findings to the employer in a timely manner. This would be much more effective than requiring individual employers to accomplishing such checks.

Employers should also ensure that employee and subcontractor rosters, as well as job and shift assignments, are current, reviewed on a weekly basis, and updated. It may be prudent for employees/contractors to wear photo ID while on the job and for badges to be recovered from individuals who are no longer on assignment. Such badges can be color coded or otherwise individualized to indicate to which parts of the plant or operations the individual has authorized access. These badges should also be periodically collected without advance announcement, accounted for, and reissued in a different format. Increasing the surveillance of contractors and implementing similar control measures while they are on the job may also be desirable. Employees or contractors should not be at the work site unless they are scheduled to be there *(11)*.

Personal items

Under proper GMP procedures, no personal items such as lunches, purses, etc. should be permitted into a food processing area; it may be advisable to extend this policy to prohibit any personal objects at all from entering the production facility. The FDA recommends that employees be provided with mesh lockers with employer-issued locks *(11)*. A condition of employment is that the employer may inspect the personal property of an employee at any time.

Compartmentalizing job functions

Job functions within a facility should be compartmentalized to the extent practicable. This would mean restricting access to specific areas of a facility to only the individuals who

FIGURE 1. Example: Production of Soft Drink Syrup Hazard Analysis Worksheet

Item, Step or Function	*Identify Potential Hazards Introduced, Controlled, or Enhanced at this Step*	*Are Any Hazards Significant?*	*What Control Measure(s) Can be Applied to Prevent the Significant Hazard*	*Is this Control Measure Critical?*
Raw Materials	Purposeful Contamination	Yes	Certification of lot by vendor Tamper proof packaging Periodic testing	Yes Yes No
Transportation-In	Purposeful Contamination	Yes	All openings, vents, doors etc. locked and sealed by vendor. Data recorder included in shipment Automated trip recorder/report Vehicle held in secured facility when unattended.	Yes Yes Yes No

Firm Name: ***All-Good Syrups***
Address: 12 Baker St
London, CT

Prepared by: Conan Doyle
Date: January 15, 2002

Product Line/Description:
Drink Syrups

Intended use and consumer:
Commercial Bottlers

need to be there. Controlling access is particularly critical for operations processing ready-to-eat food products.

A special note should be made in regard to discharged employees/ contractors. Security badges, keys, etc. should then be immediately surrendered by the individual, who should then be promptly escorted from the facility and not allowed to return to the facility except under escort as a controlled visitor. Discharges, whether they result from the end of a season, a work force reduction, or a firing for cause, need to be handled carefully and with appropriate sensitivity.

FACILITIES ACCESS

Reducing points of access to a facility should be considered *(11)*. This may include improving the security of and/or reducing the number of accessible doors, windows, hatches, trucks, railcars or bulk storage areas. The number of nooks and crannies that could be used to hide intentional contaminants either inside or outside the plant should be reduced. Emergency exit integrity and appropriate numbers of such exits should be maintained with alarmed "Emergency Use Only" exits.

Visitors and inspectors

Individuals purporting to be inspectors should provide appropriate identification and be vetted by backup procedures such as a simple telephone call to the publicly listed telephone number of the visitor's parent operation. Such individuals should be escorted at all times within the plant. Consider a "no-photography" policy as a way of improving security and as a means of protecting intellectual property if this policy is not already in effect *(18)*.

Access to processing areas, including locker and break rooms, by visitors (including truckers, delivery people, supplier representatives, customers, applicants for employment or others) and employees should be strictly controlled both within the plant and between different areas of the plant. A check-in procedure and issuance of visitor badges should be conducted in a reception area or another location that is not adjacent to the processing area. All visitor badges should be accounted for on a daily, or otherwise appropriate, basis. Some firms will no longer accept visitors on-site or visitors who have not made appointments in advance. Where visitors and tours are an important part of public relations or marketing, visitors should be confined to viewing galleries or, at a minimum, be closely monitored and escorted at all times. All individuals with escort authority should be trained and should be aware of the importance of their responsibilities.

Keys and access cards

It should be ensured that all keys can be accounted for and that each key has a discreet identification number. Keys should be marked "do not duplicate." Better yet is the use of card-swipe electronic locks that elimi-

FIGURE 2. Food Security Plan Form

Critical Control Point	Significant hazard(s)	Critical limits for each Control Measure	Monitoring				Corrective Action(s)	Verification	Records
			What	How	Frequency	Who			
Raw Materials	Purposeful Contamination	Vendor certification received from vendor and matches lot #	Certification and lot #'s	Match against shipping docs	Each lot	Receiving QC	Reject, isolate & notify vendor	Daily record review	Receiving record
		Packaging intact	Pkg integrity	Visual inspector	Each unit	Receiving QC	"	"	"
Transportation In	Purposeful Contamination	Seals intact and ID #'s match	Seals & ID #'s	Visual and match against shipping doc's	Each unit	Receiving QC	"	"	"
		No unexplained deviations	Printout	Check against schedule	Each shipment	Receiving QC	"	"	"

Firm Name: All Good Syrups

Address: 12 Baker St
London, CT

Prepared by: Conan Doyle

Product Line or Description: Soft Drink Syrups

Intended Use and Consumer: Commercial Bottler

nate the need for keys. Most of these systems allow for improved control over access and maintain a record as to when individuals have gained entry. Individual access can also be controlled on a time basis, thus permitting entry only during scheduled hours. An ID badge commonly serves a dual purpose, being the access card as well. Periodic unannounced inventories of keys or cards should also be considered.

Parking

Stricter control of parking at the facility may need to be instituted, including parking permits and vehicle registration. Enclosing the parking area, increasing physical security, addition of no-parking safe zones, changes in access and lighting, and/or instituting a vehicle inspection program may become necessary based upon an established policy which requires that all job applicants apply for positions at a location far removed from the processing facility. A policy requiring off-site initial screening and interviews of potential employees and contractors can be considered.

Employee vigilance

Employees should be made aware of their responsibilities to stay alert for and to report suspicious activities, objects and persons at their workplace or at home. Responsibility for specific security functions should be assigned to qualified individuals and included within job descriptions. Food security training programs should be provided to employees, with periodic updates that include training on how to prevent, detect and respond to a product tampering incident, or terrorist activity, actual or threatened. Such training could be conducted in conjunction with HACCP and/or recall training or refresher programs. Sales personnel and others, such as distributors and retailers, should be made familiar with products and how they are packaged and distributed so that they can detect whether a product has been altered or contaminated.

Security checks

Security checks should be conducted on at least a daily basis. All employees and contractors should be trained to be vigilant for the presence of unidentified, unattended or unauthorized vehicles, the presence of containers in or near the facility, and unauthorized access (even to unsecured areas) by unidentified persons or employees who have no apparent reason to be there. Also, employees should be trained to look for signs of sabotage or tampering with equipment, products or ingredients; removal of or tampering with product or worker safety features of equipment; or signs of attempted unauthorized access to equipment.

In light of recent developments, it is prudent to have procedures in place for handling shipments to the facility, including suspicious packages and mail. Such procedures could include securing mailrooms and instituting visual or instrument-based package screening.

Emergency evacuation plans

Most entities are required to have emergency evacuation plans in place. These plans should be reviewed for appropriateness in the context of potential biological or other terrorist threats. Management should file a copy of the operations' safety and emergency procedures with the local municipal planning department and with emergency response agencies. However, these governmental entities must be required to safeguard these documents and be ***prohibited from releasing them to any parties without the knowledge and written consent of management.*** An additional option is to have the evacuation plan, along with the facility layout, in a locked and sealed container outside the facility in case access to it is limited in an emergency.

RESEARCH AND QUALITY CONTROL LABS

Laboratories should implement similar safeguards, including controlled access to laboratories, test plots, and the supporting infrastructure. Decreased access to hazardous material is advised. GMPs require hazardous materials to be stored and handled properly to avoid contamination of food and food contact surfaces (21 CFR §§110.20(b)(2) & 110.35(b) (iv)(2)). Hazardous materials can include cleaning materials, solvents, acids, bases, paints, pesticides, lubricants and water treatment chemicals. Locked access to dangerous biological materials or chemicals could be considered, as well as reconsideration of inventory control of hazardous materials (including ingredients) and the safety and security of storage areas, including the use of hazardous materials within the processing area itself. Access to hazardous materials should be limited to only those individuals who need to use them and who have been properly trained to handle them properly.

For industrial quality control labs, access should be restricted to lab personnel only *(11)*. Under GMPs, dangerous materials should remain in the lab and not be brought into office or production areas. Responsibility for the inventory and control of dangerous materials (e.g., toxic reagents, bacterial cultures, drugs) should be assigned to a specific individual and this responsibility should be included within a job description. A plan should be in place for immediately investigating cases involving missing reagents or other potentially dangerous materials.

Quality control labs can conduct random product and environmental testing as a means of preventing contamination during the processing operation. For example, they can test portions different from those normally sampled, e.g., by sampling regions of an animal carcass in addition to those proscribed by regulation, or by collecting samples at different times or different sampling locations. A good working relationship should be developed with local or regional food testing and forensic laboratories, as their services may be critical if an issue of product or facilities contamination arises.

The first proposal, in regard to physical security, would require each food producer, manufacturer, distributor, and transportation company to conduct a food security hazard analysis followed by preparation and implementation of a written security plan. This plan would incorporate the company's Hazard Analysis Critical Control Point (HACCP) plan, Sanitation Standard Operating Procedures (SSOP), recall procedures, and applicable supporting regulations, such as Good Manufacturing Practices. The plan should also include provisions for notification of and integrated activities with local "first-responders" (fire, police, hazardous material teams, etc.) as well as local, state and federal agencies.

To be effective, the plan must also include an ongoing employee-training program as well as frequent exercises.

COSTS OF IMPLEMENTATION

Implementation of food security plans will require outlays for equipment, materials and, most likely, additional personnel. To date, there are no proposed federal programs to assist the private sector with costs of implementation, although hundreds of millions of dollars have been proposed for upgrading and expanding food inspection programs and public health preparedness measures. State and federal legislatures could provide economic support and incentive for these expenditures by implementing a 10% Investment Tax Credit. Such credits have proven to be a positive motivator for companies and a stimulus to the economy in general. A credit would provide direct tax relief while requiring a 10:1 investment by the tax paying entity.

GOVERNMENT RESPONSE

Following the September 11 incidents, the Food and Drug Administration (FDA) contacted major food industry associations to request that

they advise their members to review current procedures and markedly increase vigilance *(11, 12)*.

If a terrorist attack is suspected, seek immediate assistance from your local law enforcement and health/hazardous materials handling experts (often the fire department). Additional support can be provided by the Federal Bureau of Investigation (FBI) (National: 202/324-3000), US Department of Agriculture Office of Crisis Planning and Management (877/559-9872, 202/720-5711), The FDA Emergency Operations Office (301/443-1240) and the state emergency management division. Contact information for the relevant safety and law enforcement agencies should be readily available to employees and updated as needed. The FDA recommends that an organization have a capable media spokesman and generic press statements prepared in advance in case of an emergency *(11)*. In some states, such as Washington, National Guard units may have special training and equipment to respond to chemical or biological terrorist threats.

It is not possible to present a full picture of the bioterrorist threat to food production in an article such as this, or to present every appropriate defense, let alone to address the full scope of terrorist threats including cyberterrorism, more conventional acts of arson or vandalism, and economic terrorist acts. Suffice it to say that the threat is real and most likely these incidents will continue and possibly escalate. Individuals, institutions, and companies can become more cognizant of the threat and take steps to reduce the likelihood and impact of any incident. This does not mean that paranoia should reign supreme. These risks, like others tied to food safety, are manageable. The risks must be kept in perspective and common sense must prevail. As with HACCP and recall protocols, prior planning, training, and established procedures are essential tools for establishing a successful program.

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APPENDIX I
EXAMPLE USING RAW MATERIALS AND TRANSPORTATION-IN FOR A SOFT DRINK SYRUP MANUFACTURER

In this example, only two functions have been evaluated for illustrative purposes. The first involves raw materials provided by an outside vendor. The second involves shipping the raw materials into the plant via common carrier. The primary biological terrorist threat in both cases would be purposeful contamination. The soft drink manufacturer deems the hazard to be significant. This is a judgment call. In the first case, the purchaser could require certification by the vendor as to the purity of individual lots. Further, the materials would be required to be packaged in tamper proof packaging. Periodic random product testing could also be accomplished at receiving as a check.

The vendor would be responsible for insuring that the product is properly placed in the transporting equipment (railcar, tanker, trailer, container, etc). The vendor would then supervise the sealing of all access to the product, including doors (including in some cases inspection doors on vans or refers), vents, discharge ports, etc. Locks should also be used where practical. The vendor records all seal numbers and locations and forwards this information electronically to the purchaser.

In some instances, temperature data recorders may be placed in the cargo or cargo area and can give an indication of unauthorized access (by temperature spikes) in addition to recording normal product temperature profiles. Integral temperature monitors are often integrated with automated on-board systems that can remotely notify a shipping company of an unusual condition.

Many private and common carrier fleets are now equipped with sophisticated, automated trip loggers/recorders that are integrated with the critical elements of the vehicle and Global Positioning Systems (GPS). These systems not only identify individual drivers, and monitor vehicle speeds, van temperatures, and engine performance, but also compare vehicle locations, routes, and times against those scheduled. Some even monitor the physical condition of the driver. Normal operating information, as well as deviations that might indicate hijackings, unauthorized stops, or driver distress, are automatically transmitted via satellite communication to the parent company. In many cases, they can also communicate directly with the nearest law enforcement agency.

It is entirely practical and possible for the receiving company to match the data output from even the simpler of these devices against schedule profiles. Many modular containers also have integral solid-state devices that may be used to monitor and record activities related to a particular unit. Data from these when available, should be used as part of a security program.

The key to insuring that shipment integrity has been maintained is inspection at receiving. Product that does not meet the critical limits established by the purchasing firm should be rejected, and isolated, and the vendor should be notified immediately. The receiving records and supporting documents should be reviewed in a timely manner by a qualified supervisor for every shipment.

At receiving, vendor certification and lot numbers should be matched against those provided by the vendor, normally through the purchasing department of the purchasing company. Volumes and weights should also be compared to those in purchasing documents. In a similar manner, receiving as well as other personnel at all stages of production should inspect packaging integrity.

The receiving department should have the appropriate seal numbers available to it. As previously stated, the vendor should send these electronically. The driver or other delivery agent should have this same data and use it periodically for inspection while transporting the materials, *but should not provide the data to receiving.* Seals and locks should not be removed until immediately prior to unloading. This is an example of simple job-function compartmentalization.

The printout from the truck recorder (which will often be provided electronically by the common carrier's company from remotely downloaded data) should be examined for indications of unauthorized deviations.

While such measures as described in this example may appear onerous at first glance, many of the steps simply use accounting, quality control, and production records commonly in use. Many are just good business practices that should be employed regardless of a perceived bioterrorist threat.

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International Association for Food Protection

Food Safety Knowledge and Behavior of Sanitarians of Riyadh Municipality (Saudi Arabia)

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SUMMARY

The purpose of this work was to evaluate food safety knowledge and behavior of sanitarians in Riyadh City (SA). Most of the participants were Saudi nationals, 20 to 40 years old, with a diploma in food hygiene control. More than 67% of them initiate field inspection visits based on a scheduled plan. A high percentage (61.4-78%) believed that milk, meat, and eggs are hazardous foods. Some gaps were observed in safety knowledge, such as recognition of pH and a_w as limiting factors of microbial growth. Eighty-two percent did not know the temperature danger zone. Respondents showed high awareness with regard to some common pathogens such as *Salmonella* and *Staphylococcus* but not with regard to emerging ones such as *Campylobacter*. Knowledge was relatively good with regard to the importance of refrigeration temperatures and the shelf life of refrigerated meats but was relatively poor with regard to freezing temperature and the shelf life of frozen meat. Knowledge was obviously scanty in some critical aspects of food safety, and the results of this study should be useful in improving the inspection plan and the scientific background of sanitarians working in Riyadh Municipality. New job openings, should be filled with candidates with better qualifications, especially in the fields of food microbiology and food quality control.

A peer-reviewed article.

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INTRODUCTION

The agency responsible (in part) for regulating and assuring the safety of Saudi Arabian food supplies is the Ministry of Urban and Rural Affairs (MURA). Activities licensed and inspected by MURA include all food-related activities, as well as laundries, pet shops, and barbershops. In Riyadh City (the capital of Saudi Arabia) alone, there are more than 33,000 outlets of such activities, of which food premises comprise about 30% *(4)*. Inspection is conducted based on the traditional spot-checking protocol and uses an inspection form, with observations based mostly on subjective judgment. Not surprisingly, this type of inspection produces inconsistent outcomes from one inspector to another. Further, inspectors are not required to watch for evidence of improper food handling during their inspection visits.

Sanitarians play a vital role in preventing food poisoning and other public health-related problems,

TABLE 1. Sanitarians' characteristics

1. Nationality:	%
Saudi	92.7
Others	7.3
2. Age (years):	
20 – 30	27.5
31 – 40	52.2
> 40	20.3
3. Marital status:	
Married	75.6
Single	24.4
4. Monthly income (SR):	
< 3000	18.5
3000 – <5000	19.8
5000 – <7000	50.6
> 7000	11.1
5. Housing:	
Private	53.1
Rental	46.9
6. Education:	
Diploma (Technical Inspection Institute)	86.6
Bachelor's	13.4
7. Training:	
Yes	63.0
No	37.0

performing, in their work with food industry employees, both regulatory and educational functions. Sanitarians should be knowledgeable about food risks and sanitation and should be able to communicate this knowledge to people at all levels in the chain of food production *(9)*. Further knowledge in basic sciences is important in acquiring the desired skill in proper food inspection. Most sanitarians in Saudi Arabia have a diploma in food hygiene, received after the intermediate degree. Increased episodes of food poisoning in Riyadh in recent years have motivated officials in Riyadh Municipality to attempt to improve the food production inspection process. The objective of this work, therefore, was to evaluate the work-related knowledge and behavior of more than 100 food inspectors.

MATERIALS AND METHODS

A total of 106 questionnaires were distributed to sanitarians attending one-day on-the-job training sessions; 82 (77.4%) were completed and used for this study. The first section of the questionnaire included questions on demographic traits such as nationality, martial status, monthly income, education, and training. The second part focused on the way sanitarians perform their inspection duties. The major part of the questionnaire measured sanitarians' knowledge by means of a multiple-choice format.

Data were analyzed using the SAS system *(21)*. Frequencies and means were calculated for all survey items.

RESULTS AND DISCUSSION

Demographic data (Table 1) show that more than 92% of the sanitarians are of Saudi nationality, and about 85% of them are between 20 and 40 years old. Monthly income for more than 50% of sanitarians is between 5000 and 7000 SR. Sanitarians whose incomes were less than 5000 SR were the newly assigned ones, and only a small percentage (11.1%) earned over 7000 SR per month. More than 86% of sanitarians are graduates of the Technical Inspection Institute which has a 3-year program. The institute was founded at this low academic level to meet the limited needs that existed in the past, when food industry and food services establishments were few. Higher qualifications may be needed now that a wide range of food-related activities have greatly increased in scope. In some developed countries, high qualifications especially with regard to fields such as microbiology, chemistry, and epidemiology, are requirements for food inspector candidates *(3)*. The percentage of sanitarians who had received training was 63%. Training sessions, however, were not related to the food safety field. Scientific qualifications as well as on-the-job training are essential to not only conducting inspections correctly, but also understanding emerging issues in the field of food safety.

Table 2 shows some aspects of sanitarian behavior. Morning inspection visits were preferred by 54.9% because this period is within their regular working hours. Special arrangements, however, are made to work extra hours, especially during the summer season. It is also worth noting that most restaurant activities are conducted during afternoons and evenings and the majority of cases of foodborne diseases are associated

TABLE 2. Sanitarians' behavior of field inspection visits

	%
1. What is the time you prefer for inspection?	
Morning	54.9
Afternoon	12.2
As needed	32.9
2. What is the activity you find easy to inspect?	
Groceries	49.4
Restaurants	25.3
Butchery (sales outlet)	43.4
Fishery shops	16.9
Others	20.5
3. How many field visits do you conduct weekly?	
5 – 10	10.4
11 – 15	11.7
16 – 20	5.2
21 – 25	11.7
26 – 30	44.2
Others	16.8
4. How do you usually initiate an inspection visit?	
Based on a filed consumer complaint	21.7
When there is food poisoning incidence	15.7
Based on scheduled plan	67.5
Based on personal diligence	34.9

with such activities *(2)*. Data also show that the activity sanitarians found easiest to inspect were grocery stores (49.9%), followed by meat sales outlets (43.4%), restaurants (25.3%), and fish shops (16.9%). It is obvious that groceries and butcher shops have fewer items to inspect than such activities as restaurants have. More than 44% of the sanitarians conducted between 26 and 30 visits weekly, and almost 19% carried out more than 30 visits weekly. The smaller number of visits by the rest of them may be due to the nature of the visit. Initiation of field visits based on a scheduled plan ranked highest (67.5%) among other options of this aspect. Inspection based on personal diligence came second (34.9%), but such behavior may have a negative effect on the inspection process.

Table 3 shows data on some aspects of the sanitarians' knowledge of food handling and safety. Participants showed a good grasp of information regarding potentially hazardous foods. More than 78% considered milk and meat high-risk foods, followed by cooked meat (73.5%), poultry (65.1%), fish and eggs (61.4%) cheese (43.4%), and bread 19.3%. Much fewer sanitarians (1.2-8.4%) considered pickles, lettuce, apple, orange, cucumber, and honey as hazardous foods. It is generaly agreed that hazardous foods include milk and milk products, eggs, meat, poultry, and seafood *(9)*.

Fifty percent of the sanitarians could not identify the pH range that suppresses growth of pathogens in foods. The pH is a limiting factor for microbial growth in some natural and processed foods, such as mayonnaise *(6)*. It has been established that few microorganisms can grow at a pH below 4 *(12)*.

Water activity is a known factor in microbial growth in foods. Most fresh foods have an a_w of 0.99, and below this value, microbial growth is weakened. Bacteria are especially sensitive to low a_w, so that most spoilage bacteria cannot grow at values below 0.91 *(17)*. More than 67% of the participants did not know the water activity (a_w) value that is effective in suppressing the growth of pathogens.

When sanitarians were asked to list sanitizers that can be used to sanitize surfaces in restaurants, dettol was chosen by 59%, followed by chlorine (38.6%) and soap (36.1%). Chlorine-based sanitizers, however, are used most frequently in food premises *(16)*, where dettol is not used, although it may be used for restroom sanitation. Choosing soap (36.1%) as a means of sanitation indicates lack of knowledge about sanitizers.

For hand washing, sanitarians listed liquid soap as the first choice (84.3%) followed by powdered soap (26.5%). Twelve percent chose bar soap which is a potential means of cross contamination, for hand washing. Research has proven that hands are the main vectors of microorganisms *(11)*. A microbiological study conducted by Kobana and Brady *(15)* showed that all bar soap samples contained microorganisms, whereas liquid soap samples were almost free of microbial contamination. High awareness of the advantage of using liquid soap over other forms of soap can be attributed to educational statements passed to the sanitarians from the health department (Riyadh Municipality).

Less than 4% of sanitarians chose cloth towels for hand drying, while the rest chose hot air/disposable paper towels, both of which are generally accepted hygienic practices in food industry and health care units *(5, 19, 22)*. One study *(18)*, however, has led to some dispute regard-

TABLE 3. Sanitarians' knowledge of some aspects of food handling and food safety

	%
1. High risk foods (defined) include:	
Milk, Meat	78.3
Cooked meat	73.5
Poultry	65.1
Fish, Eggs	61.4
Cheese	43.4
Bread	19.3
Pickle, Lettuce	8.4
Apple, Cucumber	6.0
Orange	3.6
Honey	1.2
2. pH range that helps suppress the growth of pathogens is:	
4.6 and less	19.2
5.0 and less	12.8
6.0 and less	17.9
Does not know	50.0
3. Water activity (a_w) that helps suppress the growth of pathogens is:	
0.85 and less	8.1
0.95 and less	9.5
1.0 and less	14.8
Does not know	67.6
4. The sanitizers that can be used to sanitize utensils and surfaces in restaurants are (open):	
Dettol	59.0
Chlorine	38.6
Soap	36.1
Iodide	7.2
Others	4.8
Does not know	8.4
5. When washing hands, it is better to use:	
Liquid soap	84.3
Bar soap	12
Powder soap	26.5
6. The best way to dry hands is:	53.0
Hot air	74.7
Tissue paper	3.6
Cloth towel	
7. The best cutting board is the one made from:	
Wood	10.8
Plastic	65.1
Metal	22.9
Others (marble, stainless steel)	20.5

ing the role of warm-air dryers in generating airborne microorganisms.

Cutting boards are a known potential source of contamination, especially if proper steps in cleaning and sanitation are not followed. Zhao et al. *(26)* has indicated that some bacteria are readily transferred between cutting boards and foods during food preparation. More than 65% of the sanitarians picked plastic board as the best choice, followed by metal (22.9%). Only about 11% chose wood boards for this purpose. Wood surfaces are known to absorb water and bacteria. Cleaning and removal of bacteria are more difficult for wood surfaces than for plastic ones *(12, 25)*.

Temperature is the most important of the extrinsic factors that help to control microbial activity *(13)*. Todd *(23)* has concluded that poor temperature control was one of the major contributing factors in foodborne disease outbreaks.

Table 4 shows the sanitarians' knowledge about storage temperature and the shelf life of some perishable foods. More than 83% of participants identified a range of 4–7°C or less as the temperature of the home refrigerator. Similar results were seen for the best refrigeration temperature for red meat and fish. Recommended times of refrigerating for fresh meat and fish range from 1 to 5 days (at 5°C), depending on various factors. More than 60% and 80% of the sanitarians chose 1 to 3 days as the shelf life at refrigeration temperature for fish and chicken, respectively. Less knowledge was observed when questions were about the shelf life of frozen fish and chicken; 44.4% picked the range of 9–12 months for frozen fish and 37.8% picked the ranges 5–6 and 7–8 months for frozen chicken. Recommended periods for freezer storage are 6–12 months for meats (other than ground meat) and 9–12 months for whole chicken

TABLE 4. Sanitarians' knowledge of temperature and its effect on food safety and quality in different points in the food production process

	%
1. Temperature of home refrigerator is:	
0 – 2°C	25.9
4 – 7°C	58.0
> 7°C	8.6
Others	2.5
Does not know	4.9
2. The best way to refrigerate fresh fish is to keep it at:	
0°C	23.5
5°C	58.0
7°C	4.9
Does not know	13.6
3. The best way to refrigerate red meat is to keep it at:	
0 – 3°C	26.8
4 – 7°C	46.3
7 – 10°C	15.9
Does not know	11.0
4. The shelf life (days) of refrigerated fish is:	
1 – 3	60.5
4 – 7	25.9
> 7	4.9
Does not know	8.6
5. The shelf life (days) of refrigerated chicken is:	
1 – 3	11.3
4 –7	80.0
> 7	5.0
Does not know	3.8
6. Temperature of home freezing is:	
-20 – -18°C	43.2
- 10°C	30.9
0°C	16.0
Others	1.2
Does not know	8.6
7. The shelf life (months) of frozen fish is:	
5 – 6	25.9
7 – 8	24.7
9 – 12	44.4
Does not know	4.9
8. The shelf life (months) of frozen chicken is:	
5 – 6	25.6
7 – 8	12.2
9 – 12	59.8
Does not know	2.4
9. The best way to thaw frozen food, especially meat, is:	
To put it in a refrigerator	36.1
To use the microwave oven	10.8
To use normal water with 30 min change intervals	26.5
To keep it at room temperature	41.0
Others	4.8

(10). The maximum times recommended can be achieved when foods are kept at the right temperature (for refrigeration and freezing) during storage.

Table 4 included data on temperature and some related activity in food preparations. More than 41% of participants thought that the best way to thaw frozen foods was to let it thaw at room temperature, and 73.4% chose one or more of the three most acceptable ways of thawing frozen foods (refrigerator, microwave, and normal water with 30-min change interval). It is well known that thawing frozen foods at room temperature is a hazardous practice, since microbial growth takes place at the surfaces long before the center is completely thawed. Food product is temperature abused if not thawed properly *(14)*. Concerning the cooking temperature, 56.1% of the sanitarians identified 100°C (at the center) as the temperature necessary to kill pathogens in meat. Such choice was based on knowledge of traditional cooking. Only 8.5% who chose 74°C, and 19.5% did not know the right temperature, indicating poor knowledge in this aspect.

More than 82% of the sanitarians did not choose the right answer on when the danger of food poisoning starts if prepared foods are left at room temperature. Also, more than 78% did not know the dangerous holding temperature of prepared food.

Table 5 included questions to test the sanitarians' knowledge about some important microorganisms. Participants showed good knowledge about the nature of microorganisms; more than 93% knew that microorganisms include pathogens and spoilers as well as beneficial. Only forty-five percent of them, however, were able to recognize that *Staphylococcus aureus* resides on hands, hair,

TABLE 4. *Continued*

10. To assure killing pathogens, meat should be cooked until the center reaches at least:	%
60°C	13.4
74°C	8.5
100°C	56.1
Does not know	19.5
Others	2.4
11. The danger of food poisoning in prepared food left at room temperature starts at:	
2 – 4 h	17.6
5 – 8 h	37.8
12 – 24 h	29.7
Does not know	14.9
12. The dangerous holding temperature of ready food is:	
0 – 60°C	15.1
5 – 60°C	21.9
5 – 37°C	34.2
Does not know	28.8

TABLE 5. Sanitarians' knowledge about some important microorganisms in food

1. Microorganisms:	%
Are all pathogenic	6.4
Include pathogens and spoilers	23.1
Include pathogens, spoilers, and beneficial	70.5
2. Common microorganism on hands, hair, nasal cavity, and cuts is:	
Staphylococcus aureus	45.0
Coliforms	12.5
Salmonella	21.3
Bacillus cereus	7.5
Does not know	13.8
3. *Pseudomonas* spp. is the most common spoiler of meat:	
True	18.9
False	20.3
Does not know	60.8
4. *Campylobacter jejuni* is among the important pathogens in chicken:	
True	12.2
False	36.4
Does not know	51.4
5. The common pathogen in chicken is:	
Salmonella	90.4
Shigella	4.8
Polio virus	1.2
Does not know	3.6

nasal cavity, and cuts. This bacterium almost always has a human source, especially the nose and infected wounds and skin lesions *(20)*. Staphylococci as well as other bacterial species were isolated from hands and nails of food handlers *(8)*. Al-Bustan et al. (1) have isolated *Staphylococcus aureus* and other staphylococci from the hands of food handlers in 50 restaurants in Kuwait City. Normal hand washing did not influence the number of staphylococci *(7)*. *Salmonella* spp. were identified by 90.4% of participants as a common pathogen in chicken, probably because this pathogen has been blamed for several foodborne outbreaks in Riyadh City. In a similar study, a high percentage of consumers also associated *Salmonella* with chicken/poultry *(14)*. Only 12.2% of the sanitarians, however, knew that *Campylobacter jejuni* is among the important pathogens in chicken. With the development of enumeration methodology, this bacterium has been identified as a common cause of diarrhea in different parts of the world *(24)*. Regarding *Pseudomonas* spp. as a common spoilage agent of meat, only 18.9% of the sanitarians answered correctly.

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Award Nominations

The International Association for Food Protection welcomes your nominations for our Association Awards. We encourage both Members and non-members to nominate deserving professionals. Nomination criteria is available on the association's Web site at www.foodprotection.org or contact the office at 800.369.6337 or 515.276.3344.

Nominations deadline is March 17, 2003. You may make multiple nominations. All nominations must be received at the IAFP office by March 17, 2003.

- Persons nominated for individual awards must be current IAFP Members. Black Pearl Award nominees must be a company employing current IAFP Members. NFPA Food Safety Award nominees do not have to be IAFP Members.
- Previous award winners are not eligible for the same award.
- Executive Board Members and Awards Committee Members are not eligible for nomination.
- Presentation of awards will be during the Awards Banquet at IAFP 2003 – the Association's 90th Annual Meeting in New Orleans, Louisiana on August 13, 2003.

Peter Hibbard, Awards Committee Chairperson

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Nominations will be accepted for the following Awards:

Black Pearl Award — Award Showcasing the Black Pearl

Presented in recognition of a company's outstanding achievement in corporate excellence in food safety and quality.

Sponsored by Wilbur Feagan and F&H Food Equipment Company.

Fellow Award — Distinguished Plaque

Presented to Member(s) who have contributed to IAFP and its Affiliates with quiet distinction over an extended period of time.

Honorary Life Membership Award — Plaque and Lifetime Membership in IAFP

Presented to Member(s) for their devotion to the high ideals and objectives of IAFP and for their service to the Association.

Harry Haverland Citation Award — Plaque and $1,000 Honorarium

Presented to an individual for years of devotion to the ideals and objectives of IAFP.

Sponsored by Silliker, Inc.

Harold Barnum Industry Award — Plaque and $1,000 Honorarium

Presented to an individual for outstanding service to the public, IAFP and the food industry.

Sponsored by NASCO International.

Educator Award — Plaque and $1,000 Honorarium

Presented to an individual for outstanding service to the public, IAFP and the arena of education in food safety and food protection.

Sponsored by Nelson-Jameson, Inc.

Sanitarian Award — Plaque and $1,000 Honorarium

Presented to an individual for outstanding service to the public, IAFP and the profession of the Sanitarian.

Sponsored by Ecolab, Inc., Food and Beverage Division.

Maurice Weber Laboratorian Award — Plaque and $1,000 Honorarium

Presented to an individual for outstanding contributions in the laboratory, recognizing a commitment to the development of innovative and practical analytical approches in support of food safety.

Sponsored by Weber Scientific.

International Leadership Award — Plaque, $1,000 Honorarium and Reimbursement to Attend IAFP 2003.

Presented to an individual for dedication to the high ideals and objectives of IAFP and for promotion of the mission of the Association in countries outside of the United States and Canada.

Sponsored by Kraft Foods, North America.

NFPA Food Safety Award — Plaque and $3,000 Honorarium

Presented to an individual, group, or organization in recognition of a long history of outstanding contribution to food safety research and education.

Sponsored by National Food Processors Association.

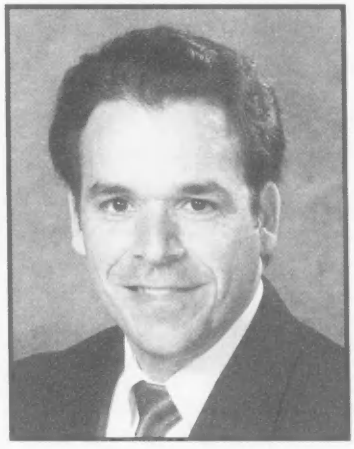
Criteria available at www.foodprotection.org

2003–2004 *Secretary Election*

The following page contains biographical information for the 2003-2004 Secretary candidates. Review the information carefully as you make your voting decision. Ballots were mailed to all International Association for Food Protection Members during the first week of February. Completed ballots are due back to the Association office by March 21, 2003. Sealed ballot envelopes are forwarded to the Tellers Committee for opening and counting. Watch for the election results in the May issue of *Food Protection Trends.*

If you have questions about the election process, contact David W. Tharp, CAE, Executive Director at 800.369.6337, or 515.276.3344, or E-mail dtharp@foodprotection.org.

DONNA M. GARREN



FRANK YIANNAS

The Candidates

Biographical Information

Donna M. Garren

Dr. Donna Garren is currently Vice President, Scientific and Technical Affairs for United Fresh Fruit & Vegetable Association headquartered in Alexandria, VA. Founded in 1904, United is the produce industry's oldest national trade association that promotes the growth and success of produce companies and their partners and represents the interests of growers, shippers, processors, brokers, wholesalers and distributors of produce, working together with their customers at retail and foodservice, suppliers at every step in the distribution chain, and international partners. United provides a fair and balanced forum to promote business solutions, help build strong partnerships among all segments of the industry and promote increased produce consumption.

In this position, Dr. Garren is responsible for all produce food safety and food quality related issues and activities, science-based regulatory and legislative activities, and technical consultation to United's membership to help them compete effectively in today's marketplace. Before assuming the vice president's position, Dr. Garren was director, scientific and regulatory affairs.

Before joining United in 1999, Dr. Garren worked for Boskovich Farms, Inc. in Oxnard, CA as director, research & development and product safety. While at Boskovich Farms, her duties included the development, implementation, and management of all produce food safety programs and the management of new product research and development projects.

During her tenure at United Fresh Fruit and Vegetable Association, Dr. Garren has provided technical advice and support to both state and federal regulatory agencies and testified before Congressional and regulatory leaders concerning fruit and vegetable food safety and quality issues. Dr. Garren has been an invited speaker at numerous national and international meetings providing educational updates on topics including produce good agricultural practices, current microbiological produce issues, general food safety and sanitation training, and consumer trends in international produce markets. Dr. Garren has also developed and managed many successful national food safety and regulatory workshops for the produce industry. In addition, she has been a member of the United States Delegation to the International Codex Committee on Food Hygiene.

Since joining the International Association for Food Protection (IAFP), Dr. Garren has served on the Program Committee and has been a member and Chairperson of the Developing Scientist Award Committee and the very successful Fruit and Vegetable Safety and Quality Professional Development Group (PDG). Dr. Garren has also given many invited talks, as well as organized numerous symposia at the IAFP Annual Meetings, including the very first international IAFP workshop on produce food safety in Guadalajara, Mexico.

Dr. Garren also serves on the Institute of Food Technologists' Fruit and Vegetable Division Executive Committee and Food Law Executive Committee.

Dr. Garren graduated from Clemson University with a Bachelor of Science degree in Food Science and Nutrition and a Minor in Microbiology and earned her Ph.D. from the University of Georgia in Food Science and Technology.

Frank Yiannas

As Manager of Walt Disney World's Food Safety & Health Department, Frank Yiannas oversees all food safety programs, as well as other public health functions, for one of the world's strongest and well-recognized global brands. His scope of responsibilities includes: food safety oversight of major theme parks and resorts, two cruise ships, two water parks, and hundreds of the world's busiest food locations. More than 15,000 food and beverage employees, hundreds of food suppliers, and a number of critical regulatory compliance issues also come under his purview.

Since joining Disney in 1989, Mr. Yiannas has expanded Disney's program beyond testing and inspections by creating leading-edge risk management strategies. Under his tenure, Disney has been recognized as a pioneer in food safety training, implementing HACCP at the food service level, developing hand-held computer technology to conduct food safety audits, and utilizing progressive microbial testing approaches. In 2001, Walt Disney World received the prestigious Black Pearl Award for corporate excellence in food safety by the International Association for Food Protection (IAFP).

As a frequent speaker at national and international conferences, Mr. Yiannas is known for his ability to build partnerships and for his innovative approaches to food safety. He has given many invited presentations to professionals in the United States and abroad and is frequently cited in industry publications.

Mr. Yiannas' commitment and involvement with IAFP includes numerous positions within the association such as: Immediate Past Chairperson of the Annual Meeting Program Committee, Past Chairperson of the Food Sanitation PDG, and Past Black Pearl Award Jury Committee Member. He has organized numerous symposia and workshops for annual meetings and lectured on relevant food safety topics as well as currently serving as the Chairperson of the Retail Food Safety & Quality PDG. Mr. Yiannas led a groundbreaking initiative on behalf of this PDG and IAFP, leading a task force to develop International Food Safety Icons, pictorial representations of important food safety concepts that can be recognized regardless of a person's native language.

At the affiliate level, Mr. Yiannas supports IAFP through his involvement with the Florida Association of Food Protection (FAFP) as their Immediate Past President. During his tenure as President in 2000 and 2001, FAFP received the Shogren Award for two consecutive years. The Shogren Award is given annually by IAFP to the best overall affiliate.

At the national level, Mr. Yiannas is Vice Chair of Council I, Laws and Regulations, of the Conference for Food Protection (CFP). This council reviews proposed changes to the Food and Drug Administration (FDA) Model Food Code. In addition, he participates in numerous professional committees involved with issues of national importance, including co-chairing a committee for the CFP to develop standards for permanent, outdoor cooking sites. Mr. Yiannas also participated on the FDA-sponsored, 10-member panel organized through the Institute of Food Technologists to review the current definition of potentially hazardous food.

Mr. Yiannas is a registered microbiologist with the American Academy of Microbiology. He holds memberships with several professional associations, including the National Environmental Health Association, the American Society of Microbiology, and the Institute of Food Technologists. He received his BS in Microbiology from the University of Central Florida and is completing a Master of Public Health (MPH) from the University of South Florida.

How the Audiovisual Library Serves IAFP Members

Purpose ...

The Audiovisual Library offers International Association for Food Protection Members an educational service through a wide variety of quality training videos dealing with various food safety issues. This benefit allows Members free use of these videos.

How It Works ...

1) Members simply fill out an order form (see page 166) and fax or mail it to the IAFP office. Members may also find a Library listing and an order form online at the IAFP Web site at www.foodprotection.org.

2) Material from the Audiovisual Library is checked out for a maximum of two weeks (three weeks outside of North America) so that all Members can benefit from its use.

3) Requests are limited to five videos at a time.

How to Contribute to the Audiovisual Library ...

1) As the IAFP Membership continues to grow, so does the need for additional committee members and materials for the Library. The Audiovisual Committee meets at the IAFP Annual Meeting to discuss the status of the Audiovisual Library and ways to improve the service. New Members are sought to add fresh insight and ideas.

2) Donations of audiovisual materials are always needed and appreciated. Tapes in foreign languages (including, but not limited to Spanish, French, Chinese [Manderin/Cantonese]), are especially desired for International Members who wish to view tapes in their native language.

3) Members may also make a financial contribution to the Foundation Fund. The Foundation Fund sponsors worthy causes that enrich the Association. Revenue from the Foundation Fund supports the IAFP Audiovisual Library. Call Lisa Hovey, Assistant Director or Lucia Collison McPhedran, Association Services at 800.369.6337 or 515.276.3344 if you wish to make a donation.

A Member Benefit of IAFP

DAIRY

D1180 **10 Points to Dairy Quality**–(10 minute videotape). Provides in-depth explanation of a critical control point in the residue prevention protocol. Illustrated with on-farm, packing plant, and milk-receiving plant scenes as well as interviews of producers, practicing veterinarians, regulatory officials and others. (Dairy Quality Assurance–1992) (Reviewed 1998)

D1010 **The Bulk Milk Hauler: Protocol & Procedures**–(8 minute videotape). Teaches bulk milk haulers how they contribute to quality milk production. Special emphasis is given to the hauler's role in proper milk sampling, sample care procedures, and understanding test results. (Iowa State University Extension–1990). (Reviewed 1998)

D1030 **Cold Hard Facts**–This video is recommended for training personnel associated with processing, transporting, warehousing, wholesaling and retailing frozen foods. It contains pertinent information related to good management practices necessary to ensure high quality frozen foods. (National Frozen Food Association–1993) (Reviewed 1998)

D1040 **Ether Extraction Method for Determination of Raw Milk**–(26 minute videotape). Describes the ether extraction procedure to measure milkfat in dairy products. Included is an explanation of the chemical reagents used in each step of the process. (CA–1988) (Reviewed 1998)

D1060 **Frozen Dairy Products**–(27 minute videotape). Developed by the California Department of Food and Agriculture. Although it mentions the importance of frozen desserts, safety and checking ingredients; emphasis is on what to look for in a plant inspection. Everything from receiving, through processing and cleaning and sanitizing is outlined, concluded with a quality control program. Directed to plant workers and supervisors, it shows you what should be done. (CA–1987) (Reviewed 1997)

D1070 **The Gerber Butterfat Test**–(7 minute videotape). Describes the Gerber milkfat test procedure for dairy products and compares it to the Babcock test procedure. (CA–1990) (Reviewed 1998)

D1080 **High-Temperature, Short-Time Pasteurizer**–(59 minute videotape). Provided by the Dairy Division of Borden, Inc. It was developed to train pasteurizer operators and is well done. There are seven sections with the first covering the twelve components of a pasteurizer and the purpose and operation of each. The tape provides the opportunity for discussion after each section or continuous running of the videotape. Flow diagrams, processing and cleaning are covered. (Borden, Inc.–1986) (Reviewed 1997)

D1090 **Managing Milking Quality**–(33 minute videotape). This training video is designed to help dairy farmers develop a quality management process and is consistent with ISO 9000 certification and HACCP processes. The first step is to evaluate the strengths and weaknesses of a dairy operation. The video will help you find ways to improve the weaknesses that are identified on your farm.

D1100 **Mastitis Prevention and Control**–(2-45 minute videotapes). This video is ideal for one-on-one or small group presentations. Section titles include: Mastitis Pathogens, Host Defense, Monitoring Mastitis, Mastitis Therapy, Recommended Milking Procedures, Postmilking Teat Dip Protocols, Milk Quality, Milking Systems. (Nasco–1993)

D1110 **Milk Plant Sanitation: Chemical Solution**–(13 minute videotape). This explains the proper procedure required of laboratory or plant personnel when performing chemical titration in a dairy plant. Five major titrations are reviewed... alkaline wash, presence of chlorine and iodophor, and caustic wash and an acid wash in a HTST system. Emphasis is also placed on record keeping and employee safety. (1989)

D1120 **Milk Processing Plant Inspection Procedures**–(15 minute videotape). Developed by the California Department of Food and Agriculture. It covers pre- and post-inspection meeting with management, but emphasis is on inspection of all manual and cleaned in place equipment in the receiving, processing and filling rooms. CIP systems are checked along with recording charts and employee locker and restrooms. Recommended for showing to plant workers and supervisors. (CA–1986)

D1130 **Pasteurizer – Design and Regulation**–(16 minute videotape). This tape provides a summary of the public health reasons for pasteurization and a nonlegal definition of pasteurization. The components of an HTST pasteurizer, elements of design, flow-through diagram and legal controls are discussed. (Kraft General Foods–1990) (Reviewed 1998)

D1140 **Pasteurizer – Operation**–(11 minute videotape). This tape provides a summary of the operation of an HTST pasteurizer from start-up with hot water sanitization to product pasteurization and shutdown. There is an emphasis on the legal documentation required. (Kraft General Foods–1990) (Reviewed 1998)

D1150 **Processing Fluid Milk**–(30 minute–140 slides–script–tape). This slide set was developed to train processing plant personnel on preventing food poisoning and spoilage bacteria in fluid dairy products. Emphasis is on processing procedures to meet federal regulations and standards. Processing

procedures, pasteurization times and temperatures, purposes of equipment, composition standards, and cleaning and sanitizing are covered. Primary emphasis is on facilities such as drains and floors, and filling equipment to prevent post-pasteurization contamination with spoilage or food poisoning bacteria. It was reviewed by many industry plant operators and regulatory agents and is directed to plant workers and management. (Penn State–1987) (Reviewed 1998)

ENVIRONMENTAL

E3010 **The ABCs of Clean–A Handwashing & Cleanliness Program for Early Childhood Programs**–For early childhood program employees. This tape illustrates how proper handwashing and clean hands can contribute to the infection control program in daycare centers and other early childhood programs. (The Soap & Detergent Association–1991)

E3020 **Acceptable Risks?**–(16 minute videotape). Accidents, deliberate misinformation, and the rapid proliferation of nuclear power plants have created increased fears of improper nuclear waste disposal, accidents during the transportation of waste, and the release of radioactive effluents from plants. The program shows the occurrence of statistically anomalous leukemia clusters; governmental testing of marine organisms and how they absorb radiation; charts the kinds and amounts of natural and man-made radiation to which man is subject; and suggests there is no easy solution to balancing our fears to nuclear power and our need for it. (Films for the Humanities & Sciences, Inc.–1993) (Reviewed 1998)

E3030 **Air Pollution: Indoor**–(26 minute videotape). Indoor air pollution is in many ways a self-induced problem...which makes it no easier to solve. Painting and other home improvements have introduced pollutants, thermal insulation and other energy-saving and water-proofing devices have trapped the pollutants inside. The result is that air pollution inside a modern home can be worse than inside a chemical plant. (Films for the Humanities & Sciences, Inc.) (Reviewed 1998)

E3040 **Asbestos Awareness**–(20 minute videotape). This videotape discusses the major types of asbestos and their current and past uses. Emphasis is given to the health risks associated with asbestos exposure and approved asbestos removal abatement techniques. (Industrial Training, Inc.–1988) (Reviewed 1998)

E3055 **Effective Handwashing–Preventing Cross-Contamination in the Food Service Industry**–(3 1/2 minute videotape). It is critical that all food service workers wash their hands often and correctly. This video discusses the double wash method and the single wash method and when to use each method. (Zep Manufacturing Company–1993)

E3060 **EPA Test Methods for Freshwater Effluent Toxicity Tests (Using Ceriodaphnia)**–(22 minute videotape). Demonstrates the Ceriodaphnia 7-Day Survival and Reproduction Toxicity Test and how it is used to monitor and evaluate effluents for their toxicity to biota and their impact on receiving waters and the establishment of NPDES permit limitations for toxicity. The tape covers the general procedures for the test including how it is set up, started, monitored, renewed and terminated. (1989) (Reviewed 1998)

E3070 **EPA Test Methods for Freshwater Effluent Toxicity Tests (Using Fathead Minnow Larva)**–(15 minute videotape). A training tape that teaches environmental professionals about the Fathead Minnow Larval Survival and Growth Toxicity Test. The method described is found in an EPA document entitled, "Short Term Methods for Estimating the Chronic Toxicity of Effluents & Receiving Waters to Freshwater Organisms." The tape demonstrates how fathead minnow toxicity tests can be used to monitor and evaluate effluents for their toxicity to biota and their impact on receiving waters and the establishment of NPDES permit limitations for toxicity. (1989) (Reviewed 1998)

E3075 **EPA: This is Super Fund**–(12 minute videotape). Produced by the United States Environmental Protection Agency (EPA) in Washington, D.C., this videotape focuses on reporting and handling hazardous waste sites in our environment. The agency emphasizes community involvement in identifying chemical waste sites and reporting contaminated areas to the authorities. The primary goal of the "Super Fund Site Process" is to protect human health and to prevent and eliminate hazardous chemicals in communities. The film outlines how to identify and report abandoned waste sites and how communities can participate in the process of cleaning up hazardous sites. The program also explains how federal, state and local governments, industry and residents can work together to develop and implement local emergency preparedness/response plans in case chemical waste is discovered in a community.

E3080 **Fit to Drink**–(20 minute videotape). This program traces the water cycle, beginning with the collection of rain-water in rivers and lakes, in great detail through a water treatment plant, to some of the places where water is used, and finally back into the atmosphere. Treatment of the water begins with the use of chlorine to destroy organisms; the water is then filtered through various sedimentation tanks to remove solid matter. Other treatments employ ozone, which oxidizes contaminants and makes them easier to remove; hydrated lime, which reduces the acidity of the water; sulfur dioxide, which removes any excess chlorine; and floculation, a process in which aluminum sulfate causes small particles to clump together and precipitate out. Throughout various stages of purification, the water is continuously tested for smell, taste, titration, and by fish. The treatment plant also monitors less common contaminants with the use of up-to-date techniques like flame spectrometers and gas liquefaction. (Films for the Humanities & Sciences, Inc.–1987)

E3110 **Garbage: The Movie**–(25 minute videotape). A fascinating look at the solid waste problem and its impact on the environment. Viewers are introduced to landfills, incinerators, recycling plants and composting operations as solid waste management solutions. Problems associated with modern land-

fills are identified and low-impact alternatives such as recycling, reuse, and source reduction are examined. (Churchill Films) (Reviewed 1998)

E3120 **Global Warming: Hot Times Ahead**–(23 minute videotape). An informative videotape program that explores the global warming phenomenon and some of the devastating changes it may cause. This program identifies greenhouse gases and how they are produced by human activities. Considered are: energy use in transportation, industry and home; effects of deforestation, planting of trees and recycling as means of slowing the build-up of greenhouse gases. (Churchill Films–1995)

E3130 **Kentucky Public Swimming Pool & Bathing Facilities**–(38 minute videotape). Developed by the Lincoln Trail District Health Department in Kentucky and includes all of their state regulations which may be different from other states, provinces and countries. This tape can be used to train those responsible for operating pools and waterfront bath facilities. All aspects are included of which we are aware, including checking water conditions and filtration methods. (1987). (Reviewed 1998)

E3135 **Plastics Recycling Today: A Growing Resource**–(11:35 minute videotape). Recycling is a growing segment of our nation's solid waste management program. This video shows how plastics are handled from curbside pickup through the recycling process to end-use by consumers. This video provides a basic understanding of recycling programs and how communities, companies and others can benefit from recycling. (The Society of the Plastics Industry, Inc.–1988)

E3140 **Putting Aside Pesticides**–(26 minute videotape). This program probes the long-term effects of pesticides and explores alternative pest-control efforts; biological pesticides, genetically-engineered microbes that kill objectionable insects, the use of natural insect predators, and the cross-breeding and genetic engineering of new plant strains that produce their own anti-pest toxins. (Films for the Humanities & Sciences, Inc.) (Reviewed 1999)

E3150 **Radon**–(26 minute videotape). This program looks at the possible health implications of radon pollution, methods home-owners can use to detect radon gas in their homes, and what can be done to minimize hazards once they are found.

E3160 **RCRA–Hazardous Waste**–(19 minute videotape). This videotape explains the dangers associated with hazardous chemical handling and discusses the major hazardous waste handling requirements presented in the Resource Conservation and Recovery Act. (Industrial Training, Inc.)

E3161 **The Kitchen Uncovered Orkin Sanitized EMP**–(13 minute videotape). This video teaches restaurant workers what they can do to prevent pest infestation. (Orkin Pest Control–1997)

The New Superfund. What It is & How It Works–A six-hour national video conference sponsored by the EPA. Target audiences include the general public, private industry, emergency responders and public interest groups. The series features six videotapes that review and highlight the following issues:

E3170 **Tape 1–Changes in the Remedial Process: Clean-up Standards and State Involvement Requirements**–(62 minute videotape). A general overview of the Superfund Amendments and Reauthorization Act (SARA) of 1986 and the challenge of its implementation. The remedy process — long-term and permanent clean-up is illustrated step-by-step, with emphasis on the new mandatory clean-up schedules, preliminary site assessment petition procedures and the hazard ranking system/National Priority List revisions. The major role of state and local government involvement and responsibility is stressed.

E3180 **Tape 2–Changes in the Removal Process: Removal and Additional Program Requirements**–(48 minute videotape). The removal process is a short-term action and usually an immediate response to accidents, fires and illegal dumped hazardous substances. This program explains the changes that expand removal authority and require procedures consistent with the goals of remedial action.

E3190 **Tape 3–Enforcement & Federal Facilities**–(52 minute videotape). Who is responsible for SARA clean-up costs? Principles of responsible party liability; the difference between strict, joint and several liability; and the issue of the innocent land owner are discussed. Superfund enforcement tools-mixed funding, De Minimis settlements and the new non-binding preliminary allocations of responsibility (NBARs) are explained.

E3210 **Tape 4–Emergency Preparedness & Community Right-to-Know**–(48 minute videotape). A major part of SARA is a free-standing act known as Title III: The Emergency Planning and Community Right-to-Know Act of 1986, requiring federal, state, and local governments and industry to work together in developing local emergency preparedness/response plans. This program discusses local emergency planning committee requirements, emergency notification procedures, and specifications on community right-to-know reporting requirements such as using OSHA Material Safety Data Sheets, the emergency & hazardous chemical inventory and the toxic chemical release inventory.

E3220 **Tape 5–Underground Storage Tank Trust Fund & Response Program**–(21 minute videotape). Another addition to SARA is the Leaking Underground Storage Tank (LUST) Trust Fund. One half of the US population depends on ground water for drinking—and EPA estimates that as many as 200,000 under-

ground storage tanks are corroding and leaking into our ground water. This program discusses how the LUST Trust Fund will be used by EPA and the states in responding quickly to contain and clean-up LUST releases. Also covered is state enforcement and action requirements, and owner/operator responsibility.

E3230 **Tape 6–Research & Development/ Closing Remarks**–(33 minute videotape). An important new mandate of the new Superfund is the technical provisions for research and development to create more permanent methods in handling and disposing of hazardous wastes and managing hazardous substances. This segment discusses the SITE (Superfund Innovative Technology Evaluation) program, the University Hazardous Substance Research Centers, hazardous substance health research and the DOD research, development and demonstration management of DOD wastes.

E3240 **Sink a Germ**–(10 minute videotape). A presentation on the rationale and techniques for effective handwashing in health care institutions. Uses strong imagery to educate hospital personnel that handwashing is the single most important means of preventing the spread of infection. (The Brevis Corp.–1986). (Reviewed 1998)

E3245 **Wash Your Hands**–(5 minute videotape). Handwashing is the single most important means of preventing the spread of infection. This video presents why handwashing is important and the correct way to wash your hands. (LWB Company–1995)

E3250 **Waste Not: Reducing Hazardous Waste**–(35 minute videotape). This tape looks at the progress and promise of efforts to reduce the generation of hazardous waste at the source. In a series of company profiles, it shows activities and programs within industry to minimize hazardous waste in the production process. Waste Not also looks at the obstacles to waste reduction, both within and outside of industry, and considers how society might further encourage the adoption of pollution prevention, rather than pollution control, as the primary approach to the problems posed by hazardous waste. (Umbrella films)

FOOD

F2260 **100 Degrees of Doom... The Time & Temperature Caper**–(14 minute videotape). Video portraying a private eye tracking down the cause of a *Salmonella* poisoning. Temperature control is emphasized as a key factor in preventing foodborne illness. (Educational Communications, Inc.–1987) (Reviewed 1998)

F2450 **A Guide to Making Safe Smoked Fish**–(21 minute videotape). Smoked fish can be a profitable product for aquaculturalists, but it can be lethal if not done correctly. This video guides you through the steps necessary to make safe smoked fish. It provides directions for brining, smoking, cooling, packaging and labeling, and cold storage to ensure safety. The video features footage of fish smoking being done using both traditional and modern equipment. (University of Wisconsin-Madison–Spring, 1999)

F2005 **A Lot on the Line**–(25 minute videotape). Through a riveting dramatization, "A Lot on the Line" is a powerful training tool for food manufacturing and food service employees. In the video, a food plant supervisor and his pregnant wife are eagerly awaiting the birth of their first child. Across town, a deli manager is taking his wife and young daughter away for a relaxing weekend. Both families, in a devastating twist of fate, will experience the pain, fear, and disruption caused by foodborne illness. This emotionally charged video will enthrall new and old employees alike and strongly reinforce the importance of incorporating GMPs into everyday work routines. Without question, "A Lot on the Line" will become an indispensable part of your company's training efforts. (Silliker Laboratories–2000)

F2007 **The Amazing World of Microorganisms**–(12 minute videotape). This training video provides your employees with an overview of how microorganisms affect their everyday lives and the foods they produce. The video explores how microscopic creatures are crucial in producing foods, fighting disease, and protecting the environment. In addition, certain microorganisms—when given the proper time and conditions to grow—are responsible for food spoilage, illness, and even death. Equipped with this knowledge, your employees will be better able to protect your brand. (Silliker Laboratories Group, Inc., Homewood, IL– 2001)

F2008 **A Recipe for Food Safety Success**–(30 minute videotape). This video helps food-industry employees understand their obligations in the areas of safety and cleanliness... what the requirements are, why they exist, and the consequences for all involved if they're not adhered to consistently. Critical information covered includes the role of the FDA and USDA; HACCP systems; sanitation and pest control; time and temperature controls that fight bacteria growth, and the causes and effects of pathogens. (J. J. Keller – 2002)

F2440 **Cleaning & Sanitizing in Vegetable Processing Plants: Do It Well, Do It Safely!**–(16 minute videotape) This training video shows how to safely and effectively clean and sanitize in a vegetable processing plant. It teaches how it is the same for processing plant as it is for washing dishes at home. (University of Wisconsin Extension–1996) (Available in Spanish)

F2010 **Close Encounters of the Bird Kind**–(18 minute videotape). A humorous but in-depth look at *Salmonella* bacteria, their sources, and their role in foodborne disease. A modern poultry processing plant is visited, and the primary processing steps and equipment are examined. Potential sources of *Salmonella* contamination are identified at the different stages of production along with the control techniques that are employed to insure safe poultry products. (Topek Products, Inc.) (Reviewed 1998)

F2015 **Controlling *Listeria*: A Team Approach**–(16 minute videotape). In this video, a small food

company voluntarily shuts down following the implication of one of its products in devastating outbreak of *Listeria monocytogenes*. This recall dramatization is followed by actual in-plant footage highlighted key practices in controlling *Listeria*. This video provides workers with an overview of the organism, as well as practical steps that can be taken to control its growth in plant environments. Finally, the video leaves plant personnel with a powerful, resounding message: Teamwork and commitment are crucial in the production of safe, quality foods. (Silliker Laboratories–2000)

F2111 **Controlling *Salmonella*: Strategies That Work**–(13 minute videotape). This training video provides practical guidelines to prevent the growth of *Salmonella* in dry environments and avoid costly product recalls. Using this video as a discussion tool, supervisors can help employees learn about water and how it fosters conditions for the growth of *Salmonella* in dry processing plants with potentially devastating consequences. (Silliker Labs– 2002)

F2037 **Cooking and Cooling of Meat and Poultry Products**–(2 videotapes – 176 minutes). (See Part 1 Tape F2035 and Part 2 Tape F2036). This is session 3 of a 3-part Meat and Poultry Teleconference cosponsored by AFDO and the USDA Food Safety Inspection Service. Upon completion of viewing these videotapes, the viewer will be able to (1) recognize inadequate processes associated with the cooking and cooling of meat and poultry at the retail level; (2) Discuss the hazards associated with foods and the cooking and cooling processes with management at the retail level; (3) Determine the adequacy of control methods to prevent microbiological hazards in cooking and cooling at the retail level, and (4) Understand the principle for determining temperature with various temperature measuring devices. (AFDO/USDA–1999)

F2030 **"Egg Games" Foodservice Egg Handling and Safety**–(18 minute videotape). Develop an effective egg handling and safety program that is right for your operation. Ideal for manager training and foodservice educational programs, this video provides step-by-step information in an entertaining, visually-exciting format. (American Egg Board–1999)

F2020 **Egg Handling & Safety**–(11 minute videotape). Provides basic guidelines for handling fresh eggs which could be useful in training regulatory and industry personnel. (American Egg Board–1997)

F2036 **Emerging Pathogens and Grinding and Cooking Comminuted Beef**–(2 videotapes – 165 minutes.) (See Part 1 Tape F2035 and Part 3 Tape F2037.) This is session 2 of a 3-part Meat and Poultry Teleconference co-sponsored by AFDO and the USDA Food Safety Inspection Service. These videotapes present an action plan for federal, state, local authorities, industry, and trade associations in a foodborne outbreak. (AFDO/USDA–1998)

F2035 **Fabrication and Curing of Meat and Poultry Products**–(2 videotapes – 145 minutes). (See Part 2 Tape F2036 and Part 3 Tape F2037). This is session 1 of a 3-part Meat and Poultry Teleconference cosponsored by AFDO and the USDA Food Safety Inspection Service. Upon viewing, the sanitarian will be able to (1) Identify typical equipment used for meat and poultry fabrication at retail and understand their uses; (2) Define specific terms used in fabrication of meat and poultry products in retail establishments, and (3) Identify specific food safety hazards associated with fabrication and their controls. (AFDO/USDA–1997)

FastTrack Restaurant Video Kit–These five short, direct videos can help make your employees more aware of various food hazards and how they can promote food safety. (DiverseyLever/American Hotel & Lodging Educational Institute – 1994)

F2500 **Tape 1–Food Safety Essentials**–(23 minute videotape). This video provides an overview of food safety. All food service employees learn six crucial guidelines for combating foodborne illness. Prepares employees for further position-specific training to apply the six food safety principles to specific jobs.

F2501 **Tape 2–Receiving and Storage**–(22 minute videotape). Make sure only safe food enters your doors! Receiving and storage staff learn what to look for and how to prevent spoilage with proper storage with this video.

F2502 **Tape 3–Service**–(22 minute videotape). Servers are your last safety checkpoint before guests receive food. This video helps you make sure they know the danger signs.

F2503 **Tape 4–Food Production**–(24 minute videotape). Food production tasks cause most food safety problems. Attack dangerous practices at this critical stage with this video training tool.

F2504 **Tape 5–Warewashing**–(21 minute videotape). Proper sanitation starts with clean dishes! With this video, warewashers will learn how to ensure safe tableware for guests and safe kitchenware for coworkers.

F2039 **Food for Thought–The GMP Quiz Show**–(16 minute videotape). In the grand tradition of television quiz shows, three food industry workers test their knowledge of GMP principles. As the contestants jockey to answer questions, the video provides a thorough and timely review of GMP principles. This video is a cost-effective tool to train new hires or sharpen the knowledge of veteran employees. Topics covered include employee practices, including proper attire, contamination, stock rotation, pest control, conditions for microbial growth and employee traffic patterns. Food safety terms such as HACCP, microbial growth niche, temperature danger zone, FIFO and cross-contamination, are also defined. (Silliker Laboratories–2000)

F2040 **Food Irradiation**–(30 minute videotape). Introduces viewers to food irradiation as a new preservation technique. Illustrates how food irradiation can be used to prevent spoilage by microorganisms, destruction by insects, overripening, and to reduce the need for chemical food additives. The food irradiation process is explained and benefits

of the process are highlighted. (Turnelle Productions, Inc.) (Reviewed 1998)

F2045 **Food Microbiological Control**–(6 videotapes – approximate time 12 hours). Designed to provide information and demonstrate the application of basic microbiology, the Good Manufacturing Practices (GMPs), retail Food Code, and sanitation practices when conducting food inspections at the processing and retail levels. Viewers will enhance their ability to identify potential food hazards and evaluate the adequacy of proper control methods for these hazards. (FDA–1998)

F2050 **Food Safe–Food Smart–HACCP & Its Application to the Food Industry**–(2-16 minute videotapes). (1)–Introduces the seven principles of HACCP and their application to the food industry. Viewers will learn about the HACCP system and how it is used in the food industry to provide a safe food supply. (2)–Provides guidance on how to design and implement a HACCP system. It is intended for individuals with the responsibility of setting up a HACCP system. (Alberta Agriculture, Food and Rural Development) (Reviewed 1998)

F2060 **Food Safe–Series I**–(4-10 minute videotapes). (1) "Receiving & Storing Food Safely," details for foodservice workers the procedures for performing sight inspections for the general conditions of food, including a discussion of food labeling and government approval stamps. (2) "Food-service Facilities and Equipment," outlines the requirements for the proper cleaning and sanitizing of equipment used in food preparation areas. Describes the type of materials, design, and proper maintenance of this equipment. (3) "Microbiology for Foodservice Workers," provides a basic understanding of the microorganisms which cause food spoilage and foodborne illness. This program describes bacteria, viruses, protozoa, and parasites and the conditions which support their growth. (4) "Food-service Housekeeping and Pest Control," emphasizes cleanliness as the basis for all pest control. Viewers learn the habits and life cycles of flies, cockroaches, rats, and mice. (Perennial Education–1991) (Reviewed 1998)

F2070 **Food Safe–Series II**–(4-10 minute videotapes). Presents case histories of foodborne disease involving (1) *Staphylococcus aureus*, (sauces) (2) *Salmonella*, (eggs) (3) *Campylobacter*, and (4) *Clostridium botulinum*. Each tape demonstrates errors in preparation, holding or serving food; describes the consequences of those actions; reviews the procedures to reveal the cause of the illness; and illustrates the correct practices in a step-by-step demonstration. These are excellent tapes to use in conjunction with hazard analysis critical control point training programs. (Perennial Education–1991) (Reviewed 1998)

F2080 **Food Safe–Series III**–(4-10 minute videotapes). More case histories of foodborne disease. This set includes (1) Hepatitis "A", (2) *Staphylococcus aureus* (meats), (3) *Bacillus cereus*, and (4) *Salmonella* (meat). Viewers will learn typical errors in the preparation, holding and serving of food. Also included are examples of correct procedures which will reduce the risk of food contamination. (Perennial Education–1991) (Reviewed 1998)

F2133 **Food Safety First**–(50 minute videotape). This food safety training video presents causes of foodborne illness in foodservice and ways to prevent foodborne illness. Individual segments include personal hygiene and handwashing, cleaning and sanitizing, preventing cross contamination and avoiding time and temperature abuse. Foodhandling principles are presented through scenarios in a restaurant kitchen. (Glo-Germ 1998). Available in Spanish.

F2090 **Food Safety: An Educational Video for Institutional Food Service Workers**–(10 minute videotape). Provides a general discussion on food safety principles with special emphasis on pathogen reductions in an institutional setting from child care centers to nursing homes. (US Department of Health & Human Services–1997)

Food Safety for Food Service Series I–An employee video series containing quick, 10-minute videos that teach food service employees how to prevent foodborne illness. This four video series examines sources of foodborne illness, plus explores prevention through awareness and recommendations for best practices for food safety. It also looks at how food safety affects the food service employee's job. (J.J. Keller & Associates–2000)

F2100 **Tape 1–Food Safety for Food Service: Cross Contamination**–(10 minute videotape). Provides the basic information needed to ensure integrity and safety in foodservice operations. Explains proper practices and procedures to prevent, detect and eliminate cross contamination.

F2101 **Tape 2–Food Safety for Food Service: HACCP**–(10 minute videotape). This video takes the mystery out of HACCP for your employees, and explains the importance of HACCP procedures in their work. Employees will come away feeling confident, knowing how to make HACCP work. The seven steps of HACCP and how HACCP is used in foodservice are some of the topics discussed.

F2102 **Tape 3–Food Safety for Food Service: Personal Hygiene**–(10 minute videotape). This video establishes clear, understandable ground rules for good personal hygiene in the foodservice workplace and explains why personal hygiene is so important. Topics include: personal cleanliness; proper protective equipment; correct hand washing procedures; when to wash hands, hygiene with respect to cross contamination and prohibited practices and habits.

F2103 **Tape 4–Food Safety for Food Service: Time and Temperature Controls**–(10 minute videotape). This video examines storage and handling of raw and cooked ingredients, and explains how to ensure their safety. Employees learn how to spot potential problems and what to do when they find them. Topics include: correct

thermometer use, cooling, thawing and heating procedures, food storage procedures, holding temperature requirements, and handling leftovers.

Food Safety for Food Service Series II–An employee video series containing quick, 10-minute videos that boost safety awareness for food service employees and teach them how to avoid foodborne illness. (J. J. Keller & Associates, Neenah, WI– 2002)

F2104 **Tape 1–Basic Microbiology and Foodborne Illness**–(10 minute videotape). Covers four common microorganisms in food, how they get into food, and simple ways to prevent contamination. Stresses the importance of keeping food at the right temperature, having proper personal hygiene, and cleaning and sanitizing work surfaces.

F2105 **Tape 2–Handling Knives, Cuts and Burns**–(10 minute videotape). Explains why sharp knives are safer than dull ones, provides tips for selecting a good knife, and gives techniques for cutting food safely. Also explains first aid for cuts and burns and the most common causes of burns.

F2106 **Tape 3–Working Safely to Prevent Injury**–(10 minute videotape). Discusses common lifting hazards and how back injuries can happen. Gives proper lifting and carrying techniques to prevent soreness and injury. Also covers how to prevent slips, trips, and falls.

F2107 **Tape 4–Sanitation**–(10 minute videotape). Provides tips for good personal hygiene habits, including the proper way to wash your hands, dress, and prepare for work. Also covers cleaning and sanitizing equipment; storing chemicals and cleaning supplies; and controlling pests that can contaminate work areas and food.

F2120 **Food Safety: For Goodness Sake, Keep Food Safe**–(15 minute videotape). Teaches foodhandlers the fundamentals of safe food handling. The tape features the key elements of cleanliness and sanitation, including: good personal hygiene, maintaining proper food product temperature, preventing time abuse, and potential sources of food contamination. (Iowa State University Extension–1990) (Reviewed 1998)

F2110 **Food Safety is No Mystery**–(34 minute videotape). This is an excellent training visual for foodservice workers. It shows the proper ways to prepare, handle, serve and store food in actual restaurant, school and hospital situations. A policeman sick from food poisoning, a health department sanitarian, and a food-service worker with all the bad habits are featured. The latest recommendations on personal hygiene, temperatures, cross-contamination, and storage of foods are included. (USDA–1987). Also available in Spanish. – (Reviewed 1998)

F2130 **Food Safety: You Make the Difference**–(28 minute videotape). Through five food workers from differing backgrounds, this engaging and inspirational documentary style video illustrates the four basic food safety concepts: handwashing, preventing cross-contamination, moving foods quickly through the danger zone, and hot/cold holding (Seattle-King County Health Department–1995)

Food Safety Zone Video Series–A one-of-a-kind series that helps get your employees to take food safety issues seriously! These short, to-the-point videos can help make your employees aware of various food hazards, and how they can help promote food safety. The 4 topics are: Basic Microbiology, Cross Contamination, Personal Hygiene, and Sanitation. (J.J. Keller & Associates – 1999). (Also available in Spanish.)

F2125 **Tape 1–Food Safety Zone: Basic Microbiology**–(10 minute videotape). In this video, food service personnel will gain a deeper understanding of food safety issues and what they can do to prevent recalls and contamination. It describes the different types of bacteria that can be harmful to food, and tells how to minimize bacterial growth through time and temperature controls, personal hygiene practices, and sanitation.

F2126 **Tape 2–Food Safety Zone: Cross Contamination**–(10 minute videotape). Quickly teach your employees how they can help prevent cross contamination. Employees are educated on why contaminants can be extremely dangerous, cause serious injury, and even death, to consumers of their food products. This fast-paced video will give your employees a deeper understanding of the different types of cross contamination, how to prevent it, and how to detect it through visual inspections and equipment. The emphasis is that prevention is the key to eliminating cross contamination.

F2127 **Tape 3–Food Safety Zone: Personal Hygiene**–(10 minute videotape). After watching this video, your employees will understand why their personal hygiene is critical to the success of your business. This video teaches employees about four basic good personal hygiene practices: keeping themselves clean, wearing clean clothes, following specific hand washing procedures, and complying with all related work practices. Personnel are also taught that personal hygiene practices are designed to prevent them from accidentally introducing bacteria to food products, and are so important that there are federal laws that all food handlers must obey.

F2128 **Tape 4–Food Safety Zone: Sanitation**–(10 minute videotape). Don't just tell your employees why sanitation is important, show them! This training video teaches employees about the sanitation procedures that cover all practices to keep workplaces

clean, and food produced free of contaminants and harmful bacteria. Four areas covered include personal hygiene, equipment and work areas, use and storage of cleaning chemicals and equipment, and pest control.

F2135 **Get with a Safe Food Attitude**–(40 minute videotape). Consisting of nine short segments which can be viewed individually or as a group, this video presents safe food handling for moms-to-be. Any illness a pregnant woman contracts can affect her unborn child whose immune system is too immature to fight back. The video follows four pregnant women as they learn about food safety and preventing foodborne illness. (US Department of Agriculture–1999)

F2136 **GLP Basics: Safety in the Food Micro Lab**–(16 minute videotape). This video is designed to teach laboratory technicians basic safety fundamentals and how to protect themselves from inherent workplace dangers. Special sections on general laboratory rules, personal protective equipment, microbiological, chemical, and physical hazards, autoclave safety, and spill containment are featured. (Silliker Laboratories Group, Inc., Homewood, IL–2001)

F2137 **GMP Basics: Avoiding Microbial Cross-Contamination**–(15 minute videotape). This video takes a closer look at how harmful microorganisms, such as *Listeria*, can be transferred to finished products. Employees see numerous examples of how microbial cross-contamination can occur from improper traffic patterns, poor personal hygiene, soiled clothing, unsanitized tools and equipment. Employees need specific knowledge and practical training to avoid microbial cross-contamination in plants. This video aids in that training. (Silliker Laboratories–2000)

F2140 **GMP Basics – Employee Hygiene Practices**–(20 minute videotape). Through real-life examples and dramatization, this video demonstrates good manufacturing practices that relate to employee hygiene, particularly hand washing. This video includes a unique test section to help assess participants' understanding of common GMP violations. (Silliker Laboratories–1997)

F2143 **GMP Basics: Guidelines for Maintenance Personnel**–(21 minute videotape). Developed specifically for maintenance personnel working in a food processing environment, this video depicts a plant-wide training initiative following a product recall announcement. Maintenance personnel will learn how GMPs relate to their daily activities and how important their roles are in the production of safe food products. (Silliker Laboratories–1999)

F2148 **GMP–GSP Employee**–(38 minute videotape). This video was developed to teach food plant employees the importance of "Good Manufacturing Practices" and "Good Sanitation Practices." Law dictates that food must be clean and safe to eat. This video emphasizes the significance of each employee's role in protecting food against contamination. Tips on personal cleanliness and hygiene are also presented. (L.J. Bianco & Associates)

F2150 **GMP: Personal Hygiene & Practices in Food Manufacturing**–(14 minute videotape). This video focuses on the personal hygiene of food-manufacturing workers, and explores how poor hygiene habits can be responsible for the contamination of food in the manufacturing process. This is an instructional tool for new food-manufacturing line employees and supervisors. It was produced with "real" people in actual plant situations, with only one line of text included in the videotape. (Penn State–1993)–(Available in Spanish and Vietnamese)

F2147 **GMP Basics: Process Control Practices**–(16 minute videotape). In actual food processing environments, an on-camera host takes employees through a typical food plant as they learn the importance of monitoring and controlling key points in the manufacturing process. Beginning with receiving and storing, through production, and ending with packaging and distribution, control measures are introduced, demonstrated, and reviewed. Employees will see how their everyday activities in the plant have an impact on product safety. (Silliker Laboratories–1999)

F2160 **GMP: Sources & Control of Contamination during Processing**–(20 minute videotape). This program, designed as an instructional tool for new employees and for refresher training for current or reassigned workers, focuses on the sources and control of contamination in the food-manufacturing process. It was produced in actual food plant situations. A concise description of microbial contamination and growth and cross-contamination, a demonstration of food storage, and a review of aerosol contaminants are also included. (Penn State–1995)

F2180 **HACCP: Safe Food Handling Techniques**–(22 minute videotape). The video highlights the primary causes of food poisoning and emphasizes the importance of self-inspection. An explanation of potentially hazardous foods, cross-contamination, and temperature control is provided. The main focus is a detailed description of how to implement a Hazard Analysis Critical Control Point (HACCP) program in a food-service operation. A leader's guide is provided as an adjunct to the tape. (The Canadian Restaurant & Foodservices Association–1990) (Reviewed 1998)

F2169 **HACCP: Training for Employees — USDA Awareness**–(15 minute videotape). This video is a detailed training outline provided for the employee program. Included in the video is a synopsis of general federal regulations; HACCP plan development; incorporation of HACCP's seven principles; HACCP plan checklist, and an HACCP employee training program. (J.J. Keller & Associates–1999)

F2172 **HACCP: Training for Managers**–(17 minute videotape). Through industry-specific examples and case studies, this video addresses the seven HACCP steps, identifying critical control points, recordkeeping and documentation, auditing, and monitoring. It also explains how HACCP relates to other programs such as Good Manufacturing Practices and plant sanitation. (J.J. Keller & Associates, Inc.–2000)

F2170 **The Heart of HACCP**–(22 minute videotape). A training video designed to give plant personnel a clear understanding of the seven HACCP principles and practical guidance on how to apply these principles to their own work environment. This video emphasizes the principles of primary concern to plant personnel such as critical limits, monitoring systems, and corrective actions that are vital to the success of a HACCP plan. (Silliker Laboratories Group–1994)

F2171 **HACCP: The Way to Food Safety**–(53 minute videotape). The video highlights the primary causes of food poisoning and stresses the importance of self-inspection. Potentially hazardous foods, cross-contamination and temperature control are explained. The video is designed to give a clear understanding of the seven HACCP principles and practical guidance on how to apply these principles to a work environment. Critical limits, monitoring systems and corrective action plans are emphasized. The video also provides an overview of foodborne pathogens, covering terminology, the impact of pathogens, and what employees must do to avoid problems. Also described are the sources, causes and dangers of contamination in the food industry. (Southern Illinois University–1997)

F2173 **Inside HACCP: Principles, Practices & Results**–(15 minute videotape). This video is designed to help you build a more knowledgeable work-force and meet safety standards through a comprehensive overview of HACCP principles. Employees are provided with details of prerequisite programs and a clear overview of the seven HACCP principles. "Inside HACCP" provides short succinct explanations of how HACCP works and places special emphasis on the four principles —monitoring, verification, corrective action, and recordkeeping – in which employees actively participate. (Silliker Laboratories Group, Inc., Homewood, IL–2001)

F2175 **Inspecting For Food Safety–Kentucky's Food Code**–(100 minute videotape). Kentucky's Food Code is patterned after the Federal Food Code. The concepts, definitions, procedures, and regulatory standards included in the code are based on the most current information about how to prevent foodborne diseases. This video is designed to prepare food safety inspectors to effectively use the new food code in the performance of their duties. (Department of Public Health Commonwealth of Kentucky–1997) (Reviewed 1999)

F2190 **Is What You Order What You Get? Seafood Integrity**–(18 minute videotape). Teaches seafood department employees about seafood safety and how they can help insure the integrity of seafood sold by retail food markets. Key points of interest are cross-contamination control, methods and criteria for receiving seafood and determining product quality, and knowing how to identify fish and seafood when unapproved substitutions have been made. (The Food Marketing Institute) (Reviewed 1998)

F2210 **Northern Delight–From Canada to the World**–(13 minute videotape). A promotional video that explores the wide variety of foods and beverages produced by the Canadian food industry. General in nature, this tape presents an overview of Canada's food industry and its contribution to the world's food supply. (Ternelle Production, Ltd.) (Reviewed 1998)

F2240 **On the Front Line**–(18 minute videotape). A training video pertaining to sanitation fundamentals for vending service personnel. Standard cleaning and serving procedures for cold food, hot beverage and cup drink vending machines are presented. The video emphasizes specific cleaning and serving practices which are important to food and beverage vending operations. (National Automatic Merchandising Association–1993) (Reviewed 1998)

F2250 **On the Line**–(30 minute videotape). This was developed by the Food Processors Institute for training food processing plant employees. It creates an awareness of quality control and regulations. Emphasis is on personal hygiene, equipment cleanliness and good housekeeping in a food plant. It is recommended for showing to both new and experienced workers. (Available in Spanish) The Food Processors Institute. 1993. (Reviewed 1998)

F2270 **Pest Control in Seafood Processing Plants**–(26 minute videotape). Videotape which covers procedures to control flies, roaches, mice, rats and other common pests associated with food processing operations. The tape will familiarize plant personnel with the basic characteristics of these pests and the potential hazards associated with their presence in food operations. (Reviewed 1998)

F2280 **Principles of Warehouse Sanitation**–(33 minute videotape). This videotape gives a clear, concise and complete illustration of the principles set down in the Food, Drug and Cosmetic Act and in the Good Manufacturing Practices, as well as supporting legislation by individual states. (American Institute of Baking–1993)

F2271 **Preventing Foodborne Illness**–(10 minute videotape). This narrated video is for food service workers, with emphasis on insuring food safety by washing one's hands before handling food, after using the bathroom, sneezing, touching raw meats and poultry, and before and after handling foods such as salads and sandwiches. Safe food temperatures and cross contamination are also explained. (Colorado Dept. of Public Health and Environment– 1999)

F2290 **Product Safety & Shelf Life**–(40 minute videotape). Developed by Borden Inc., this videotape was done in three sections with opportunity for review. Emphasis is on providing consumers with good products. One section covers off-flavors, another product problems caused by plant conditions, and a third the need to keep products cold and fresh. Procedures to assure this are outlined, as shown in a plant. Well done and directed to plant workers and supervisors. (Borden–1987) – (Reviewed 1997)

F2220 **Proper Handling of Peracidic Acid**–(15 minute videotape). Introduces paracidic acid as a chemical sanitizer and features the various precautions needed to use the product safely in the food industry.

F2230 **Purely Coincidental**–(20 minute videotape). A parody that shows how foodborne illness can adversely affect the lives of families that are

involved. The movie compares improper handling of dog food in a manufacturing plant that causes the death of a family pet with improper handling of human food in a manufacturing plant that causes a child to become ill. Both cases illustrate how handling errors in food production can produce devastating outcomes. (The Quaker Oats Company–1993.) (Reviewed 1998)

F2310 **Safe Food: You Can Make a Difference**–(25 minute videotape). A training video for foodservice workers which covers the fundamentals of food safety. An explanation of proper food temperature, food storage, cross-contamination control, cleaning and sanitizing, and handwashing as methods of foodborne illness control is provided. The video provides an orientation to food safety for professional foodhandlers. (Tacoma–Pierce County Health Department–1990). (Reviewed 1998)

F2320 **Safe Handwashing**–(15 minute videotape). Twenty-five percent of all foodborne illnesses are traced to improper handwashing. The problem is not just that handwashing is not done, the problem is that it's not done properly. This training video demonstrates the "double wash" technique developed by Dr. O. Peter Snyder of the Hospitality Institute for Technology and Management. Dr. Snyder demonstrates the procedure while reinforcing the microbiological reasons for keeping hands clean. (Hospitality Institute for Technology and Management–1991) (Reviewed 1998)

F2325 **Safe Practices for Sausage Production**–(3 hour videotape). This videotape is based on a series of educational broadcasts on meat and poultry inspections at retail food establishments produced by the Association of Food and Drug Officials (AFDO) and USDA's Food Safety and Inspection Service (FSIS), along with FDA's Center for Food Safety and Applied Nutrition. The purpose of the broadcast was to provide training to state, local, and tribal sanitarians on processes and procedures that are being utilized by retail stores and restaurants, especially those that were usually seen in USDA-inspected facilities. The program will cover the main production steps of sausage products, such as the processes of grinding, stuffing, and smoking, and typical equipment used will be depicted. Characteristics of different types of sausage (fresh, cooked and smoked, and dry/semi-dry) will be explained. Pathogens of concern and outbreaks associated with sausage will be discussed. The written manual for the program is available at www.fsis.usda.gov/ofo/hrds/STATE/RETAIL/manual.htm. (1999)

F2460 **Safer Processing of Sprouts**–(1 hour and 22 minute videotape). Sprouts are enjoyed by many consumers for their taste and nutritional value. However, recent outbreaks of illnesses associated with sprouts have demonstrated a potentially serious human health risk posed by this food. FDA and other public health officials are working with industry to identify and implement production practices that will assure that seed and sprouted seed are produced under safe conditions. This training video covers safe processing practices of sprouts including growing, harvesting, milling, transportation, storage, seed treatment, cleaning and sanitizing, sampling and microbiological testing. (CA Dept. of Health Services, Food and Drug Branch; U.S. Food and Drug Administration, and the Centers for Disease Control and Prevention – 2000)

F2330 **Sanitation for Seafood Processing Personnel**–(20 minute videotape). A training video suited for professional foodhandlers working in any type of food manufacturing plant. The film highlights Good Manufacturing Practices and their role in assuring food safety. The professional foodhandler is introduced to a variety of sanitation topics including: (1) foodhandlers as a source of food contamination, (2) personal hygiene as a means of preventing food contamination, (3) approved food storage techniques including safe storage temperatures, (4) sources of cross-contamination, (5) contamination of food by insects and rodents, (6) garbage handling and pest control, and (7) design and location of equipment and physical facilities to facilitate cleaning. (Reviewed 1998)

F2340 **Sanitizing for Safety**–(17 minute videotape). Provides an introduction to basic food safety for professional foodhandlers. A training pamphlet and quiz accompany the tape. Although produced by a chemical supplier, the tape contains minimal commercialism and may be a valuable tool for training new employees in the food industry. (Clorox–1990) (Reviewed 1998)

F2341 **Science and Our Food Supply**–(45 minute videotape). Becoming food safety savvy is as easy as A-B-C! This video includes step-by-step journey food travels from the farm to the table; the Fight BAC.™ Campaign's four simple steps to food safety, clean, cook, separate (combat cross contamination), and chill, and the latest in food safety careers. Other topics covered include understanding bacteria, food processing and transportation, and the future technology of food processing. (FDA-Center for Food Safety and Applied Nutrition–2001)

F2350 **ServSafe® Steps to Food Safety**–The ServSafe food safety series consists of six videos that illustrate and reinforce important food safety practices in an informative and entertaining manner. The videos provide realistic scenarios in multiple industry segments. English and Spanish are provided on each tape. (National Restaurant Association Education Foundation –2000)

Step One: Starting Out with Food Safety–(12 minute videotape). Defines what foodborne illness is and how it occurs; how foods become unsafe; and what safety practices to follow during the flow of food.

Step Two: Ensuring Proper Personal Hygiene–(10 minute videotape). Introduces employees to ways they might contaminate food; personal cleanliness practices that help protect food; and the procedure for thorough handwashing.

Step Three: Purchasing, Receiving and Storage–(12 minute videotape). Explains how to choose a supplier; calibrate and use a thermometer properly; accept or reject a delivery; and store food safely.

Step Four: Preparing, Cooking, and Serving–(11 minute videotape). Identifies proper practices for thawing, cooking, holding, serving, cooling and reheating food.

Step Five: Cleaning and Sanitizing–(11 minute videotape). Describes the difference between cleaning and sanitizing; manual and machine warewashing; how sanitizers work; how to store clean items and cleaning supplies; and how to setup a cleaning program.

Step Six: Take the Food Safety Challenge: Good Practices, Bad Practices — You Make the Call!–(35 minute videotape). Challenges viewers to identify good and bad practices presented in five short scenarios from different industry segments.

F2400 **The Amazing World of Microorganisms**–(12 minute videotape). This video will provide your employees with an overview of how microorganisms affect their everyday lives and the foods they produce. The video explores how microscopic creatures are crucial in producing foods, fighting disease, and protecting the environment. In addition, certain microorganisms are responsible for food spoilage, illness, and even death. Equipped with this knowledge, your employees will be better able to protect your brand. (Silliker Laboratories Group, Inc., Homewood, IL–2001)

F2430 **Smart Sanitation: Principles & Practices for Effectively Cleaning Your Food Plant**–(20 minute videotape). A practical training tool for new sanitation employees or as a refresher for veterans. Employees will understand the food safety impact of their day-to-day cleaning and sanitation activities and recognize the importance of their role in your company's food safety program. (Silliker Laboratories Group–1996)

F2370 **Supermarket Sanitation Program–"Cleaning & Sanitizing"**–(13 minute videotape). Contains a full range of cleaning and sanitizing information with minimal emphasis on product. Designed as a basic training program for supermarket managers and employees. (1989) (Reviewed 1998)

F2380 **Supermarket Sanitation Program–"Food Safety"**–(11 minute videotape). Contains a full range of basic sanitation information with minimal emphasis on product. Filmed in a supermarket, the video is designed as a basic program for manager training and a program to be used by managers to train employees. (1989) (Reviewed 1998)

F2390 **Take Aim at Sanitation**–(8 minute videotape). This video features tips on food safety and proper disposal of single service items. Also presented is an emphasis on food contact surfaces as well as the manufacture, storage and proper handling of these items. (Foodservice and Packaging Institute, Inc.–1995). (Available in Spanish)

F2410 **Wide World of Food Service Brushes**–(18 minute videotape). Discusses the importance of cleaning and sanitizing as a means to prevent and control foodborne illness. Special emphasis is given to proper cleaning and sanitizing procedures and the importance of having properly designed and constructed equipment (brushes) for food preparation and equipment cleaning operations. (1989) (Reviewed 1998)

F2420 **Your Health in Our Hands–Our Health in Yours**–(8 minute videotape). For professional foodhandlers, the tape covers the do's and don'ts of foodhandling as they relate to personal hygiene, temperature control, safe storage and proper sanitation. (Jupiter Video Production–1993). (Reviewed 1998)

OTHER

M4010 **Diet, Nutrition & Cancer**–(20 minute videotape). Investigates the relationship between a person's diet and the risk of developing cancer. The film describes the cancer development process and identifies various types of food believed to promote and/or inhibit cancer. The film also provides recommended dietary guidelines to prevent or greatly reduce the risk of certain types of cancer.

M4020 **Eating Defensively: Food Safety Advice for Persons with AIDS**–(15 minute videotape). While HIV infection and AIDS are not acquired by eating foods or drinking liquids, persons infected with the AIDS virus need to be concerned about what they eat. Foods can transmit bacteria and viruses capable of causing life-threatening illness to persons infected with AIDS. This video provides information for persons with AIDS on what foods to avoid and how to better handle and prepare foods. (FDA/CDC–1989)

M4030 **Ice: The Forgotten Food**–(14 minute videotape). This training video describes how ice is made and where the critical control points are in its manufacture, both in ice plants and in on-premises locations (convenience stores, etc.); it documents the potential for illness from contaminated ice and calls on government to enforce good manufacturing practices, especially in on-premises operations where sanitation deficiencies are common. (Packaged Ice Association–1993)

M4050 **Personal Hygiene & Sanitation for Food Processing Employees**–(15 minute videotape). Illustrates and describes the importance of good personal hygiene and sanitary practices for people working in a food processing plant. (Iowa State–1993)

M4060 **Psychiatric Aspects of Product Tampering**–(25 minute videotape). This was presented by Emanuel Tanay, M.D. from Detroit, at the fall 1986 conference of CSAFDA. He reviewed a few cases and then indicated that abnormal behavior is like a contagious disease. Media stories lead to up to 1,000 similar alleged cases, nearly all of which are false. Tamper-proof packaging and recalls are essential. Tampering and poisoning are characterized by variable motivation, fraud and greed. Law enforcement agencies have the final responsibilities. Tamper proof containers are not the ultimate answer. (1987)

M4070 **Tampering: The Issue Examined**–(37 minute videotape). Developed by Culbro Machine Systems, this videotape is well done. It is directed to food processors and not regulatory sanitarians or consumers. A number of industry and regulatory agency management explain why food and drug containers should be made tamper evident. (Culbro–1987)

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- ❒ D1040 Ether Extraction Method for Determination of Raw Milk
- ❒ D1060 Frozen Dairy Products
- ❒ D1070 The Gerber Butterfat Test
- ❒ D1080 High-Temperature, Short-Time Pasteurizer
- ❒ D1090 Managing Milking Quality
- ❒ D1100 Mastitis Prevention and Control
- ❒ D1110 Milk Plant Sanitation: Chemical Solution
- ❒ D1120 Milk Processing Plant Inspection Procedures
- ❒ D1130 Pasteurizer – Design and Regulation
- ❒ D1140 Pasteurizer – Operation
- ❒ D1150 Processing Fluid Milk (slides)

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- ❒ E3010 The ABCs of Clean – A Handwashing & Cleanliness Program for Early Childhood Programs
- ❒ E3020 Acceptable Risks?
- ❒ E3030 Air Pollution: Indoor
- ❒ E3040 Asbestos Awareness
- ❒ E3055 Effective Handwashing–Preventing Cross-Contamination in the Food Service Industry
- ❒ E3060 EPA Test Methods for Freshwater Effluent Toxicity Tests (Using Ceriodaphnia)
- ❒ E3070 EPA Test Methods for Freshwater Effluent Toxicity Tests (Using Fathead Minnow Larva)
- ❒ E3075 EPA: This is Superfund
- ❒ E3080 Fit to Drink
- ❒ E3110 Garbage: The Movie
- ❒ E3120 Global Warming: Hot Times Ahead
- ❒ E3130 Kentucky Public Swimming Pool & Bathing Facilities
- ❒ E3135 Plastic Recycling Today: A Growing Resource
- ❒ E3140 Putting Aside Pesticides
- ❒ E3150 Radon
- ❒ E3160 RCRA – Hazardous Waste
- ❒ E3161 Sanitation Video
- ❒ E3170 The New Superfund: What It is & How It Works–(1) Changes in the Remedial Process: Clean-up Standards & State Involvement Requirements
- ❒ E3180 The New Superfund: What It is & How It Works–(2) Changes in the Removal Process: Removal & Additional Program Requirements
- ❒ E3190 The New Superfund: What It is & How It Works – (3) Enforcement and Federal Facilities
- ❒ E3210 The New Superfund: What It is & How It Works – (4) Emergency Preparedness & Community Right-to-Know
- ❒ E3220 The New Superfund: What It is & How It Works – (5) Underground Storage Tank Trust Fund & Response Program
- ❒ E3230 The New Superfund: What It is & How It Works – (6) Research & Development/Closing Remarks
- ❒ E3240 Sink a Germ
- ❒ E3245 Wash Your Hands
- ❒ E3250 Waste Not: Reducing Hazardous Waste

FOOD

- ❒ F2260 100 Degrees of Doom...The Time & Temperature Caper
- ❒ F2450 A Guide to Making Safe Smoked Fish
- ❒ F2005 A Lot on the Line
- ❒ F2007 The Amazing World of Microorganisms
- ❒ F2008 A Recipe for Food Safety Success
- ❒ F2440 Cleaning & Sanitizing in Vegetable Processing Plants: Do It Well, Do It Safely!
- ❒ F2010 Close Encounters of the Bird Kind
- ❒ F2015 Controlling *Listeria*: A Team Approach
- ❒ F2111 Controlling *Salmonella*: Strategies that Work
- ❒ F2037 Cooking and Cooling of Meat and Poultry Products (2 Videos)
- ❒ F2030 "Egg Games" Foodservice Egg Handling and Safety
- ❒ F2020 Egg Handling & Safety
- ❒ F2036 Emerging Pathogens and Grinding and Cooking Comminuted Beef (2 Videos)
- ❒ F2055 Fabrication and Curing of Meat and Poultry Products (2 Videos) *FastTrack Restaurant Video Kit*
- ❒ F2500 Tape 1–Food Safety Essentials
- ❒ F2501 Tape 2–Receiving and Storage
- ❒ F2502 Tape 3–Service
- ❒ F2503 Tape 4–Food Production
- ❒ F2504 Tape 5–Warewashing
- ❒ F2039 Food for Thought – The GMP Quiz Show
- ❒ F2040 Food Irradiation
- ❒ F2045 Food Microbiological Control (6 Videos)
- ❒ F2050 Food Safe – Food Smart – HACCP & Its Application to the Food Industry (Part 1&2)
- ❒ F2060 Food Safe – Series I (3 Videos)
- ❒ F2070 Food Safe – Series II (4 Videos)
- ❒ F2080 Food Safe – Series III (4 Videos)
- ❒ F2153 Food Safety First
- ❒ F2090 Food Safety: An Educational Video for Institutional Food-Service Workers
- ❒ F2100 Tape 1–Cross Contamination
- ❒ F2101 Tape 2–HACCP
- ❒ F2102 Tape 3–Personal Hygiene
- ❒ F2103 Tape 4–Time and Temperature Controls
- ❒ F2104 Tape 1–Basic Microbiology and Foodborne Illness
- ❒ F2105 Tape 2–Handling Knives, Cuts and Burns
- ❒ F2106 Tape 3–Working Safely to Prevent Injury
- ❒ F2107 Tape 4–Sanitation
- ❒ F2120 Food Safety: For Goodness Sake, Keep Food Safe
- ❒ F2110 Food Safety is No Mystery
- ❒ F2130 Food Safety: You Make the Difference
- ❒ F2125 Food Safety Zone: Basic Microbiology
- ❒ F2126 Food Safety Zone: Cross Contamination
- ❒ F2127 Food Safety Zone: Personal Hygiene
- ❒ F2128 Food Safety Zone: Sanitation
- ❒ F2135 Get with a Safe Food Attitude
- ❒ F2136 GLP Basics: Safety in the Food Micro Lab
- ❒ F2137 GMP Basics: Avoiding Microbial Cross-Contamination
- ❒ F2140 GMP Basics: Employee Hygiene Practices
- ❒ F2143 GMP Basics: Guidelines for Maintenance Personnel
- ❒ F2148 GMP – GSP Employee
- ❒ F2150 GMP: Personal Hygiene and Practices in Food Manufacturing
- ❒ F2147 GMP Basics: Process Control Practices
- ❒ F2160 GMP: Sources & Control of Contamination during Processing
- ❒ F2180 HACCP: Safe Food Handling Techniques
- ❒ F2169 HACCP:Training for Employees–USDA Awareness
- ❒ F2172 HACCP:Training for Managers
- ❒ F2170 The Heart of HACCP
- ❒ F2171 HACCP: The Way to Food Safety
- ❒ F2173 Inside HACCP: Principles, Practices & Results
- ❒ F2175 Inspecting for Food Safety – Kentucky's Food Code
- ❒ F2190 Is What You Order What You Get? Seafood Integrity
- ❒ F2210 Northern Delight – From Canada to the World
- ❒ F2240 On the Front Line
- ❒ F2250 On the Line
- ❒ F2270 Pest Control in Seafood Processing Plants
- ❒ F2271 Preventing Foodborne Illness
- ❒ F2280 Principles of Warehouse Sanitation
- ❒ F2290 Product Safety & Shelf Life
- ❒ F2220 Proper Handling of Peracidic Acid
- ❒ F2230 Purely Coincidental
- ❒ F2310 Safe Food: You Can Make a Difference
- ❒ F2320 Safe Handwashing
- ❒ F2325 Safe Practices for Sausage Production
- ❒ F2460 Safer Processing of Sprouts
- ❒ F2330 Sanitation for Seafood Processing Personnel
- ❒ F2340 Sanitizing for Safety
- ❒ F2341 Science and Our Food Supply
- ❒ F2550 SERVSAFE® Steps to Food Safety (6 Videos)
- ❒ F2430 Smart Sanitation: Principles & Practices for Effectively Cleaning Your Food Plant
- ❒ F2370 Supermarket Sanitation Program – "Cleaning & Sanitizing"
- ❒ F2380 Supermarket Sanitation Program – "Food Safety"
- ❒ F2390 Take Aim at Sanitation
- ❒ F2410 Wide World of Food-Service Brushes
- ❒ F2420 Your Health in Our Hands – Our Health in Yours

OTHER

- ❒ M4010 Diet, Nutrition & Cancer
- ❒ M4020 Eating Defensively: Food Safety Advice for Persons with AIDS
- ❒ M4030 Ice: The Forgotten Food
- ❒ M4050 Personal Hygiene & Sanitation for Food Processing Employees
- ❒ M4060 Psychiatric Aspects of Product Tampering
- ❒ M4070 Tampering: The Issue Examined

Visit our Web site at www.foodprotection.org for detailed tape descriptions

NEW MEMBERS

BRAZIL

Andrea Leao Carneiro
Uberlandia, Minas Gerais

SPAIN

Jesus Periago Caston
Murcia University
Murcia, Murcia

UNITED STATES

ALABAMA

Pamela S. Gochenour
Auburn University
Opelika

John P. Nelson
Jefferson Co. Health Dept.
Birmingham

CALIFORNIA

Dennis D. Crenwelge
Foster Farms, Turlock

Mark A. Cullison
General Mills Inc.
Long Beach

Lisa Lehman
Lehman Foods Inc.
North Hills

Alejandra Mendoza
Nestle USA, Reseda

Jenny Paukova
Nestle USA, Encino

Linh U. Phan
Nestle USA, Arleta

L. D. Taylor
Kraft/Nabisco
Buena Park

CONNECTICUT

Yue Li
Sensor Research & Development
Corp., Farmington

FLORIDA

Steve Otwell
University of Florida
Gainesville

GEORGIA

Joseph M. Holt
Gold Kist Inc., Atlanta

Brian A. Nummer
University of Georgia
Athens

Kurt E. Westmoreland
Silliker Inc., Cleveland

HAWAII

Aurora A. Saulo
University of Hawaii at Manoa
Honolulu

LOUISIANA

Ligia V. A. Da Silva
Louisiana State University
Baton Rouge

MAINE

Elizabeth Ehrenfeld
Southern Maine Technical College
South Portland

MARYLAND

Jennifer Riley
BD Diagnostic Systems
Sparks

MASSACHUSETTS

Alphajour A. Bah
General Mills Bakeries & Foodservices
Chelsea

MINNESOTA

Jeffrey S. Haviland
Seitz Stainless Inc., Avon

MISSOURI

Charles Lansford
City of Jefferson, Jefferson City

Yong Li
University of Missouri-Columbia
Columbia

NORTH CAROLINA

Jennifer R. Mayhall
Kay Chemical Co.
Greensboro

OHIO

Thomas I. Lovey
City of Cleveland Health Dept.
Cleveland

PENNSYLVANIA

John Stevenson
North Side Foods Corp.
Arnold

TENNESSEE

Robert Owen
Heritage Farms Dairy
Murfreesboro

TEXAS

Claire V. Bellott
Texas Dept. of Health, Euless

Alejandro Echeverry
Texas Tech University
Lubbock

Mike Giles
SouthWest Dairy, Tyler

UTAH

Bruno J. Marberger
Compass Group, Riverton

WISCONSIN

Christine M. Palka
Agrilink Foods, Green Bay

Chris Simon
Weyauwega Milk Products
Little Chute

Vern Winker
Lactoprot USA Inc., Blue Mounds

UPDATES

Rugh to Head New 3-A Entity

Timothy R. Rugh, CAE, has been selected as Executive Director of the new 3-A entity, 3-A Sanitary Standards, Inc., by its Board of Directors. Rugh officially opened the doors of the new entity on January 2, 2003 at its offices in McLean, VA. Under Rugh's leadership, 3-A Sanitary Standards, Inc. will manage the 3-A Standards writing process and the transition from self-certification to Third Party Verification and 3-A Symbol authorization.

Rugh brings some unique qualifications to his position including previous executive experience in standards organizations, food industry associations, and association management companies. Prior to joining 3-A SSI, Rugh was executive vice president of the International Cast Polymer Alliance (ICPA) in Arlington, VA.

Tim's experience spans 20 years of service for national and international associations representing manufacturers of industrial, high technology and commercial products.

Donald Zink New FDA Employee

Donald Zink, Ph.D. was recently appointed senior food scientist, the Center for Food Safety and Applied Nutrition, US Food and Drug Administration (CFSAN/FDA). Prior to joining FDA, Dr. Zink had served as vice president of food safety and research and development at future beef operations, an integrated meat packing and processing business.

Dr. Zink has 23 years experience in food safety, food processing and public health research and policy. His professional experience encompasses academia and industry.

Dr. Zink holds a M.S. in microbiology and a Ph.D. in biochemistry and biophysics, both from Texas A & M University.

Karen Huether Joins NCFST

Karen Huether has joined National Center for Food Safety and Technology (NCFST) as Director of Food Safety. Most recently, she was director of microbiology and food safety at Kraft Foods, East Hanover, NJ.

Prior to that, she was director of food safety-corporate food safety officer at Nabisco. She has 22 years of experience with Nabisco and their food safety program.

Karen received a master's in business administration in 1986 and has a B.S. in microbiology.

www.foodprotection.org

NCBA Files *E. coli* Comments

The National Cattlemen's Beef Association (NCBA) is urging government to recognize the need for continuing research and the important role invention technologies play in reducing the incidence of *E. coli* contamination.

In comments submitted to the USDA's Food Safety Inspection Service (FSIS) on *E. coli* O157:H7 contamination of beef products, NCBA says, "FSIS needs to have a clear, systematic approach to allow for testing of new technologies under normal operating conditions in the plant. FSIS needs a streamlined review process with the FDA to get these technologies approved, validated, and implemented."

Since 1993, NCBA has invested $16 million in checkoff dollars on research into new interventions at pre- and post-harvest to further reduce the presence of *E. coli*, and significant progress has been made. As research continues to identify new technologies, NCBA says fast approvals by the Food and Drug Administration (FDA) and FSIS are needed in order to test these interventions in the plant and then implement them across the industry.

According to NCBA, "Multiple interventions at all points in the process will be critical as we work toward further control and reduction of the pathogen. No one sector can do this alone. All sectors of the industry must work together with government and consumers. There must be a unified approach, utilizing the best available science, to control and reduce the incidence of *E. coli* O157:H7."

NCBA continues to coordinate a coalition of organizations across the beef chain to join together with government in a partnership fostering science-based problem solving, and enhancing consumer education. Changing FSIS policy requires plants producing raw beef products to reassess their Hazard Analysis Critical Control Point (HACCP) plans and implement the necessary Critical Control Point (CCP) steps to adequately address the pathogen. Large plants were required to have their reassessment of their HACCP plans completed, or provide documentation on why they did not need to reassess by Dec. 6. Inspectors start collecting data to check reassessment outcomes on Dec. 23. NCBA says, "beef safety is a top priority for NCBA and the beef industry. We are committed to working with the entire beef chain and the state and federal governments to further decrease the incidence of this pathogen."

UK Food Standards Agency Raises Concerns Over Spanish Eggs with European Commission

The Food Standards Agency (FSA) in the United Kingdom (UK) has raised concerns over Spanish eggs with the European Commission, and directly with the Spanish food safety authorities after evidence emerged of a link between a number of outbreaks of *Salmonella* in England and Wales and eggs imported from Spain. An outbreak of gastroenteritis due to a strain of S. Enteritidis PT 14b (not known to be linked with foreign travel) is ongoing in England and Wales, with a cumulative total of 290 confirmed cases November 6. The FSA has issued guidance to importers and wholesalers of Spanish eggs that they should ensure that these eggs are heat treated.

Further emerging evidence suggests that not all food businesses are following the FSA's advice on the proper handling and use of eggs. Examples of poor practices identified so far include raw eggs being used in uncooked products such as icing and desserts, and poor practice around basic food hygiene. The FSA has repeated its advice that all eggs — UK, Spanish, or other imported eggs — should be properly handled and used.

Antex *Shigella* Vaccine Safe and Immunogenic, Phase I Trial Offers Hope for US Troops Deployed Overseas

Antex Biologics Inc. has announced that it has completed the required laboratory analysis for its Phase I human infection. The results of the trial demonstrate that the vaccine is well tolerated, and no serious adverse events were reported. The trial was carried out at the Johns Hopkins University Vaccine Testing Unit in Baltimore, and was designed to test the safety of the vaccine and to generate initial immunogenicity data. The vaccine was developed using the company's proprietary Nutriment Signal Transduction (NST) technology.

The Phase I trial was funded under a US Army contract. The US Army's interest in a *Shigella* vaccine

is to protect its troops deployed in endemic regions overseas, such as the Middle East. The *Shigella* vaccine is one of three components of the company's combination ACTIVAX vaccine to prevent diseases caused by the consumption of contaminated food and water. ACTIVAX is a multi-component vaccine designed to prevent and eradicate travelers' diseases caused by *Shigella*, *Campylobacter jejuni* and enterotoxigenic *E. coli* (ETEC) bacteria. The company is also developing each of the three vaccine components as potential individual pathogen-specific vaccines.

The *Shigella* trial consisted of three groups of subjects treated with two different dosing regimens of the vaccine and a placebo. Preliminary serological data indicated that the vaccine elicited IgA and IgG antibodies, the primary immunogenicity endpoints of the trial, specifically against Lipopolysaccharide or LPS, the bacteria's dominant immunogen. "We are extremely excited about the results of this trial. We have now taken all three of the ACTIVAX components into human trials and have gathered safety and immunogencity data sufficient to proceed into clinical trials with the combination vaccine," said Dr. Alan Liss, Antex's vice president of product development.

Diseases caused by the consumption of contaminated food and water are the most prevalent illnesses afflicting travelers and are serious problems for military troops deployed overseas. Enteric bacteria, including *Campylobacter*, *Shigella* and ETEC, are the leading causes of these diseases, which can include gastritis, acute diarrhea, high fever, dehydration, severe dysentery and often death. There are currently no vaccines on the market for travelers' diseases, which are responsible for more than three million deaths a year worldwide.

Campylobacter is the number one foodborne pathogen in the US International public health officials estimate that it causes 400 to 500 million cases of diarrhea worldwide each year. ETEC is estimated to cause more than 600 million cases of mild to severe diarrhea annually. *Shigella* is estimated to add more than 200 million cases annually worldwide and is an unusually virulent bacterium that causes endemic or epidemic dysentery and often death. Together, these bacteria are responsible for more than one billion cases of travelers' diseases each year. Infections occur most frequently in overcrowded areas with poor sanitation and sub-standard hygiene, and can be transmitted through person-to-person contact and through contaminated food and unsafe water supplies. There are no vaccines on the market against travelers' diseases.

Salmonella Enteritidis in Eggs Imported to Norway

Norway (like Finland and Sweden) has a very low level of *Salmonella* in domestic foodstuffs and animals. Therefore, strict guarantees in regard to *Salmonella* are required for foodstuff consignments to these countries. Foodstuffs subject to additional guarantees are fresh beef, veal, pork and poultry meat, and raw shell eggs for human consumption. *Salmonella enterica* serotype Enteritidis, which is the most common serotype found in poultry in most countries, has never been detected in Norwegian poultry production.

Shell eggs for human consumption are infrequently imported into Norway, since most of the demand is met by domestic egg production. At times when egg business operators need additional supplies, eggs are mainly imported from Finland and Sweden. Due to exceptional circumstances over the last few months, eggs were imported from the Netherlands and Germany in October and November. Eggs from Germany were intended for production of egg products so the requirement of an additional guarantee did not apply. Eggs from the Netherlands were sold as fresh shell eggs directly to consumers.

Salmonella Enteritidis phage type (PT) 8 was isolated from the eggs imported from Germany and *S.* Enteritidis PT 4 in the two lots from the Netherlands. Since the eggs from the Netherlands were sold directly to consumers, these were withdrawn from the market, and further distribution of the lots was banned by the Statens naeringsmiddeltilsyn (Norwegian Food Control Authority) on November 19, by which time many had already been consumed.

A warning was issued and people who had already bought eggs from these lots were asked to return them either to shops or local food control authorities for destruction. So far, an increase in domestic cases of *S.* Enteritidis has not been apparent. The situation is being monitored closely.

Butchers Prove They are Up to the Job

Food safety standards in Scotland's butchers' shops have clearly improved since the *E. coli* O157 outbreak of 1996, although a report recently published reveals some lessons have still to be learned. Commissioned by the Food Standards Agency Scotland, the report was independently conducted by Dr. J. Verner Wheelock. Its findings put forward several recommendations on lessons needing to be learned by

government regulators after studying the impact of Butchers' Shop Licensing Regulations implemented in October 2000.

Dr. Wheelock's findings are based on interviews with relevant officials in all of Scotland's 32 local authorities, visits to 198 butchers' shops throughout the country and the views of 1,893 meat consumers.

Piggy Wiggly and Dick's Supermarkets to Sell Surebeam® Processed Fresh Ground Beef throughout Wisconsin, Northern Illinois

SureBeam Corporation has announced that consumers can now buy SureBeam processed fresh ground beef at Fresh Brands, Inc. supermarkets throughout Wisconsin and northern Illinois. With 101 stores operating as Piggly Wiggly and Dick's Supermarkets, Fresh Brands, Inc., begins offering case-ready fresh ground beef processed with SureBeam Corporation's revolutionary electron beam technology, a process that uses ordinary electricity to safely eliminate the threat of dangerous bacteria from food products.

"By offering SureBeam processed fresh ground beef, Fresh Brands continues its tradition of providing a quality product to its customers. Consumers can now be assured that the product they purchase also provides them with an added measure of safety in addition to giving them great tasting ground beef," said Michael Houser, vice chairman and executive vice president/chief marketing officer of Fresh Brands, Inc. Piggly Wiggly and Dick's Supermarkets are selling SureBeam processed fresh ground beef products in one-pound case-ready packages of 93-percent and 85-percent lean.

"I'm pleased to have Fresh Brands join the growing list of leading supermarkets selling SureBeam processed ground beef. By offering SureBeam processed ground beef, Fresh Brands continues to define the Piggly Wiggly and Dick's Supermarkets as quality brands," stated Larry Oberkfell, SureBeam chairman, president and CEO.

Similar to a microwave oven, SureBeam technology uses electricity as an energy source to irradiate harmful bacteria such as *E. coli*, *Listeria*, and *Salmonella*. The SureBeam patented system is based on proven electron beam technology that destroys dangerous bacteria, much like thermal pasteurization does to milk.

Fresh Brands entry into the market brings to over 1,200 the total number of stores in the Midwest, Northeast and Mid-Atlantic States offering SureBeam processed fresh ground beef. This is in addition to the thousands of supermarkets providing SureBeam processed frozen hamburger patties, which are also provided through home delivery, direct mail and food service.

Fresh Brands, Inc. is a supermarket retailer and grocery wholesaler through corporate-owned retail, franchised and independent supermarkets. The corporate-owned and franchised retail supermarkets currently operate under the Piggly Wiggly and Dick's Supermarkets brands. Fresh Brands currently has 74-franchised Piggly Wiggly supermarkets, 27 corporate-owned Piggly Wiggly and Dick's Supermarkets, two distribution centers and a centralized bakery/deli production facility. The company controls nearly one billion dollars in retail grocery sales. Stores are located throughout Wisconsin and northern Illinois.

Meat Hygiene Service Audited

The Food Standards Agency of the United Kingdom has published the annual results of audits carried out into the performance of the Meat Hygiene Service's (MHS) hygiene and inspection teams at licensed plants. The report recognizes areas where the MHS performed well, particularly the enforcement of measures designed to protect the public from the risk of BSE, such as the removal of specified risk material.

However, it also reveals a marked difference in the performance of some of the MHS plant-based teams. MHS response to the FSA report on the audit of the Meat Hygiene Service.

Full report available at http://www.food.gov.uk/news/newsarchive/102434.

Food Bacteria Mutations Can be Controlled

The appropriate use of sanitizers and antimicrobial food preservatives is a simple method to control food-borne pathogens without concern

for creating "super" bugs — microorganisms resistant to antimicrobial treatment. This, according to the not-for-profit, international scientific society Institute of Food Technologists and its forthcoming Scientific Status Summary, Resistance and Adaptation to Food Antimicrobials, Sanitizers, and Other Process Controls.

According to the report published in the November issue of IFT's *Food Technology* magazine, there is no evidence that proper use of antimicrobial agents in food manufacturing settings will lead to the development of resistant microorganisms.

Acknowledging that data addressing the creation of antimicrobial-resistant pathogens are scarce, the report calls for increasing studies of the conditions that exist within and on food production and processing lines.

"In the laboratory, it's been proven beyond a shadow of a doubt that organisms can develop tolerances when improperly exposed to sanitizers or antimicrobials. More study is needed in realistic settings, such as model food processing lines," said P. Michael Davidson, IFT member, professor at the University of Tennessee, and co-author of the summary.

There is the potential for emergence of resistant microorganisms with an ever-increasing reliance on and use of sanitizers on food handling equipment and raw food products, the report states. However, it does not predict any public health problems resulting from microorganisms that develop resistance to current antimicrobial applications in food manufacturing.

"There's no indication of an increase in the incidence of resistant organisms on food products, after applying preservatives, sanitizers or antimicrobial agents," Davidson says. Simple methods for overcoming the potential for development of antimicrobial resistance by pathogens in food manufacturing settings include the appropriate use of antimicrobial agents, avoidance of sub-lethal concentrations of antimicrobial agents, and the appropriate use of combinations of antimicrobials, the report concludes.

First Guidance Report for Industry on Product Recall and Traceability

The Food Safety Authority of Ireland (FSAI), in conjunction with the Food and Drink Federation (IBEC) has published the first Guidance Note on Product Recall and Traceability, to supply industry with a step by step strategy in dealing with traceability and the process of recalling products.

The Guidance Note was developed as a result of direct request from industry through IBEC for more information and clarification of the procedures for the identification and removal of unsafe foodstuffs from the food chain. The regulatory agencies and the food industry have worked together to produce the Guidance Note in order to protect consumer health, business's reputations and brand names.

According to Dr. Patrick Wall, chief executive, FSAI, this Guidance Note will help businesses operating in the food industry ensure that traceability and recall systems are fundamental components of their food safety management system.

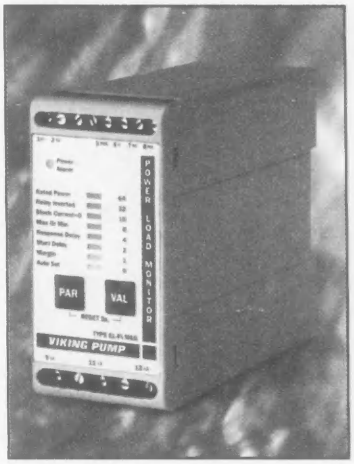
"Even within the best managed food businesses, an issue involving the safety of a foodstuff may occur. This may be as a result of a packaging defect, a preservation failure, a production or storage problem or a problem with the ingredients of a foodstuff. It is imperative that food businesses can identify a unique batch of product and the raw materials used in its production and follow that batch through the production and distribution process to the customer," said Dr. Wall.

The report outlines the role of the regulatory authorities and the food industry and the actions to take when an unsafe food must be removed from the market. Standards for recall notices are included in the document as well as guidelines for media communication. Consumers have to be confident that food businesses put consumers' health before any other consideration. When an untoward event occurs, damage to brand names and business reputations can be minimized if the public can see industry taking action rapidly to ensure their customers' health is protected.

"Good traceability can mean that a problem can be pinpointed to one batch of product or one day's production. The alternative is that all output from the business comes under suspicion necessitating recall of all products and closure of the business pending ongoing investigations to identify an explanation for the contamination incident," concluded Dr. Wall.

According to Mr. Ciaran Fitzgerald, director of the Food & Drink Federation, IBEC healthy consumers and consumer confidence are ingredients for profitable businesses and IBEC is happy to work in partnership with the regulatory agencies in the development and implementation of high standards. "Traceability is important if industry is to be sure that best practices have been applied in the production and processing of ingredients and products. It is also vital to be able to look both forward

INDUSTRY PRODUCTS



Viking Pump Inc.

Viking's New Power Load Monitor Offers Pump System Protection

Viking Pump has introduced the power load monitor, which can protect any motor-driven pump and pump system from either overload or underload conditions created by overpressure, cavitation, empty tank or other problems. Suitable for both new installations and for upgrading existing units, the new power load monitor helps prevent downtime and reduce maintenance costs caused by pump and system problems. It provides high levels of accuracy and reliability, as well as simple installation.

By monitoring both voltage and power, Viking's power load monitor measures the normal working load, then calculates and sets an automatic shutdown point for detected power changes. The load limit margin is adjustable to prevent unintentional stoppage.

To calculate the load, the monitor utilizes the pump's electrical motor as a sensor, measuring pump motor input power and calculating power loss using an advanced algorithm. This unique measurement method is more reliable than conventional monitoring methods. The power load monitor can handle single- or three-phase motors up to 50 full load amps, at voltages up to 690 VAC, 50 or 60 Hz.

Viking Pump Inc., Cedar Falls, IA

READER SERVICE NO. 235

Russell Finex Introduces Its New Horizontal Eco Self-Cleaning Filter

Russell Finex has introduced a new horizontal filter which offers even easier operation and maintenance along with the same high operating performance in terms of improved product quality, increased capacity and reduced maintenance costs as the award winning eco self cleaning filter.

This improvement has been made to meet the needs of today's ever-increasing health and safety regulations placed on industries as diverse as industrial liquid coatings to food products.

The major benefit of the filter is the ability to dismantle and re-assemble the machine for screen change, product change-over and cleaning by one person without the need for tools. The end cap has the option of being fitted with a support arm and hinge arrangement which is held captive on the machine. This means that the operator does not have to bear the weight of the end cap during strip down. Furthermore, the two-valve automatic discharge system can now be added without the need for any additional mechanical support for disassembly.

What sets the horizontal filter apart from other filters is the unique SprioKlene assembly which provides continuous cleaning of the entire inner surface of the screen. The spiral positively drives oversize away from the filtration area, maintaining consistent flow rates while keeping the differential pressure low. This unique feature allows the filter to be used both horizontally as well as vertically.

Horizontal filters produce substantial savings in operating costs compared to designs with disposable bags and cartridge filters. These incur high costs in terms of media replacement and disposal, product loss and down-time. The re-usable Russell filter elements are continuously wiped clean and therefore strip downs are infrequent. Product line change-overs can be effected with minimum delay, resulting in a significant saving in downtime.

In conventional filters, waste solids can build up quite quickly in the discharge section. This necessitates frequent dismantling for cleaning, resulting in product loss and wasted processing time. Russell's solution is the discharge cone agitator, designed specifically to overcome the problems associated with sticky oversize. The agitator enables you to run the system for longer periods without a strip down.

As an option, the body of a unit can be supplied jacketed allowing heated water, oil or steam to circulate around it. This helps to maintain a constant temperature for the product and prevents it solidifying. The support swing arm allows permanent connection to a heating supply to all parts of the filter unit for ease of disassembly.

The units are totally enclosed to protect the product from airborne and other contamination and operator exposure to the product is minimal.

The eco filter group has been designed to solve some of the problems inherent with processing a wide variety of products including all types of paints, inks, resins, glues, dispersions, liquid chocolate, emulsions, suspensions, coatings, water filtration and many other applications.

Russell Finex Inc., Pineville, NC

READER SERVICE NO. 236

Cold Cathode UV Germicidal Lamps for Air and Water Purification Systems by Gilway Technical Lamp

A line of cold cathode UV fluorescent lamps that provide optimum design flexibility by not requiring ballasts and, unlike filters, are unaffected by pathogen particle size have been introduced by Gilway Technical Lamp of Woburn, MA.

Gilway Cold Cathode UV Fluorescent Lamps feature spectral distributions of 300 nm to 400 nm with a peak wavelength of 350 nm and 200 nm to 300 nm with a peak wavelength of 254 nm. Suitable for a wide variety of air and water purification applications, these compact, long-life lamps start instantly and operate from 5 or

Gilway Technical Lamp

12VDC inverters rather than requiring ballasts.

Providing uniform linear illumination and life ratings >10,000 hours, Gilway Cold Cathode UV Fluorescent Lamps come in 30 mm up to 250 mm lengths that are <3.0 mm dia.

An ozone free version and a bright white version with special phosphors that enhance visible illumination to 26,000 cd/m^2 levels and draws only 5 mA are offered.

Gilway Technical Lamp, Woburn, MA

READER SERVICE NO. 237

First Ever Simultaneous *Listeria* spp./ *Salmonella* spp. Test Launched by Matrix MicroScience Ltd.

Matrix MicroScience Ltd. has announced the launch of a unique rapid detection and positive identification system, which simultaneously tests for *Listeria* spp. and *Salmonella* spp. contamination in food samples. Previously, tests for each pathogen have had to be conducted separately.

Giving completed test results in just 40 hours, the new Pathatrix Dual test, has received AOAC* RI validation after an extensive evaluation process at Campden & Chorleywood Food Research Association (CCFRA). Matrix's Pathatrix system has also received AOAC accreditation for the individual testing of *E. coli* O157, *Listeria* spp. and *Salmonella* spp.

As a result of the dual test, laboratories will no longer have to conduct two separate tests, weigh both sets of samples or prepare two sets of selective media.

"Potentially, laboratories testing for both pathogens could double productivity by this breakthrough allowing laboratories to simultaneously test for *Listeria* and *Salmonella* contamination in food, bringing potentially massive benefits for throughput and efficiency. Reducing the labor involved in media preparation and weighing. The single sample requires no chemicals, simply buffered peptone water and the process achieves significant savings in terms of both equipment and consumables," said Dr. Adrian Parton, managing director of Matrix MicroScience.

Utilizing a proven technology, Pathatrix requires less than two minutes hands-on time per test. Viable cultures are produced during the test allowing full and detailed analysis of any positive results.

A standard 25g food sample is homogenized with 225ml of growth media in a stomacher and is incubated overnight. Pathatrix capture reagent, which consists of antibody-coated magnetic particles specific to the target pathogen, are then added directly to the sample. The sample is loaded onto the Pathatrix workstation using a Matrix proprietary consumable pack, connecting the sample to the circulatory system in preparation for the Capture-Culture step.

Once loaded, the Pathatrix workstation is pre-programmed to run for 30 minutes at the desired incubation temperature. Upon completion of the

run, the target microorganisms are bound onto the phase by the capture reagent. Residual debris and non-specific binding are removed during a single wash step.

The capture phase is disconnected from the system and the capture reagent/pathogen complexes are eluted by washing the phase into a vessel. The captured pathogen complexes are then concentrated into a small volume. i.e., 200ul using a magnetic rack. The sample can be plated directly onto selective media and incubated overnight for visualization the following morning.

In the case of the new dual test, the single sample is simply split over two plates, each containing the appropriate media for the target pathogen.

The standard Pathatrix test enables colonies to be viewed within 40 hours from point of sample without the interference from other non-target organisms that are seen in conventional tests.

Matrix MicroScience Ltd., Newmarket, United Kingdom

READER SERVICE NO. 238

Bio-Solutions Brings Waste Treatment Services to Maryland

Bio-Solutions is one of the latest franchises opening around the country that specializes in the bio-remediation of waste, such as grease and sewage. The company maintains grease traps and drain lines for restaurants, hospitals, nursing homes, schools, and other food establishments. Bio-Solutions of Maryland also specializes in servicing sewage pump stations, sewer lines, digesters, and clarifiers, to name a few, at the wastewater treatment plants for municipalities.

"Grease causes about 40% of the blockages in sewer lines and pump stations, which results in sewage overflowing out of manholes and pump stations, which is devastating to the environment," said Kevin Whitmore, vice president of Bio-Solutions of Maryland. "One of the leading factors for getting involved with Bio-Solutions was that this bio service would be an extremely valuable service in Maryland, because of the Chesapeake Bay and its treasured watershed."

The Bio-Solutions products and services provide customers a multitude of benefits including: (1) In most cases the entire Bio-Solutions service equals the monthly cost of having grease traps pumped; (2) The Bio-Solutions products digest grease 24/7, which means the grease is not sitting in a grease trap and creating an odor; (3) The Bio-Solutions service also treats the inside drain lines which is a main source of odor and the breeding area for fruit flies and drain moths; and (4) The product eliminates grease at its source — thus it is not passed into the sewage system and it helps to maintain the lines past the grease trap.

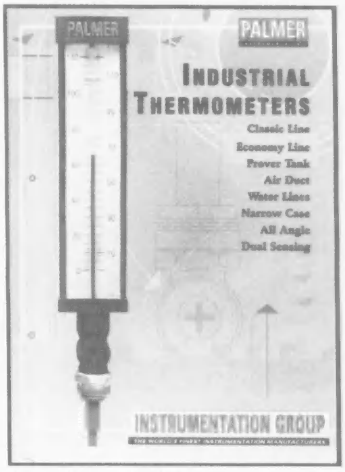
Grease is not a welcomed substance — whether it is in the grease trap, sewage lines or trucked to a treatment plant. "Bio-Solutions is simple — digest the grease at the source, reduce to a liquid fertilizer and it will not harm the environment," added Daly.

Bio-Solutions, Baltimore, MD

READER SERVICE NO. 239

Palmer Industrial Thermometers Catalog from the Instrumentation Group

Palmer Instruments Inc. has introduced its new full color catalog of industrial thermometers. Palmer industrial thermometers set industry standards for accuracy, quality, and rugged operation.



Palmer Instruments Inc.

This newest catalog introduces Palmers new line of sky blue economy industrial thermometers. Sky Blue's are affordable, mercury-free, and environmentally safe industrials with lead free glass, perfect for HVAC and building construction applications. Available in 3-1/2 inch and 6 inch stem lengths in temperature ranges 300°F (149°C). Additionally, Palmer offers a wide range of "Red Reading" mercury filled economy industrials with stem lengths to 12 inches and a full selection for fahrenheit or dual temperature ranges. All of Palmer's economy industrial thermometers are easy to read and offer flex angle adjustment, allowing for any required viewing angle.

Also featured are Palmer's classic industrial thermometers. With looks that match performance, these classic thermometers are designed and constructed for long-term industrial process service. Many classic mercury thermometers are also available in non-mercury, or red spirit fill.

In addition, for those interested in thermometers designed for the specialized task of air or gas temperature measurement, this catalog presents Palmer's air duct thermometers,

for maximum sensitivity to change provided by the perforated stem design and protected thermometer bulb. Narrow case industrial thermometers for water lines and air ducts offer the same high quality materials with space-saving size.

For versatile solutions Palmer offers all angle industrial thermometers. One thermometer can be "definitely" adjusted to most any angle, greatly simplifying engineering and purchasing operations and aiding in minimum process down time.

Palmer Instruments Inc., Asheville, NC

READER SERVICE NO. 240

Anderol's Food Grade Lubricants Provide Brand Insurance

Food processors can now effectively achieve HACCP (Hazard Analysis Critical Control Point protocol) food safety goals with Anderol's synthetic and PQ(r) white-oil based food grade lubricants. Anderol's proprietary chemistry is comparable to the performance of non-food grade, premium lubricants. Its safety and quality standards meet both FDA 21 CFR 178.3570 and NSF standards along with other worldwide requirements, helping to protect and secure brand integrity.

"The food industry is a safe and profitable manufacturing business experiencing increased government and public awareness. Employing high-performing food grade lubricants, such as Anderol's synthetics and PQ series, is similar to purchasing brand insurance. Essentially this protects our customers' brand as it relates to the consumers' perception of quality, safety and value," says Garrett M. Grega, global marketing manager for Anderol.

Extreme pressure tests show both PQ white-oil based and Anderol synthetic PAO-based food-grade lubricants perform as well as non H-1 approved lubricants at high and low temperature ranges, lessening the disparity of food grade industrial lubricants. The superior performance of both types of food lubricants are attributed to state-of-the-art additive packages addressing good water washout and steam resistance, excellent anti-wear properties, and rust and oxidation resistance. These features keep equipment operating at peak performance with extended drain cycles. In addition, these lubricants exhibit excellent wear and load-carrying abilities while reducing downtime and insuring food safety.

Anderol, East Hanover, NJ

READER SERVICE NO. 241

In Memory

Clarence K. Luchterhand, 88, died Saturday, December 7, 2002, at the St. Mary's Health Care Center in Madison, Wisconsin.

Clarence was an icon of the national dairy sanitation program. He began his lengthy career with the Carnation Milk Company, and for a short time worked as a dairy inspector for the Wisconsin Department of Agriculture. He was soon appointed to the position of milk sanitarian with the Wisconsin State Board of Health. As a milk sanitarian, Clarence worked tirelessly at the local, state, and national levels to improve and promote milk safety practices. His early efforts in the 1940s and '50s did much to lower the incidence of milk borne outbreaks, especially scarlet fever. He was instrumental in the development of the National Conference on Interstate Milk Shipments (NCIMS), a cooperative effort between states which eventually led to a national grade A milk program. Today the NCIMS is recognized as a model regulatory program and one that has been essential for the continued safety and quality of our nation's dairy products. Clarence implemented the Grade A milk program in Wisconsin and managed that program until his retirement in 1984.

Throughout his career Clarence volunteered his knowledge and applied his leadership skills with many professional associations. He served as President of the Wisconsin Association of Milk and Food Sanitarians (WAMFS) in 1947 and later served as President of the Wisconsin Environmental Health Association (WEHA). Among the many professional honors bestowed upon him were the WAMFS Sanitarian of the Year Award (1964) and the WEHA Sanitarian of the Year Award (1971).

Clarence was an active member of IAFP and had many personal friends within the Association. As an IAFP member, he served on the past Budget and Audit Committee and on numerous award committees. He was a member of the Sanitary Procedures Committee for 15 years and served as its chairman for two of those years. In 1974, Clarence received the distinguished IAFP Sanitarian of the Year Award, and in 1985 he was honored with the IAFP Lifetime Membership Award.

Although the recipient of many awards, Clarence praised all those who worked around him, and would always express his gratitude for all the people who made his career so successful. After his retirement from public health, Clarence continued to serve his community with the Elks Lodge, Eagles Club, Kiwanis, the Red Cross and his local church, where he taught Sunday school for many years. He is survived by his wife of 64 years, Ellen, his children and his many grandchildren and great-grandchildren.

LAFP 2003 Proposed Symposia

Aquaculture: Microbial Safety and Quality Issues

Bacterial Stress Response to Intervention Technologies

Campylobacter: A Pathogen in Need of Resolution

Cost of Food Safety

Current Issues in Food Toxicology

Dairy Regulations (Global Harmonization)

Detection Methods for Foodborne Pathogens

Emerging Issues in Water Quality

Food Allergen Control

Food on the Move

Food Plant Microbial Ecology

Food Safety Objectives, Microcriteria and Performance Standards

Food Worker Hygiene Management

Global Update on Trends in the Food Safety Regulatory Structures

Impact of Bioinformatics on Food Microbiology

Intervention Strategies for Ready to Eat Meats

Investigation Techniques in an Age of Biosecurity

Natural Antimicrobials

Recent Foodborne Outbreaks

Recipe for Food Safety at Retail

Risk Assessment in the Fresh Produce Industry

Risk Communication

Safety-based Shelf-life Dating

Spoilage and Pathogenic Fungi and Yeasts

USDA Perspectives on Food Safety

Virulence of Pathogens of Regulatory Control

Visit our Web site for updated information.

www.foodprotection.org

Event Information

EVENING TOURS

MONDAY NIGHT SOCIAL AT MARDI GRAS WORLD – *Sponsored by IGEN International, Inc.*

Monday, August 11, 2003 • 6:30 p.m. – 10:00 p.m.

Fred Flinstone awaits. So do Rhett Butler, Wonder Woman, King Kong, Hulk Hogan and Marilyn Monroe. They're standing around a wondrous warehouse filled with Mardi Gras floats, giant disembodied heads and larger-than-life creatures such as Medusa and Poseidon.

Coming upon them at Blaine Kern's Mardi Gras World is like walking into a giant toy box of doll parts. What visitors are actually seeing are bits and pieces of Mardi Gras floats (and some complete ones), movie-set pieces and sculpted characters made for Walt Disney World attractions and other festive occasions.

Blaine Kern, known in New Orleans as "Mr. Mardi Gras," started the company Blaine Kern Artists in 1947 and opened Mardi Gras World to the public in 1984. Now, 150,000 people tour the studio every year.

Even those who never plan to go to the real Mardi Gras would probably like visiting Mardi Gras World. After all, how often do you get to see Spiderman, Marilyn, Scarlett and Rhett all in the same room? The night will be filled with food, entertainment, and fun! This is a Monday Night Social you will not want to miss.

CREOLE QUEEN DINNER & JAZZ CRUISE

Tuesday, August 12, 2003
7:00 p.m. – 8:00 p.m. Boarding
8:00 p.m. – 10:00 p.m. Cruising with Dinner

Constructed at Moss Point, Mississippi, the Paddle-wheeler Creole Queen took her maiden voyage on October 1, 1983. She is an authentic paddle-wheeler powered by a 24-foot diameter paddlewheel. You will experience the finest in Southern hospitality as you board the Creole Queen for a leisurely and fun trip down the Mississippi. The sounds of Dixieland fill the air as you step aboard for an adventure back in time. Relive the era when cotton was king while enjoying a lavish Creole buffet. A cruise on the Mississippi is pure New Orleans and pure pleasure! Your ticket purchase benefits the IAFP Foundation Fund.

IAFP FUNCTIONS

NEW MEMBER RECEPTION

Saturday, August 9, 2003 • 4:30 p.m. – 5:30 p.m.

If you recently joined the Association or if this is your first time attending an IAFP Annual Meeting, welcome! Attend this informal reception to learn how to get the most out of attending the Meeting and meet some of today's leaders.

AFFILIATE RECEPTION

Saturday, August 9, 2003 • 5:30 p.m. – 7:00 p.m.

Affiliate officers and delegates plan to arrive in time to participate in this educational reception. Watch your mail for additional details.

COMMITTEE MEETINGS

Sunday, August 10, 2003 • 7:00 a.m. – 5:00 p.m.

Committees and Professional Development Groups (PDGs) plan, develop and institute many of the Association's projects, including workshops, publications, and educational sessions. Share your expertise by volunteering to serve on any number of committees or PDGs.

STUDENT LUNCHEON

Sunday, August 10, 2003 • 12:00 p.m. – 1:30 p.m.

The mission of the Student PDG is to provide students of food safety with a platform to enrich their experience as Members of IAFP. Sign up for the luncheon to help start building your professional network.

IAFP JOB FAIR

Sunday, August 10 through Wednesday August 13, 3002

Employers, take advantage of recruiting the top food scientists in the world! Post your job announcements and interview candidates. Watch for additional information at www.foodprotection.org.

DAYTIME TOURS

NEW ORLEANS SUPER CITY TOUR

Sunday, August 10, 2003 • 9:00 a.m. – 2:00 p.m.

See the landmarks and architecture and listen to the legends and charm that make New Orleans famous! Three hundred years of entertaining history about "America's Most Interesting City" make this tour a visitor's favorite. The tour will begin with Jackson Square, continue along Esplanade Avenue with its splendid architecture, and then on to the "Cities of the Dead" where you'll learn about a most unusual burial system. City Park, Lake Pontchartrain, the New Orleans Yacht Club, the oldest in the US and the Causeway, the longest bridge in the world are next on the agenda. Traveling along the line of the famous St. Charles Avenue Streetcar, the tour will pass Tulane and Loyola Universities and Audubon Park. Better known as "Millionaire's Row", St. Charles Avenue boasts stately mansions and lush tropical gardens. While uptown, enjoy a traditional New Orleans jazz brunch at Dominique's. The tour will brush the edges of the warehouse and business districts enroute back to the Hilton New Orleans Riverside. When this tour draws to an end, guests will have a much deeper understanding of New Orleans and its fascinating history.

SWAMP & BAYOU TOUR

Monday, August 11, 2003 • 9:00 a.m. – 1:00 p.m.

Along with the wondrous alligator, visit a few other Louisiana swamp friends. How about a beautiful ivory white egret (related to the crane) perched on a moss-draped cypress tree searching for an ill-fated catfish? Or a curious raccoon along the bayou's edge gathering his lunch of crawfish while a Louisiana snapping turtle watches him from atop a fallen willow tree? Or a Cajun hunter's cabin with an alligator sunbathing on his weather-beaten wharf? All this and much more will accompany your adventure into the pristine bayous and swamps of Southern Louisiana. Your guide will entertain you with Cajun folklore and Cajun Zydeco music as he skillfully guides your climate-controlled swamp boat beneath the beautiful foliage draped mysteriously across your path. He will bring you into hidden coves which you probably only thought existed on the Discovery Channel. Enjoy lunch in the Gator Den Cafe before leaving Cajun country.

RIVER ROAD PLANTATION TOUR

Tuesday, August 12, 2003
9:00 a.m. – 4:00 p.m.

Sit back, relax and enjoy a delightful journey along the River Road, back in time to an era when sugar was king and a massive plantation was a sugar planter's kingdom! A native tour guide will point out sites and tell tales of the bygone antebellum period on the excursion to two magnificent plantations, Oak Alley and San Francisco. Oak Alley is named for the dramatic double row of live oaks interlaced to form a beautiful canopy leading three hundred yards from River Road to the mansion. It is considered to be one of the finest remaining examples of adaptive restoration. Nowhere else in the Mississippi Valley is there such a spectacular setting! Enjoy a luncheon buffet on the grounds before continuing along River Road to bright and colorful San Francisco Plantation. Originally named for its builder, Marmillion, it was renamed as a derivation of the French Slang "sans fruscins" — "without a penny in my pocket," in reference to its high cost to build. Gingerbread galleries and extensive ornamentation mark the exterior while San Francisco's interior is ornate, boasting handcarved woodwork, ceiling paintings, frescos and beveled glass. A tour you will be sure to remember.

NEW ORLEANS SCHOOL OF COOKING

Wednesday, August 13, 2003 • 9:30 a.m. – 1:00 p.m.

Join in the fun in the comfortable atmosphere of a Louisiana homestyle kitchen to learn the secrets of authentic Creole cooking. The City That Care Forgot never forgets about its food, and you will never forget it either. In just three hours, you'll learn to recreate the magic of New Orleans in your own kitchen. Founded in 1980, the cooks at The New Orleans School of Cooking demonstrate basic Creole recipes and share their favorite tips while the rich, spicy aromas float through the air.

HOSPITALITY ROOM

SPOUSE/COMPANION ROOM

Register your spouse/companion and they will have access to the hospitality room where a continental breakfast and afternoon snacks are provided Sunday through Wednesday.

IMPORTANT! Please read this information before completing your registration form.

MEETING INFORMATION

Register to attend the world's leading food safety conference.

Registration includes:

- Technical Sessions
- Symposia
- Poster Presentations
- Ivan Parkin Lecture
- Exhibit Hall Admittance
- Cheese and Wine Reception
- Exhibit Hall Reception
- Program and Abstract Book

4 EASY WAYS TO REGISTER

Complete the Attendee Registration Form and submit it to the International Association for Food Protection by:

Online: www.foodprotection.org

Fax: 515.276.8655

Mail: 6200 Aurora Avenue, Suite 200W, Des Moines, IA 50322-2864, USA

Phone: 800.369.6337; 515.276.3344

The early registration deadline is July 9, 2003. After this date, late registration fees are in effect.

International Association for Food Protection®

REFUND/CANCELLATION POLICY

Registration fees, less a $50 administration fee and any applicable bank charges, will be refunded for written cancellations received by July 25, 2003. No refunds will be made after July 25, 2003; however, the registration may be transferred to a colleague with written notification. Refunds will be processed after August 18, 2003. Event and tour tickets purchased are nonrefundable.

EXHIBIT HOURS

Sunday, August 10, 2003	8:00 p.m. – 10:00 p.m.
Monday, August 11, 2003	9:30 a.m. – 1:30 p.m. 3:00 p.m. – 6:30 p.m.
Tuesday, August 12, 2003	9:30 a.m. – 1:30 p.m.

DAYTIME TOURS

(Lunch included in all daytime tours)

Sunday, August 10, 2003	
New Orleans Super City Tour	9:00 a.m. – 2:00 p.m.
Monday, August 11, 2003	
A Swamp Tour Experience	9:00 a.m. – 1:00 p.m.
Tuesday, August 12, 2003	
River Road Plantation Tour	9:00 a.m. – 4:00 p.m.
Wednesday, August 13, 2003	
New Orleans School of Cooking	9:30 a.m. – 1:00 p.m.

EVENING EVENTS

Sunday, August 10, 2003	
Opening Session	7:00 p.m. – 8:00 p.m.
Cheese and Wine Reception *Sponsored by Kraft Foods North America*	8:00 p.m. – 10:00 p.m.
Monday, August 11, 2003	
Exhibit Hall Reception *Sponsored by Qualicon Inc.*	5:00 p.m. – 6:30 p.m.
Monday Night Social at Mardi Gras World *Sponsored by IGEN International, Inc.*	6:30 p.m. – 10:00 p.m.
Tuesday, August 12, 2003	
Creole Queen Dinner and Jazz Tour Ticket sales will benefit the IAFP Foundation Fund	7:00 p.m. – 10:00 p.m.
Wednesday, August 13, 2003	
Awards Banquet Reception	6:00 p.m. – 7:00 p.m.
Awards Banquet	7:00 p.m. – 9:30 p.m.

HOTEL INFORMATION

For reservations, contact the hotel directly and identify yourself as an International Association for Food Protection Annual Meeting attendee to receive a special rate of $145/$165 per night, single/double. Make your reservations as soon as possible; this special rate is available only until July 9, 2003.

Hilton New Orleans Riverside
Two Poydras St.
New Orleans, Louisiana 70140
800.HILTONS
504.561.0500

International Association for
Food Protection®
6200 Aurora Avenue, Suite 200W
Des Moines, IA 50322-2864, USA
Phone: 800.369.6337 • 515.276.3344
Fax: 515.276.8655
E-mail: info@foodprotection.org
Web site: www.foodprotection.org

Attendee Registration Form

Name (Print or type your name as you wish it to appear on name badge) _____ Member Number: _____

Employer _____ Title _____

Mailing Address (Please specify: ❒ Home ❒ Work) _____

City _____ State/Province _____ Country _____ Postal/Zip Code _____

Telephone _____ Fax _____ E-mail _____

❒ Regarding the ADA, please attach a brief description of special requirements you may have. Member since: _____

❒ IAFP occasionally provides Attendees' addresses (excluding phone and E-mail) to vendors and exhibitors supplying products and services for the food safety industry. If you prefer NOT to be included in these lists, please check the box.

PAYMENT MUST BE RECEIVED BY JULY 9, 2003 TO AVOID LATE REGISTRATION FEES

REGISTRATION FEES:	MEMBERS	NONMEMBERS	TOTAL
Registration (Awards Banquet included)	$ 305 ($355 late)	$ 475 ($525 late)	_____
Association Student Member (Awards Banquet included)	$ 52 ($ 62 late)	Not Available	_____
Retired Association Member (Awards Banquet included)	$ 52 ($ 62 late)	Not Available	_____
One Day Registration:* ❒ Mon. ❒ Tues. ❒ Wed.	$ 170 ($195 late)	$ 235 ($260 late)	_____
Spouse/Companion* (Name): _____	$ 50 ($ 50 late)	$ 50 ($ 50 late)	_____
Children 15 & Over* (Names): _____	$ 25 ($ 25 late)	$ 25 ($ 25 late)	_____
Children 14 & Under* (Names): _____	FREE	FREE	_____
*Awards Banquet not included			

EVENTS:		# OF TICKETS	
Student Luncheon (Sunday, 8/10)	$ 5 ($ 10 late)	_____	_____
Monday Night Social at Mardi Gras World (Monday, 8/11)	$ 39 ($ 44 late)	_____	_____
Children 14 and under	$ 34 ($ 39 late)	_____	_____
Creole Queen Dinner and Jazz Tour (Tuesday, 8/12)	$ 70 ($ 75 late)	_____	_____
Awards Banquet (Wednesday, 8/13)	$ 50 ($ 55 late)	_____	_____

DAYTIME TOURS: (Lunch included in all daytime tours)			
New Orleans Super City Tour (Sunday, 8/10)	$ 69 ($ 74 late)	_____	_____
A Swamp Tour Experience (Monday, 8/11)	$ 68 ($ 73 late)	_____	_____
River Road Plantation Tour (Tuesday, 8/12)	$ 70 ($ 75 late)	_____	_____
New Orleans School of Cooking (Wednesday, 8/13)	$ 48 ($ 53 late)	_____	_____

PAYMENT OPTIONS:

❒ Check Enclosed ❒ VISA ❒ MasterCard ❒ AMERICAN EXPRESS

TOTAL AMOUNT ENCLOSED $ _____ US FUNDS on US BANK

_____ Expiration Date _____
Account Number

Name on Card _____

Signature _____

JOIN TODAY AND SAVE!!!
(Attach a completed Membership application)

EXHIBITORS DO NOT USE THIS FORM

Food Protection Trends, Vol. 23, No. 2, Pages 182-189

3-A® Sanitary Standards for Sensors and Sensor Fittings and Connections Used on Milk and Milk Products Equipment, Number 74-02

Formulated by
International Association of Food Industry Suppliers (IAFIS)
International Association for Food Protection (IAFP)
United States Public Health Service (USPHS)
The European Hygienic Equipment Design Group (EHEDG)
The Dairy Industry Committee (DIC)
United States Department of Agriculture — Dairy Programs (USDA)

It is the purpose of the IAFIS, IAFP, USPHS, EHEDG, DIC, and USDA in connection with the development of the 3-A Sanitary Standards Program to allow and encourage full freedom for inventive genius or new developments. Multiple-use rubber and rubber-like materials heretofore or hereafter developed which so differ in design, materials, and fabrication or otherwise as not to conform to the following standards but which, in the fabricator's opinion, are equivalent or better, may be submitted for the joint consideration of the IAFIS, IAFP, USPHS, EHEDG, DIC, and USDA at any time. The 3-A Sanitary Standards and 3-A Accepted Practices provide hygienic criteria applicable to equipment and systems used to produce, process, and package milk, milk products, and other perishable foods or comestible products. Standard English is the official language of 3-A Sanitary Standards and 3-A Accepted Practices.

A SCOPE

A1 These standards cover the sanitary aspects of sensors and sensor fittings and connections for equipment which contains or processes milk and milk products and on lines which convey milk and milk products.

A2 In order to conform to these 3-A Sanitary Standards, sensors and sensor fittings and connections shall comply with the following design, material, and fabrication criteria.[1]

B DEFINITIONS

B1 *Product:* Shall mean milk, milk products, and culture media.

B2 *Solutions:* Shall mean those homogeneous mixtures of chemical solute(s) and solvent used for flushing, cleaning, rinsing, and sanitizing.

B3 Surfaces

B3.1 *Product Contact Surfaces:* Shall mean all surfaces which are exposed to the product and surfaces from which liquids may drain, drop, diffuse, or be drawn into the product.

B3.2 *Nonproduct Contact Surfaces:* Shall mean all other exposed surfaces.

B4 *Sensor Fittings and Connections* (hereinafter referred to as "fittings"): Shall mean fittings and/or connections for instruments or their sensing elements that will be installed in product equipment and in sanitary pipelines for the measurement of temperature, pressure, liquid level, pH, oxidation-reduction potential (ORP), viscosity, conductivity, or composition.

B5 *Permanently Installed Fittings:* Shall mean fittings that are permanently installed in the equipment or system by welding or a method provided for in the applicable 3-A Sanitary Standards or 3-A Accepted Practices.

[1]Use current revisions or editions of all referenced documents cited herein.

B6 **Sensors**

B6.1 *pH Sensor:* Shall mean a device which is sensitive to hydrogen ion activity requiring a hydrogen ion-sensitive electrode and a reference electrode providing electrolytic contact with the product or solution.

B6.2 *Oxidation-Reduction Potential (ORP) Electrode:* Shall mean a noble metal electrode sensitive to electrochemical potential of the product or solution and a reference electrode providing electrolytic contact with the product or solution.

B6.3 *Conductivity Sensor:* Shall mean a device sensitive to resistance changes in the product or solution as a function of ionic concentration.

B6.4 *Pressure Sensor:* Shall mean a device sensitive to changes in force per unit area as exerted by the product or solution.

B6.5 *Temperature Sensor:* Shall mean a device sensitive to the degree of hotness or coldness of a product or solution.

B6.6 *Viscosity Sensor:* Shall mean a device sensitive to the flow resistance of product or solution.

B6.7 *Liquid Level Sensor:* Shall mean a device capable of measuring liquid product or solution height either directly or indirectly, or as a function of pressure (see B6.4).

B6.7.1 *Ultrasonic Level Sensor:* Shall mean a device capable of measuring liquid product or solution height using high frequency sound energy.

B6.8 *Composition Sensor:* Shall mean a device capable of measuring the chemical constituents of the product or solution.

B7 *Noble Metal(s):* Shall mean metals, such as gold, silver, platinum, and iridium which have a relatively positive electrode potential, and which do not enter readily into chemical combination with nonmetals. These materials have a high resistance to corrosive attack by acids and corrosive agents and resist atmospheric oxidation.

B8 *Bond:* Shall mean the adhesive and/or cohesive forces holding two materials together, excluding press or shrink fits.

B9 **Cleaning**

B9.1 *Mechanical Cleaning or Mechanically Cleaned:* Shall mean soil removal by impingement, circulation, or flowing chemical detergent solutions and water rinses onto and over the surfaces to be cleaned, by mechanical means in equipment specifically designed for this purpose.

B9.2 *Manual Cleaning:* Shall mean soil removal when the equipment is partially or totally disassembled. Soil removal is effected with chemical solutions and water rinses with the assistance of one or a combination of brushes, nonmetallic scouring pads and scrapers, high or low pressure hoses and tank(s) which may be fitted with recirculating pumps, and with all cleaning aids manipulated by hand.

B10 *Sanitizing or Sanitization:* Shall mean a process applied to a cleaned surface which is capable of reducing the numbers of the most resistant human pathogens by at least 5 logarithmic reductions (99.999%) by applying accumulated hot water or steam or by applying an EPA-registered sanitizer according to label directions. Sanitizing may be effected by mechanical or manual methods.

B11 *Sterilization:* Shall mean a process effected by heat, chemicals, or other mechanical means that destroys all vegetative bacteria and inactivates relevant bacterial spores.

B12 *Simple Hand Tools:* Shall mean implements normally used by operating and cleaning personnel such as a screwdriver, wrench, or hammer.

B13 *Readily or Easily Removable:* Shall mean quickly separated from the equipment with the use of simple hand tools.

B14 *Nontoxic Materials:* Shall mean those substances which under the conditions of their use are in compliance with applicable requirements of the Food, Drug, and Cosmetic Act of 1938, as amended.

B15 *Corrosion Resistant:* Shall mean the surface maintains its original surface characteristics for its predicted service period when exposed to the conditions encountered in the environment of intended use including expected contact with product and cleaning, sanitizing, or sterilization compounds or solutions.

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[2]The data for this series are contained in the *AISI Steel Products Manual, Stainless & Heat Resisting Steels*, Table 2-1. Available from the American Iron and Steel Society 186 Thorn Hill Road, Warrendale, PA 15086 (724) 776-1535.

[3]Steel Founders Society of America, Cast Metal Federation Building, 455 State Street, Des Plaines, IL 60016 (708) 299-9160.

C MATERIALS

C1 Metals

C1.1 Product contact surfaces shall be of stainless steel of the AISI 300 Series[2] or ACI types[3] (See Appendix, Section F), or metal which under conditions of intended use is at least as corrosion resistant as stainless steel of the foregoing types, and is nontoxic and nonabsorbent, except that:

C1.2 Noble metals or their oxides may be used for pH or ORP electrodes and parts having the same functional purposes and shall be nontoxic.

C2 Nonmetals

C2.1 Glass may be used in pH or ORP electrodes and, when used, shall be heat and chemical resistant. (See Section E2.)

C2.1.1 Fluids internal to the pH and ORP measuring and reference electrodes shall be nontoxic.

C2.2 Where materials having certain inherent functional purposes are required for specific application, such as ion-permeable materials on pH electrodes or reference junctions in pH or ORP sensors, or as level sensors, ceramic materials may be used. Ceramic materials shall be inert, nontoxic, insoluble, and resistant to scratching, scoring, and distortion when exposed to the conditions encountered in the environment of intended use and in cleaning and bactericidal treatment or sterilization. The ceramic materials shall be nonpermeable to microorganisms and shall have an average pore size less than 0.20 mm.

C2.3 Rubber and rubber-like materials may be used for sensor insulators, sensor holders, gaskets, diaphragms, bonded coatings and coverings, and parts having the same functional purposes.

C2.3.1 Rubber and rubber-like materials, when used for the above-specified application(s), shall conform to the 3-A Sanitary Standards for Multiple-Use Rubber and Rubber-Like Materials Used as Product Contact Surfaces in Dairy Equipment, Number 18-.

C2.4 Plastic materials may be used for sensors, sensor insulators, sensor holders, gaskets, diaphragms, bonded coatings and coverings, and parts having the same functional purposes.

C2.4.1 Plastic materials, when used, for the above-specified application(s) shall conform to the 3-A Sanitary Standards for Multiple-Use Plastic Materials Used as Product Contact Surfaces for Dairy Equipment, Number 20-.

C2.5 Ion-permeable plastic materials may also be used on pH electrodes or reference junctions in pH or ORP sensors.

C2.5.1 Plastic materials, when used for the above-specified applications, shall meet all requirements of the 3-A Sanitary Standards for Multiple-Use Plastic Materials Used as Product Contact Surfaces in Dairy Equipment, Number 20-, except for Section H2 (weight gain). The plastic materials shall be nonpermeable to microorganisms and shall have an average pore size of less than 0.20 mm.

C2.6 Rubber and rubber-like materials having product contact surfaces shall be of such composition as to retain their surface and conformational characteristics when exposed to the conditions encountered in the environment of intended use and in cleaning and bactericidal treatment or sterilization.

C2.6.1 The final bond and residual adhesive, if used, on bonded rubber and rubber-like materials and bonded plastic materials shall be nontoxic.[4]

C2.7 Materials used for transmitting pressure in diaphragm-type devices shall be nontoxic.

C3 In a processing system to be sterilized by heat and operated at a temperature of 250°F (121°C) or higher, all materials having product contact surface(s) used in the construction of instrument fittings and connections shall be such that they can be (1) sterilized by saturated steam or water under pressure (at least 15.3 psig or 106 kPa) at a temperature of at least 250°F (121°C) and (2) operated at the temperature required for processing.

C4 Nonproduct Contact Surfaces

C4.1 All nonproduct contact surfaces shall be of corrosion-resistant material or material that is rendered corrosion resistant. If coated, the coating used shall adhere. All nonproduct contact surfaces shall be relatively nonabsorbent, durable, and cleanable. Parts removable for cleaning having both product contact and nonproduct contact surfaces shall not be painted.

[4] Adhesives shall comply with 21 CFR 175 - Indirect Food Additives: Adhesives and Components of Coatings. Document for sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 (202) 512-1800.

D FABRICATION

D1 Surface Texture

D1.1 All product contact surfaces shall have a finish at least as smooth as a No. 4 ground finish on stainless steel sheets and be free of imperfections such as pits, folds, and crevices in the final fabricated form. (See Appendix, Section G.)

D2 Permanent Joints

D2.1 All permanent joints in metallic product contact surfaces shall be continuously welded and shall meet the surface texture requirements of Section D1.1, except that:

D2.1.1 In such cases where welding or the use of adhesives for joining plastic insulation materials to probe conductors or other metallic components is impractical, press-fitting may be employed. The final juncture shall be continuous, without crevices, and shall not allow liquid penetration under the conditions encountered in the environment of intended use, and in cleaning and bactericidal treatment or sterilization. (See Appendix, Section J.)

D3 Bonded Materials

D3.1 Bonded rubber and rubber-like materials and bonded plastic materials having product contact surfaces shall be bonded in a manner that the bond is continuous and mechanically sound, so that when exposed to the conditions encountered in the environment of intended use and in cleaning and bactericidal treatment or sterilization, the rubber, rubber-like, or plastic material does not separate from the base material to which it is bonded.

D4 Cleaning and Inspectibility

D4.1 Fittings that are to be mechanically cleaned shall be designed so that the product contact surfaces of the sensing device can be mechanically cleaned and all nonremoved appurtenances thereto can be mechanically cleaned and are accessible for inspection.

D4.2 Product contact surfaces not designed to be mechanically cleaned shall be easily accessible for cleaning and inspection either when in an installed position or when removed. Demountable parts shall be readily removable.

D5 Gaskets

D5.1 Gaskets having a product contact surface shall be removable or bonded.

D5.2 Grooves in gaskets shall be no deeper than their width.

D5.3 Gasket retaining grooves in product contact surfaces for removable gaskets shall not exceed 1/4 in. (6.35 mm) in depth or be less than 1/4 in. (6.35 mm) wide, except those for standard O-rings smaller than 1/4 in. (6.35 mm) and those provided for in Section D9.

D5.4 Gaskets and seals shall be exposed to cleaning solutions during mechanical cleaning.

D6 Radii

D6.1 All internal angles of less than 135° on product contact surfaces shall have radii of not less than 1/4 in. (6.35 mm) except that:

D6.1.1 Smaller radii may be used when they are required for essential functional reasons, such as those in sensing devices for high pressure gauges, viscosity sensors, ultrasonic level sensing devices, and conductivity sensors. In no case shall such radii be less than 1/32 in. (0.794 mm) except that:

D6.1.1.1 The radius at the juncture of flat sealing surfaces and at the junctures of press-fits is zero by nature of the design and description of this type of fabrication.

D6.1.2 The grooves in gaskets or gasket retaining grooves shall be not less than 1/16 in. (1.59 mm), except those for standard 1/4 in. (6.35 mm) and smaller O-rings, and those provided for in Section D9.

D6.1.3 The radii in grooves for standard 1/4 in. (6.35 mm) O-rings shall not be less than 3/32 in. (2.38 mm) and for standard 1/8 in. (3.18 mm) O-rings shall be not less than 1/32 in (0.793 mm).

D6.1.4 The minimum radii for fillets of welds in product contact surfaces shall be not less than 1/4 in. (6.35 mm) except that the minimum radii for such welds may be 1/8 in. (3.18 mm) when the thickness of one or both parts joined is less than 3/16 in. (4.76 mm).

D7 Threads

D7.1 There shall be no threads on products contact surfaces except that:

D7.1.1 Sensor probes and sensor fittings may be assembled utilizing threaded connections provided that:

D7.1.1.1 there are no exposed threads, and

D7.1.1.2 there shall be no internal cavity behind the threads, and

D7.1.1.3 the threads of such assembled fittings are sealed from product contact to prevent intrusion of product, liquids, and/or microorganisms into contact with the thread.

D7.1.2 The EDTCF shall contain data describing test results documenting compliance with D7.1.1.3.

D8 **Draining**

D8.1 All product contact surfaces shall be self-draining when properly installed, except for normal adherence.

D9 **Fittings and Connections**

D9.1 All sanitary fittings and connections shall conform to the 3-A Sanitary Standards for Sanitary Fittings for Milk and Milk Products, Number 63-.

D10 **Heat Sterilization Systems**

D10.1 Sensor fittings, connections, and gaskets, if used, in a processing system to be sterilized by heat and operated at a temperature of 250°F (121°C) or higher shall comply with the following additional criteria:

D10.1.1 The construction shall be such that all product contact surfaces can be (1) sterilized by saturated steam or water under pressure (at least 15.3 psig or 106 kPa) at a temperature of at least 250°F (121°C) and (2) operated at the temperature required for processing.

D10.1.2 Devices that have a product contact surface(s) to be used in such a processing system, not designed so that the system is automatically shut down if the product pressure in the system becomes less than that of the atmosphere and cannot be restarted until the system is re-sterilized, shall have a steam or other sterilizing medium chamber surrounding the joint at the product contact surface between the fitting and the device. The sensor fitting shall be constructed so that the steam chamber or other sterilizing medium chamber may be exposed for inspection.

D10.1.3 The connection(s) on steam or other sterilizing medium chambers for the steam or other sterilizing medium lines shall be such that the lines can be securely fastened to the connections. The lines shall be connected in a manner that they may be disconnected to allow the sterilizing medium chamber to be inspected and cleaned if necessary.

D11 **Drawings**

D11.1 Sensors, sensor fittings, and connections drawings are found in Appendix, Section L of these standards. Dimensions and the contour of these components shown on the drawings are for reference only and changes may be added if they do not affect cleanability. Sensors, sensor fittings, and connections not illustrated in these drawings shall be considered as being included in these standards provided they conform to the provisions herein and have no special requirements for fabrication and installation.

D12 **Nonproduct Contact Surfaces**

D12.1 Nonproduct contact surfaces shall be relatively free of pockets and crevices, and shall be readily cleanable. Nonproduct contact surfaces that are prone to corrosion, such as aluminum connector heads, shall be coated to resist attack by normally encountered cleaning and sanitizing solutions. Those surfaces to be coated shall be effectively prepared for coating. (See Appendix, Section I.)

D12.2 All interconnecting capillary tubes or electrical cables shall be corrosion resistant, smooth, and cleanable. If armored, the armor shall be of spiral stainless steel or plastic coated. There shall be no exposed woven armor.

D12.3 Nonproduct contact surfaces shall have provision to drain leakage of product. If the nonproduct contact surface is insulated, the leakage shall drain beyond the insulation.

E **SPECIAL CONSIDERATIONS**

The criteria for fittings and connections having special requirements for fabrication or installation will be found in the following sub-sections:

E1 Sensor spuds for tanks shall comply with the following drawings: 3-A 74-00-13, 3-A 74-00-14, or 3-A 74-00-15. (See Appendix, Section L.)

E1.1 Shall be welded flush to the inside of the tank (vessel).

E1.2 Shall be installed so that the leakage detection port, if provided, is at the lowest point.

E1.3 When the sensor capsule is in its installed position in the sensor spud, the O-ring or gasket and diaphragm shall form a crevice-free joint and shall be self-draining.

E2 When glass is used as a product contact surface in pH or ORP electrodes, the glass should be installed

in such a manner as to protect it from breakage or be provided with a cleanable sanitary protective shield or device.

APPENDIX

The Appendix of 3-A Sanitary Standards is not normative but is intended to provide guidance on material selection, fabrication criteria, cleaning procedures, and may include drawings or other pertinent information.

F **STAINLESS STEEL MATERIALS**

Stainless steel conforming to the applicable composition ranges established by AISI for wrought products, or by ACI for cast products, should be considered in compliance with the requirements of Section C1 herein. Where welding is involved, the carbon content of the stainless steel should not exceed 0.08 %. The first reference cited in C1 sets forth the chemical ranges and limits of acceptable stainless steel of the 300 Series. Cast grades of stainless steel corresponding to types 303, 304, and 316 are designated CF-16F, CF-8, and CF-8M, respectively. The chemical compositions of these cast grades are covered by ASTM[5] specifications A351/A351M, A743/A743M and A744/A744M.

G **PRODUCT CONTACT SURFACE FINISH**

Surface finish equivalent to 150 grit or better as obtained with silicon carbide, properly applied on stainless steel sheets, is considered in compliance with the requirements of Section D1 herein. A maximum R_a of 32.0 µin. (0.80 µm), when measured according to the recommendations in American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME)[6] B46.1 - *Surface Texture*, is considered to be equivalent to a No. 4 finish.

H **OPERATING RANGE**

Sensors should be labeled in a visible location with information about the conditions of use regarding maximum or minimum allowable temperature and/or pressure conditions.

I **NONPRODUCT CONTACT SURFACES**

The following design criteria are recommended for nonproduct contact surfaces:

1. Exposed threads should be minimized.
2. No exposed continuous piano-type hinges should be used on the equipment or control cabinets.
3. Electrical and utility connections should be as remote as practical from the product areas or connections.
4. Riveted appendages should not be used.
5. Name plates should be effectively sealed to the equipment. If nameplates are used, welding is preferred.
6. Caulking should be avoided.
7. Socket head cap screws should not be used.

J **PRESS-FITS**

Press-fits may be used to produce crevice-free permanent joints in metal-to-plastic product contact surfaces when welding or bonding is not practical. Press-fits may only be used to assemble parts having circular cross sections, free of shoulders or relieved areas.

The design of press-fits depends on a variety of factors. The outside diameter of the part being inserted is greater than the inside diameter of the hole and the parts are forced together by applying pressure. The pressure required is dependent primarily upon the diameter of the parts, the amount of interference, the distance the inner member is forced in, and the characteristics of the plastic material.

Materials and assembly procedures should be used which will assure that a crevice-free joint is produced.

K **ENGINEERING DESIGN AND TECHNICAL CONSTRUCTION FILE**

The following is an example of an engineering design and technical construction file (EDTCF) to be maintained by the fabricator as evidence of complying with 3-A Sanitary Standards or 3-A Accepted Practices. (The file may contain more or less information as applicable to the equipment or system.)

K1 **Purpose**

K1.1 To establish and document the material, fabrication, and installation (where appropriate) requirements for the engineering design and technical construction files for all products, assemblies, and sub-assemblies supplied by the manufacturer thereof to be in compliance with the sanitary criteria found in 3-A Sanitary Standards or 3-A Accepted Practices. It is recommended that the engineering and construction file or files be submitted with applications for 3-A Symbol use authorization.

[5] Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959. Phone: (610) 832-9500.

[6] Available from the American Society of Mechanical Engineers, 345 East 47th Street, New York, NY 10017-2392 (212) 705-7722.

K2 **Scope**

K2.1 This EDTCF applies to equipment specified by:

K2.1.1 3-A Sanitary Standards for Sensors and Sensor Fittings and Connections Used on Milk and Milk Products Equipment, Number 74-02.

K2.1.2 List all other applicable 3-A Sanitary Standards and 3-A Accepted Practices.

K3 **Responsibilities**

K3.1 This EDTCF is maintained by: The Engineering Manager (or other company official) **{name and title of responsible official}** is responsible for maintaining, publishing, and distributing this EDTCF.

K3.2 Implementation: All divisions, specifically development engineering, standards engineering, sales engineering, and product departments are responsible for implementing this EDTCF.

K4 **Applicability**

K4.1 The 3-A Sanitary Standards and 3-A Accepted Practices are voluntarily applied as suitable sanitary criteria for dairy and food processing equipment. 3-A Sanitary Standards are referenced in the Grade A Pasteurized Milk Ordinance: "Equipment manufactured in conformity with 3-A Sanitary Standards complies with the sanitary design and construction standards of this Ordinance."

K5 **References**

K5.1 List any additional regulations that apply to the equipment or system covered by this EDTCF.

K5.2 Date of conformity or 3-A Symbol Authorization and certificate number, if authorized.

K6 **Design and Technical Construction File**

K6.1 The Engineering Design and Technical Construction File may consist of the following:

a. an overall drawing of the subject equipment;
b. full detailed drawings, accompanied by any calculations, notes, test results, etc. required to check the conformity of the equipment with the 3-A Standards or 3-A Practices;
c. a list of:
    (1) the essential requirements of the standards or practices;
    (2) other technical specifications, which were used when the equipment was designed;
d. a description of methods adopted;
e. if essential, any technical report or certificate obtained from a competent testing body or laboratory;
f. any technical report giving the results of tests carried out internally by Engineering or others;
g. documentation and test reports on any research or tests on components, assemblies and/or the complete product to determine and demonstrate that by its design and construction the product is capable of being installed, put into service, and operated in a sanitary manner (optional);
h. a determination of the foreseeable lifetime of the product (optional);
i. a copy of the instructions for the product (Instruction Manuals/Instruction Books);
j. for serial manufacturing, the internal measures that will be implemented to insure that the equipment will continue to be manufactured in conformity with the provisions of the 3-A Sanitary Standards or 3-A Accepted Practices;
k. engineering reports;
l. laboratory reports;
m. bills of material;
n. wiring diagrams, if applicable;
o. sales order engineering files;
p. hazard evaluation committee reports, if executed;
q. change records;
r. customer specifications;
s. any notified body technical reports and certification tests;
t. copy of the 3-A Symbol authorization, if applicable.

K6.2 The file does not have to include detailed plans or any other specific information regarding the sub-assemblies, tooling, or fixtures used for the manufacture of the product unless a knowledge of them is essential for verification of conformity with the basic sanitary requirements found in 3-A documents.

K6.3 The documentation referred to in K6.1 above need not permanently exist in a material manner in the EDTCF, but it must be possible to assemble them and make them available within a period of time commensurate with its importance (one week is considered reasonable time). As a minimum, each product EDTCF must physically contain an index of the applicable documents of K6.1 above.

K6.4 The EDTCF may be in hard copy or software form.

K7 **Confidentiality**

K7.1 The EDTCF is the property of the manufacturer and is shown at their discretion, except that all or part of this file will be available to the 3-A Symbol Council or a regulatory agency for cause and upon request.

K8 **File Location**

K8.1 The EDTCF shall be maintained at **{location}**.

K9 **File Retention**

K9.1 The EDTCF (including all documentation referred to in K6.1) shall be retained and kept available for 12 years following the date of placing the product in use or from the last unit produced in the case of series manufacture.

L **DIAGRAMS**

These diagrams are intended to demonstrate general principles only, and are not intended to limit individual ingenuity. The design used should conform to the sanitary requirements set forth in these 3-A Sanitary Standards. The following examples are included in this Appendix:

These standards are effective November 24, 2002.

The drawings (not included) are unchanged from No. 74-01. No. 74-02 with drawings is available from: www.3-A.org.

Food Protection Trends, Vol. 23, No. 2, Pages 190-197

3-A® Sanitary Standards for Pulsation Dampening Devices, Number 82-00

Formulated by
International Association of Food Industry Suppliers (IAFIS)
International Association for Food Protection (IAFP)
United States Public Health Service (USPHS)
The Dairy Industry Committee (DIC)
United States Department of Agriculture – Dairy Programs (USDA)

It is the purpose of the IAFIS, IAFP, USPHS, DIC, and USDA in connection with the development of the 3-A Sanitary Standards Program to allow and encourage full freedom for inventive genius or new developments. Pulsation Dampening Device specifications heretofore or hereafter developed which so differ in design, materials, and fabrication or otherwise as not to conform to the following standards but which, in the fabricator's opinion, are equivalent or better, may be submitted for the joint consideration of the IAFIS, IAFP USPHS, DIC, and USDA at any time. The 3-A Sanitary Standards and 3-A Accepted Practices provide hygienic criteria applicable to equipment and systems used to produce, and package milk, milk products, and other perishable foods or comestibles. Standard English is the official language of 3-A Sanitary Standards and 3-A Accepted Practices.

A SCOPE

A1 These standards cover the sanitary requirements for pulsation dampening devices used in hygienic and aseptic processing systems for fluid dairy products and other fluid comestibles.

A2 In order to conform to these 3-A Sanitary Standards, pulsation dampening devices shall comply with the following design, material, and fabrication criteria and the applicable documents referenced herein.[1]

B DEFINITIONS

B1 *Product:* Shall mean fluid milk, fluid milk products, and other fluid comestibles.

B2 *Pulsation Dampeners:* Shall mean equipment capable of reducing or eliminating fluid pulsations and/or fluid pressure peaks.

B3 Surfaces

B3.1 *Product Contact Surfaces:* Shall mean all surfaces which are exposed to the product and surfaces from which liquids may drain, drop, diffuse, or be drawn into the product.

B3.2 *Nonproduct Contact Surfaces:* Shall mean all other exposed surfaces.

B4 Cleaning

B4.1 *Mechanical Cleaning or Mechanically Cleaned:* Shall mean soil removal by impingement, circulation, or flowing chemical detergent solutions and water rinses onto and over the surfaces to be cleaned by mechanical means in equipment or systems specifically designed for this purpose.

B4.2 *Manual (COP) Cleaning:* Shall mean soil removal when the equipment is partially or totally disassembled. Soil removal is effected with

[1]Use current revisions or editions of all referenced documents cited herein.

[2]Additional information on surface modification is contained in *Advanced Materials and Processes*, Volume 137(1), "Coatings and Coating Practices" by H. Herman, "Surface Modification" by F. A. Smidt. ASM International, Materials Park, OH 44073 (216) 338-5151.

chemical solutions and water rinses with the assistance of one or a combination of brushes, nonmetallic scouring pads and scrapers, high or low pressure hoses and tank(s) which may be fitted with recirculating pump(s), and with all cleaning aids manipulated by hand.

B5 **Surface Modification**[2]

B5.1 *Surface Treatments:* Shall mean a process whereby chemical compositions or mechanical properties of the existing surface are altered. There is no appreciable, typically less than 1 mm, build-up of new material or removal of existing material.

B5.1.1 Surface treatments may include:
1. Mechanical (shot peening[3], polishing)
2. Electropolishing

B5.2 *Coatings:* Shall mean the results of a process where a different material is deposited to create a new surface. There is appreciable, typically more than 1 mm, build-up of new material. The coating material does not alter the physical properties of the substrate.

B5.2.1 Coating processes include:
1. Engineering Plating
(e.g., Electrodeposition[4], gold deposition)

B6 *Corrosion Resistant:* Shall mean the surface has the property to maintain its original surface characteristics for its predicted service period when exposed to the conditions encountered in the environment of intended use, including expected contact with product and cleaning, sanitizing, or sterilization compounds or solutions.

B7 *Dead End:* Shall mean an area or space wherein a product, ingredient, cleaning, or sanitizing agent, or other extraneous matter may be trapped, retained, or not completely displaced during operational or cleaning procedures.

B8 *Easily or Readily Accessible:* Shall mean a location which can be safely reached by personnel from the floor, platform, or other permanent work area.

B9 *Easily or Readily Removable:* Shall mean quickly separated from the equipment with the use of simple hand tools if necessary.

B10 *Inspectable:* Shall mean all product contact surfaces can be made available for close visual observation.

B11 *Microbial Impermeability:* Shall mean the ability of the equipment to prevent the ingress of microorganisms from the environment to product contact surfaces.

B12 *Nontoxic Materials:* Shall mean those substances which under the conditions of their use are in compliance with applicable requirements of the Food, Drug, and Cosmetic Act of 1938, as amended.

B13 *Sanitizing or Sanitization:* Shall mean a process applied to a cleaned surface which is capable of reducing the numbers of the most resistant human pathogens by at least 5 $\log_{10}$ reductions (99.999%) to 7 $\log_{10}$ reductions (99.99999%) by applying accumulated hot water, hot air, or steam, or by applying an EPA-registered sanitizer according to label directions. Sanitizing may be effected by mechanical or manual methods.

B14 *Shadow Areas:* Shall mean zones in product contact surfaces where cleaning solutions will not flow directly across the surface.

B15 *Soil:* Shall mean the presence of unwanted organic residue or inorganic matter, with or without microorganisms, including food residue, in or on the equipment.

B16 *Simple Hand Tools:* Shall mean implements such as a screwdriver, wrench, or mallet normally used by operating and cleaning personnel.

B17 *Sterilization:* Shall mean a process effected by heat, chemicals, or other mechanical means that destroys all vegetative bacteria and inactivates relevant bacterial spores.

B18 *Flexible Liners:* Shall mean a membrane or bladder which separates compressible media from product.

B19 *Liner Supports:* Shall mean fabrications or structures which maintain the desired function, shape, attachment or seal of the liner.

B20 *Bond*: Shall mean the adhesive or cohesive forces holding materials together. This definition excludes press and shrink fits.

C **MATERIALS**

C1 **Metals**

C1.1 Product contact surfaces shall be of stainless steel of the American Iron and Steel Institute (AISI) 300 Series[5] (excluding 301 and 302) or corresponding Alloy Cast Institute (ACI) types[6] or metal which under conditions of intended use is at least as corrosion resistant as stainless steel of the foregoing types, and is nontoxic and nonabsorbent. (See Appendix, Section E.)

[3] MIL-S-13165C (1), *Military Specification: Shot Peening of Metal Parts.* Available from Standardization, Document Order Desk (Department of Navy), 700 Robbins Avenue, Building 4, Section D, Philadelphia, PA 19111-5094 (215) 697-2179.

[4] Federal Specification #QQ-C-320B for Chromium Plating (Electrodeposited), with Amendment 4. Federal Specification #QQ-N-290A for Nickel Plating (Electrodeposited). Available from the General Services Administration, Federal Supply Services Bureau, Specification Section, 470 East L'Enfant Plaza, Suite 8100, Washington, DC 20407 (202) 755-0325.

C1.2 Pulsation dampener housings, liner supports, and end caps made of the materials provided for in C1.1 may have their product contact surfaces modified by surface treatment or coating(s).

C1.3 Pulsation dampener housings, liner supports, and end caps may also be made of other nontoxic structurally suitable metal(s) that have their product contact surfaces modified by coating(s).

C2 **Nonmetals**

C2.1 Rubber and rubber-like materials may be used for flexible liners, liner supports, housing gaskets, housing seals, and parts having the same functional purposes.

C2.1.1 Rubber and rubber-like materials, when used for the above-specified application(s), shall conform to the applicable provisions of the 3-A Sanitary Standards for Multiple-Use Rubber and Rubber-Like Materials Used as Product Contact Surfaces in Dairy Equipment, Number 18-.

C2.2 Plastic materials may be used for gaskets, liner supports, and parts having the same functional purposes.

C2.2.1 Plastic materials, when used for the above-specified application(s), shall conform to the applicable provisions of the 3-A Sanitary Standards for Multiple-Use Plastic Materials Used as Product Contact Surfaces for Dairy Equipment, Number 20-.

C2.3 Rubber and rubber-like materials having product contact surfaces shall be of such composition as to retain their surface and conformational characteristics when exposed to the conditions encountered in the environment of intended use and in cleaning and bactericidal treatment or sterilization.

C2.4 The adhesive, if used, on bonded rubber and rubber-like materials and bonded plastic materials shall be nontoxic.[7]

C3 **Additional Material Requirements**

C3.1 In a processing system to be sterilized by heat and operated at a temperature of 250°F (121°C) or higher, all materials having product contact surface(s) used in the construction of the pulsation dampeners and nonmetallic component parts shall be such that they can be (1) sterilized by saturated steam or water under pressure (at least 15.3 psig or 106 kPa) at a temperature of at least 250°F (121°C) and (2) operated at the temperature required for processing.

C4 **Nonproduct Contact Surfaces**

C4.1 All nonproduct contact surfaces shall be of corrosion-resistant material or material that is rendered corrosion resistant. If coated, the coating used shall adhere. All nonproduct contact surfaces shall be relatively nonabsorbent, durable, and cleanable. Parts removable for cleaning having both product contact and nonproduct contact surfaces shall not be painted.

D **FABRICATION**

D1 **Surface Texture**

D1.1 All product contact surfaces shall have a finish at least as smooth as a No. 4 ground finish on stainless steel sheets and be free of imperfections such as pits, folds and crevices in the final fabricated form. (See Appendix, Section F.)

D2 **Permanent Joints**

D2.1 All permanent joints in metallic product contact surfaces shall be continuously welded.[8]

D2.2 Welding shall produce product contact surfaces which are at least as smooth as a No. 4 ground finish on stainless steel sheets and which are free of imperfections such as pits, folds, and crevices.

D3 **Coatings**

D3.1 Coatings, if used, shall be free from surface delamination, pitting, flaking, spalling, blistering, and distortion when exposed to the conditions encountered in the environment of intended use and in cleaning and bactericidal treatment or sterilization.

D3.2 The minimum thickness of electrodeposited coatings shall not be less than 0.00020 in. (0.0050 mm) for all product contact surfaces.

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[5] The data for this series are contained in the *AISI Steel Products Manual, Stainless & Heat Resisting Steels*, Table 2-1. Available from the American Iron and Steel Society, 410 Commonwealth Drive, Warrendale, PA 15086 (412) 776-1535.

[6] Steel Founders Society of America, Cast Metal Federation Building, 455 State Street, Des Plaines, IL 60016 (708) 299-9160.

[7] Adhesives shall comply with 21 CFR 175 - Indirect Food Additives: Adhesives and Components of Coatings. Document for sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 (202) 512-1800.

[8] Criteria for hygienic welds may be found in AWS/ANSI D18.1 —*Specification for Welding of Austenitic Stainless Steel Tube and Pipe Systems in Sanitary (Hygienic) Applications*. Available from the American Welding Society, 550 N.W. LeJeune Rd., Miami, FL 33126, phone: (305) 443-9353, fax: (305) 443-7559, e-mail: info@amweld.org; and EHEDG Doc. 9 —Welding Stainless Steel to Meet Hygienic Requirements. Available from the European Hygienic Equipment Design Group, Ellen Moens, Avenue Grand Champ 148, 1150 Brussels, Belgium.

D4 **Cleaning and Inspectability**

D4.1 Pulsation dampeners that are to be mechanically cleaned shall be designed so that the product contact surfaces of the pulsation dampeners and all nonremoved appurtenances thereto can be mechanically cleaned and are easily accessible, readily removable, and inspectable.

D4.2 Product contact surfaces not designed to be mechanically cleaned shall be easily accessible for cleaning and inspection either when in an installed position or when removed. Demountable parts shall be readily removable.

D4.3 There shall be no shadow areas or dead ends, except that:

D4.3.1 Pulsation dampening devices which may retain product during processing shall be provided with means to maintain product temperature less than 40.0°F (4.40°C) or greater than 145°F (63.0°C).

D4.3.2 Pulsation dampening devices that have dead ends or shadow areas shall be disassembled and manually cleaned.

D4.4 Pulsation dampeners with flexible liners shall include a leak detection system which will indicate a failure of the flexible liner.

D4.4.1 Leak detection systems for pulsation dampeners, which meet product contact surface requirements on both sides of the liner and the air inlet, shall be sufficient to alert the operator of a failure of the liner, and the air shall meet the requirements for 3-A® Accepted Practices for Supplying Air Under Pressure in Contact with Milk, Milk Products, and Product Contact Surfaces, Number 604- or:

D4.4.2 The manufacturer shall provide a failsafe leak detection system which will make the system stop in an orderly manner whenever liquid is sensed on the nonproduct side of the liner or pressure rise or change in conductivity is sensed in the intermediate space or the leak detection system fails.

D4.4.2.1 The leak detection apparatus shall be easily tested independently, or verified on the pulsation dampener while the system is in operation. One test method for pulsation dampeners is to submerge the detector probes(s) in a conductive fluid such as water to determine that the system starts on orderly shutdown.

D5 **Draining**

D5.1 All product contact surfaces shall be self-draining except for normal clingage.

D5.1.1 If specific positioning of the pulsation dampener is required to assure drainage, appropriate markings shall be provided to indicate the required position.

D6 **Fittings**

D6.1 All sanitary fittings and connections shall conform to the applicable provisions of the 3-A Sanitary Standards for Sanitary Fittings for Milk and Milk Products, Number 63-.

D7 **Instrument Connections**

D7.1 All instrument connections having product contact surfaces shall conform to the applicable provisions of the 3-A Sanitary Standards for Sensors and Sensor Fittings and Connections Used on Fluid Milk and Milk Products Equipment, Number 74-.

D8 **Sanitary Tubing**

D8.1 All metal tubing shall conform to the 3-A Sanitary Standards for Polished Metal Tubing for Dairy Products, Number 33-.

D9 **Gaskets**

D9.1 Gaskets having a product contact surface shall be removable or bonded.

D9.2 Grooves in gaskets shall be no deeper than their width.

D9.3 Gasket retaining grooves in product contact surfaces for removable gaskets shall not exceed 1/4 in. (6.35 mm) in depth or be less than 1/4 in. (6.35 mm) wide except those for standard O-rings smaller than 1/4 in. (6.35 mm), and those provided for in Sections D6.1 and D7.1.

D10 **Radii**

D10.1 All internal angles of less than 135° on product contact surfaces shall have radii of not less than 1/8 in. (3.18 mm), except that:

D10.1.1 Smaller radii may be used when they are required for essential functional reasons, such as those in liner support alignment grooves. In no case shall such radii be less than 1/32 in. (0.794 mm), and must adequately mechanically cleaned.

D10.1.2 The radii in grooves in gaskets or gasket retaining grooves shall be not less than 1/16 in. (1.59 mm), except for those for standard 1/4 in. (6.35 mm) and smaller O-rings, and those provided for in the 3-A Standards referenced in Sections D6.1 and D7.1.

D10.1.3 Radii in standard O-ring grooves shall be as specified in Appendix, Section G.

D10.1.4 Radii in nonstandard O-ring grooves shall be those radii closest to a standard O-ring as specified in Appendix, Section G.

D11 **Threads**

D11.1 There shall be no threads on product contact surfaces.

D12 **Springs**

D12.1 Coil springs shall be made of round cross-section stock. Coil springs having product contact surfaces shall have at least 3/32 in. (2.38 mm) openings between coils, including the ends, when the spring is in the free position. End coils shall not be modified to produce a flat mounting surface.

D13 **Sterilization Systems**

D13.1 Pulsation dampening devices used in a processing system to be sterilized by heat and operated at a temperature of 250°F (121°C) or higher shall comply with the following additional criteria:

D13.2 The construction shall be such that all product contact surfaces can be (1) sterilized by saturated steam or water under pressure (at least 15.3 psig or 106 kPa) at a temperature of at least 250°F (121°C) and (2) operated at the temperature required for processing.

D13.3 Pulsation dampening devices that have a product contact surface(s) to be used in such a processing system, not designed so that the system is automatically shut down if the product pressure in the system becomes less than that of the atmosphere and cannot be restarted until the system is re-sterilized, shall have a steam or other sterilizing medium chamber surrounding the liner attachment point(s) and end cap gasket(s) at the product contact surface if required to maintain sterility. The pulsation dampening device shall be constructed so that the steam chamber or other sterilizing medium chamber may be exposed for inspection.

D13.4 Where steam or other sterilizing medium is used, the connection(s) on the pulsation dampening device shall be such that the steam lines or other sterilizing medium lines can be securely fastened to the pulsation dampening device. The pulsation dampening device shall be constructed so that the steam or other sterilizing medium chamber may be exposed for inspection.

D13.5 The seal(s) in a pulsation dampening device designed to be used in a processing system to be sterilized by heat and operated at a temperature of 250°F (121°C) or higher shall be between the product contact surface and the steam or other sterilizing chamber.

D14 **Nonproduct Contact Surfaces**

D14.1 Nonproduct contact surfaces shall have a relatively smooth finish, substantially free of pockets and crevices, and be readily cleanable and those surfaces to be coated shall be effectively prepared for coating.

APPENDIX

E STAINLESS STEEL and EQUIVALENT MATERIALS

E1 Stainless steel conforming to the applicable composition ranges established by AISI for wrought products, or by ACI for cast products, should be considered in compliance with the requirements of Section C1 herein. Where welding is involved, the carbon content of the stainless steel should not exceed 0.08%. The first reference cited in C1 sets forth the chemical ranges and limits of acceptable stainless steel of the 300 Series. Cast grades of stainless steel corresponding to types 303, 304, and 316 are designated CF-16F, CF-8, and CF-8M, respectively. The chemical compositions of these cast grades are covered by ASTM[9] specifications A351/A351M, A743/A743M and A744/A744M.

E2 **TABLE 1**

WROUGHT PRODUCTS TYPICALLY USED			
UNS #	**ASTM[9]**	**AISI/ SAE[5]**	**Properties**
S30300	A-582	303	Free-Machining S.S.; Austenitic
S30400	A-276 A-666	304	Austenitic S.S.
S30403	A-276 A-666	304L	Low Carbon Austenitic S.S.
S31600	A-276 A-666	316	Austenitic S.S. plus Mo*
S31603	A-276 A-666	316L	Low Carbon Austenitic S.S. plus Mo*

*Molybdenum

E3 **TABLE 2**

CAST PRODUCTS			
UNS #	**ASTM[9]**	**ACI[6]**	**Common Names**
J92500	A-351 A-743 A-744	CF-3	Cast 304L
J92800	A-351 A-743 A-744	CF-3M	Cast 316L
J92600	A-351 A-743 A-744	CF-8	
J92900	A-351 A-743 A-744	CF-8M	Cast 316
J92180	A-747	CB7 Cu — 1	Cast 17-4 PH
J92110	A-747	CB7 Cu —2	Cast 15-5 PH
N26055	A-494	CY5Sn BiM	Alloy 88
J92701	A-743	CF-16F	Free Machining Austenitic S.S.

[9]Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959. Phone: (610) 832-9500.

E4 **TABLE 3 OPTIONAL METAL ALLOYS**

Optional metal alloys having the following compositions are examples considered in compliance with Section C herein. (Percentages are maximum unless range is given.)

	UNS N08367	UNS S21800	UNS S20161	UNS N26055	UNS N26455	UNS S17400	UNS S15500	UNS S32900	UNS R20500	UNS R50400
	ASTM A743 Grade CN-3MN	ASTM A743 Grade CF-10 MnN		ASTM A494 Grade CY5SnBiM	ASTM A494 Grade CW-2M	ASTM A747 Grade CB7Cu-1	ASTM A747 Grade CB7Cu-2		ASTM A560 Grade 50Cr-50Ni	ASTM B67 Grade C-2
C	0.03	0.10	0.15	0.05	0.02	0.07	0.07	0.20	0.10	0.10
Mn	2.00	7.00-9.00	4.00-6.00	1.5	1.00	0.70	0.70	1.00	0.30	
Si	1.00	3.50-4.50	3.00-4.00	0.5	0.80	1.00	1.00	0.75	1.00	
P	0.040	0.040	0.040	0.03	0.03	0.035	0.035	0.040	0.02	
S	0.010	0.030	0.040	0.03	0.03	0.03	0.03	0.030	0.02	
Cr	20.0-22.0	16.00-18.00	15.0-18.0	11.0-14.0	15.0-17.5	15.50-17.7	14.0-15.50	23.0-28.0	48.0-52.0	
Ni	23.5-25.5	8.00-9.00	4.00-6.00	Balance	Balance	3.60-4.60	4.50-5.50	2.50-5.00	Balance	
Mo	6.0-7.0			2.0-3.5	15.0-17.5			1.00-2.00		
Cb						0.15-0.35	0.15-0.35			
Cu	0.75					2.50-3.20	2.50-3.20			
N	0.18-0.26	0.08-0.18	0.08-0.20			0.05	0.05		0.30	
Fe	Balance	Balance	Balance	2.00	2.00	Balance	Balance	Balance	1.00	0.30
Sn				3.0-5.0						
Bi				3.0-5.0						
W					1.0					
Ti									0.50	Balance
Al									0.25	
Other										H = 0.015 N = 0.03 O = 0.25

E5 Metal alloys or metals other than the above may be as corrosion resistant as 300 Series Stainless steel. This may be shown when metal alloys or metals are tested in accordance with ASTM G31 Laboratory Immersion Corrosion Testing of Metals and have a corrosion rate of less than 10 mil per year. The test parameters such as the type of chemical(s), their concentration(s), and temperature(s) should be representative of cleaning and sanitizing conditions used in dairy equipment. Alloys containing lead, leachable copper, or other toxic metals should not be used.

F PRODUCT CONTACT SURFACE FINISH

F1 Surface finish equivalent to 150 grit or better as obtained with silicon carbide, properly applied on stainless steel sheets, is considered in compliance with the requirements of Section D1 herein. A maximum R_a of 32.0 µin. (0.80 µm), when measured according to the recommendations in American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME)[10] B46.1 - *Surface Texture*, is considered to be equivalent to a No. 4 finish.

F2 Sheets of 2B (cold rolled) stainless steel, inspected and selected to be free of pits, folds and crevices are generally found to be as smooth as or smoother than stainless steel sheets with a No. 4 ($R_a \leq 32.0$ µin. or ≤0.80 µm) finish and are acceptable for the fabrication of equipment if free of imperfections.

[10] Available from the American Society of Mechanical Engineers, 345 East 47th Street, New York, NY 10017-2392 (212) 705-7722.

G **O-RING GROOVE RADII**

TABLE 4 — Minimum Groove Radii Dimensions for Standard O-Rings

O-Ring Cross Section, Nominal (AS 568[11])	O-Ring Cross Section, Actual (AS 568)	O-Ring Cross Section, Actual (ISO 3601-1[12])	Minimum Groove Radius
1/16 in.	0.070 in.	1.80 mm	0.016 in. (0.406 mm)
3/32 in.	0.103 in.	2.65 mm	0.031 in. (0.787 mm)
1/8 in.	0.139 in.	3.55 mm	0.031 in. (0.787 mm)
3/16 in.	0.210 in.	5.30 mm	0.062 in. (1.575 mm)
1/4 in.	0.275 in.	7.00 mm	0.094 in. (2.388 mm)

H **ENGINEERING DESIGN AND TECHNICAL CONSTRUCTION FILE**

The following is an example of an engineering design and technical construction file (EDTCF) to be maintained by the fabricator as evidence of complying with 3-A Sanitary Standards or 3-A Accepted Practices. (The file may contain more or less information as applicable to the equipment or system.)

H1 **Purpose**

H1.1 To establish and document the material, fabrication, and installation (where appropriate) requirements for the engineering design and technical construction files for all products, assemblies, and sub-assemblies supplied by the manufacturer thereof to be in compliance with the sanitary criteria found in 3-A Sanitary Standards or 3-A Accepted Practices. It is recommended that the engineering and construction file or files be submitted with applications for 3-A Symbol use authorization.

H2 **Scope**

H2.1 This EDTCF applies to equipment specified by:

H2.1.1 3-A Sanitary Standards for Pulsation Dampening Devices, Number 82-00.

H2.1.2 List all applicable 3-A Sanitary Standards and 3-A Accepted Practices.

H3 **Responsibilities**

H3.1 This EDTCF is maintained by: The Engineering Manager (or other company official) **{name and title of responsible official}** is responsible for maintaining, publishing, and distributing this EDTCF.

H3.2 Implementation: All divisions, specifically development engineering, standards engineering, sales engineering, and product departments are responsible for implementing this EDTCF.

H4 **Applicability**

H4.1 The 3-A Sanitary Standards and 3-A Accepted Practices are voluntarily applied as suitable sanitary criteria for dairy and food processing equipment. 3-A Sanitary Standards are referenced in the Grade A Pasteurized Milk Ordinance: "Equipment manufactured in conformity to 3-A Sanitary Standards complies with the sanitary design and construction standards of this Ordinance."

H5 **Reference**

H5.1 List any additional regulations that apply to the equipment or system covered by this EDTCF.

H5.2 Date of conformity or 3-A Symbol Authorization and certificate number, if authorized.

H6 **Design and Technical Construction File**

H6.1 The Engineering Design and Technical Construction File may consist of the following:

a. an overall drawing of the subject equipment;
b. full detailed drawings, accompanied by any calculations, notes, test results, etc. required to check the conformity of the equipment with the 3-A Standards or 3-A Practices;
c. a list of:
   (1) the essential requirements of the standards or practices;
   (2) other technical specifications, which were used when the equipment was designed;
d. a description of methods adopted;
e. if essential, any technical report or certificate obtained from a competent testing body or laboratory;
f. any technical report giving the results of tests carried out internally by Engineering or others;

[11] The document establishing these standard dimensions is Aerospace Standard (AS) 568, published by SAE, 400 Commonwealth Drive, Warrendale, PA 15086 (412-776-4970).

[12] The document establishing these standard dimensions is ISO 3601-1: published by the International Organization for Standardization (ISO), 1 Rue de Varembe, Case Postale 58, CH 1 1211, Geneva, Switzerland (41-22-734-1240).

g. documentation and test reports on any research or tests on components, assemblies and/or the complete product to determine and demonstrate that by its design and construction the product is capable of being installed, put into service, and operated in a sanitary manner (optional);

h. a determination of the foreseeable lifetime of the product (optional);

i. a copy of the instructions for the product (Instruction Manuals/Instruction Books);

j. for serial manufacturing, the internal measures that will be implemented to insure that the equipment will continue to be manufactured in conformity to the provisions of the 3-A Sanitary Standards or 3-A Accepted Practices;

k. engineering reports;

l. laboratory reports;

m. bills of material;

n. wiring diagrams, if applicable;

o. sales order engineering files;

p. hazard evaluation committee reports, if executed;

q. change records;

r. customer specifications;

s. any notified body technical reports and certification tests;

t. copy of the 3-A Symbol authorization, if applicable.

H6.2 The file does not have to include detailed plans or any other specific information regarding the sub-assemblies, tooling, or fixtures used for the manufacture of the product unless a knowledge of them is essential for verification of conformity to the basic sanitary requirements found in 3-A documents.

H6.3 The documentation referred to in H6.1 above need not permanently exist in a material manner in the EDTCF, but it must be possible to assemble them and make them available within a period of time commensurate with its importance (one week is considered reasonable time). As a minimum, each product EDTCF must physically contain an index of the applicable document of H6.1 above.

H6.4 The EDTCF may be in hard copy or software form.

H7 **Confidentiality**

H7.1 The EDTCF is the property of the manufacturer and is shown at their discretion, except that all or part of this file will be available to the 3-A Symbol Council or a regulatory agency for cause and upon request.

H8 **File Location**

H8.1 The EDTCF shall be maintained at **{location}**.

H9 **File Retention**

HI9.1 The EDTCF (including all documentation referred to in H6.1) shall be retained and kept available for 12 years following the date of placing the product in use or from the last unit produced in the case of series manufacture.

These Standards are effective November 24, 2002.

Food Protection Trends, Vol. 23, No. 2, Pages 198-215

3-A® Accepted Practices for the Design, Fabrication, and Installation of Milking and Milk Handling Equipment, Number 606-05

Formulated by
International Association of Food Industry Suppliers (IAFIS)
International Association for Food Protection (IAFP)
United States Public Health Service (USPHS)
The Dairy Industry Committee (DIC)
United States Department of Agriculture – Dairy Programs (USDA)

It is the purpose of the IAFIS, IAFP, USPHS, DIC, and USDA in connection with the development of the 3-A Sanitary Standards Program to allow and encourage full freedom for inventive genius or new developments. Milking and milk handling equipment specifications heretofore or hereafter developed which so differ in design, materials, and fabrication or otherwise as not to conform to the following standards but which, in the fabricator's opinion, are equivalent or better, may be submitted for the joint consideration of the IAFIS, IAFP, USPHS, DIC and USDA at any time. Standard English is the official language of 3-A Sanitary Standards and 3-A Accepted Practices.

A **SCOPE**

A1 These 3-A Accepted Practices shall pertain to equipment used in a milking system that begins with the equipment applied to the cow to extract milk and continues to all components in the system exclusive of the container in which the raw milk is stored or from which the milk is removed from the dairy farm.

A2 In order to conform to these 3-A Accepted Practices, milking and milk handling equipment shall conform to the following design, material, fabrication, and installation criteria.[1]

B **DEFINITIONS (See Appendix, Section J, Figures 1 & 2)**

B1 *Product:* Shall mean raw milk.

B2 *Solutions:* Shall mean those homogeneous mixtures of chemical solute(s) and solvent used for flushing, cleaning, rinsing, and sanitizing.

B3 **Surfaces**

B3.1 *Product Contact Surfaces:* Shall mean all surfaces which are exposed to the product and surfaces from which liquids may drain, drop, or be drawn into the product.

B3.2 *Solution Contact Surfaces:* Shall mean the interior surfaces of the equipment or system which are used exclusively for supply and recirculation of cleaning and/or sanitizing solutions, except those used to supply concentrated cleaning and/or sanitizing materials to the point of use.

B3.3 *Nonproduct Contact Surfaces:* Shall mean all other exposed surfaces.

B3.3.1 *Splash Contact Surfaces:* Shall mean other nonproduct contact surfaces that during normal use are subject to accumulation of soil and which require routine cleaning.

B4 **Cleaning**

B4.1 *Mechanical Cleaning or Mechanically Cleaned:* Shall mean soil removal by impingement, circulation, or flowing chemical detergent solutions and water rinses onto and over the surfaces to be cleaned by mechanical means in equipment or systems specifically designed for this purpose.

[1] Use current revisions or editions of all referenced documents cited herein.

B4.1.1 *Cleaned In Place (CIP):* Shall mean mechanical cleaning of equipment, the cleanability of which has been sufficiently established such that all product or solution contact surfaces do not have to be readily accessible for inspection, i.e. silo-type tanks or welded pipelines.

B4.2 *Manual (COP) Cleaning:* Shall mean soil removal when the equipment is partially or totally disassembled. Soil removal is effected with chemical solutions and water rinses with the assistance of one or a combination of brushes, nonmetallic scouring pads and scrapers, high or low pressure hoses and tank(s) which may be fitted with recirculating pump(s), and with all cleaning aids manipulated by hand.

B5 **Pipelines**

B5.1 *Milk Line:* Shall mean rigid pipelines which have welded joints or sanitary fittings and are designed for mechanical cleaning and which are used for the dual function of transporting milk and air.

B5.2 *Wash Line:* Shall mean rigid pipelines which have welded joints or have sanitary fittings and are used exclusively for the supply and recirculation of cleaning and/or sanitizing solutions, except those used to supply concentrated cleaning and/or sanitizing materials to the point of use.

B5.3 *Main Air Line:* Shall mean the rigid pipe or tube from the vacuum pump through the sanitary trap to the receiver.

B5.4 *Milk Transfer Line:* Shall mean a pipe which performs the single function of transporting milk.

B5.5 *Pulsator Air Line:* Shall mean the rigid pipe or tube that supplies vacuum to the pulsator(s).

B6 **Component Equipment**

B6.1 *Sanitary Fittings:* Shall mean welded or rolled-on fittings with gaskets to form joints designed for mechanical cleaning which form substantially smooth flush interior surfaces.

B6.2 *Air Injector:* Shall mean a mechanical valve used to admit air intermittently into the washing system to increase the cleaning action.

B6.3 *Short Pulse Tube:* Shall mean the flexible air hose or tube between the claw or unit mounted pulsator and the teatcup shell.

B6.4 *Claw:* Shall mean the sanitary manifold (which may include a reservoir or claw bowl) that spaces the teatcup assemblies in a cluster and connects them to the long milk tube and may include a manifold to connect the long pulse tube to the short pulse tubes.

B6.5 *Cluster:* Shall mean an assembly comprising teatcups and claw.

B6.6 *Teatcup Jetters:* Shall mean the manifold assembly used to supply cleaning solutions through the claw and teatcup assemblies for mechanical cleaning in the milking parlor.

B6.7 *Vacuum Tube:* Shall mean a flexible air tube or hose that connects a bucket milker to a vacuum line.

B6.8 *Long Pulse Tube:* Shall mean a flexible air tube or hose that connects a pulsator to a claw.

B6.9 *Milk Meter:* Shall mean in-line equipment that measures the quantity or rate of flow of milk from individual cows.

B6.10 *Long Milk Tube (Milk Hose):* Shall mean a flexible hose or tube that connects the claw or claw bowl to a bucket or a milk line or a milk transfer line.

B6.11 *Milk Inlet:* Shall mean a nipple on the milk line or milk transfer line.

B6.12 *Milk Cock (Milk Inlet Valve):* Shall mean an open-close device incorporated in the milk inlet.

B6.13 *Short Milk Tube:* Shall mean a tube that connects the teatcup liner to the claw inlet nipple.

B6.14 *Nipple:* Shall mean a short pipe projecting from the claw, pulsator, milking machine lid, or other part of the milking system apparatus.

B6.15 *Pipeline Milking Machine:* Shall mean a milking equipment system utilizing milk lines and/or milk transfer lines.

B6.16 *Receiver:* Shall mean a vessel that receives milk from the milk line or milk transfer line.

B6.17 *Releaser:* Shall mean a device that releases milk from under vacuum and discharges it to atmospheric pressure.

B6.18 *Sanitary Trap:* Shall mean a flow vessel that separates the milk side of a milking machine system from the vacuum supply side to keep milk and fluids out of the vacuum system and to prevent back-flow of fluids.

B6.19 *Slip-On Connectors:* Shall mean a nipple free of barbs over which a hose is positioned without any additional attachment.

B6.20 *Stall Cock:* Shall mean the valve device on the pulsator air line to which the vacuum hose or pulsator is attached.

B6.21 *Teatcup:* Shall mean the teatcup shell and liner or inflation.

B6.22 *Teatcup liner or Inflation:* Shall mean a rubber or rubber-like flexible sleeve with mouthpiece and barrel which fits inside the teatcup shell. The liner may have an integral or separate short milk tube.

B6.23 *Teatcup Shell:* Shall mean the metal or plastic case or shell in which the teatcup liner or inflation is enclosed.

B6.24 *Transfer Station:* Shall mean a receptacle and piping or tubing system which conveys milk from the milking area to the container in which the milk is stored. Transfer stations are used with the pail or bucket type milking units.

B6.25 *Vacuum Pump:* Shall mean an air pump(s) connected to a milking system that creates a suction and maintains partial vacuum.

B6.26 *Bucket Milking Machine:* Shall mean a machine in which milk flows from the claw into a portable milk receiving bucket which is connected to the vacuum system.

B6.27 *Distribution Tank:* Shall mean an air vessel or chamber, in the main air line between the vacuum pump and the sanitary trap, which acts as a manifold for other pipelines.

B6.28 *Drop Lines for Mechanical Cleaning:* Shall mean those flexible hoses which connect wash lines to teatcup jetters or milk meters.

B6.29 *Milk Cooling and Holding Tank:* Shall mean a vertical or horizontal cylindrical, rectangular, or oval or other equally satisfactorily shaped tank.

B6.30 *Milking Parlor:* Shall mean a milking area where cows are present only when being milked.

B6.31 *Milk Pump:* Shall mean a centrifugal or positive displacement pump which moves milk from the receiver to the milk holding tank.

B6.32 *Pulsator:* Shall mean a device for producing cyclic pressure change inside a teatcup shell.

B6.33 *Vacuum Milk Holding Tank:* Shall mean a milk cooling and holding tank which is under vacuum during milking.

B7 *Simple Hand Tools:* Shall mean implements normally used by operating and cleaning personnel such as a screwdriver, wrench or hammer.

C MATERIALS

C1 Metals

The materials of product contact surfaces of equipment included in the milking system for which there are 3-A Sanitary Standards or 3-A Accepted Practices shall conform to the material criteria of the applicable standards or accepted practices.

C1.1 Other product contact surfaces shall be of stainless steel of the American Iron and Steel Institute (AISI) 300 Series[2] or corresponding Alloy Cast Institute (ACI) types[3] (See Appendix, Section H), or metal which under conditions of intended use is at least as corrosion resistant as stainless steel of the foregoing types, and is nontoxic and nonabsorbent, except that:

C2 Nonmetals

C2.1 Glass may be used for milk lines, milk transfer lines, receivers, receiver air lines, claws, fittings, and elbows, and shall be of a clear, heat-resistant type.

C2.2 Rubber and rubber-like materials may be used in sealing applications, long air hoses, milk hoses, short milk tubes, vacuum tubes, long and short pulse tubes, filter parts, teatcup liners, teatcup jetters, O-rings, drip deflectors, level sensing devices (probes), sensor insulators, and parts having the same functional purposes.

C2.2.1 Rubber and rubber-like materials, when used for the above-specified application(s), shall conform to the applicable provisions of the 3-A Sanitary Standards for Multiple-Use Rubber and Rubber-Like Materials Used as Product Contact Surfaces in Dairy Equipment, Number 18-.

[2] The data for this series are contained in the *AISI Steel Products Manual, Stainless & Heat Resisting Steels*, Table 2-1. Available from the American Iron and Steel Society, 186 Thorn Hill Road, Warrendale, PA 15086 (724) 776-1535.

[3] Steel Founders Society of America, Cast Metal Federation Building, 455 State Street, Des Plaines, IL 60016 (708) 299-9160.

C2.3 Plastic materials may be used in sealing applications, transparent flexible tubing for transfer stations, milk hoses, short milk tubes, milk line fittings, vacuum tubes, long and short pulse tubes, plug-type valves, sight and light openings in product or solution pipelines, milk lines or wash lines, filter parts, teatcup liners, O-rings, drip deflectors, level sensing devices (probes), sensor insulators, teatcup jetters, metering devices, releasers, claws, pipeline drain assemblies, air injectors, buckets and bucket lids, float balls and milk inlets and parts having the same functional purposes.

C2.3.1 Plastic materials when used for the above-specified application(s) shall conform to the applicable provisions of the 3-A Sanitary Standards for Multiple-Use Plastic Materials Used as Product Contact Surfaces for Dairy Equipment, Number 20-.

C2.4 Bonded rubber and rubber-like materials and bonded plastic materials having product contact surfaces shall be of such composition as to retain their surface and conformational characteristics when exposed to the conditions encountered in the environment of intended use and in cleaning and bactericidal treatment.

C2.5 The final bond and residual adhesive, if used, on bonded rubber and rubber-like materials and bonded plastic materials shall be nontoxic.[4]

C2.6 Where materials having certain inherent functional purposes are required for specific applications, such as probe coatings and rotary seals, carbon and/or ceramic materials may be used. Carbon and/or ceramic materials shall be inert, nonporous, nontoxic, nonabsorbent, insoluble, resistant to scratching, scoring, and distortion when exposed to the conditions encountered in the environment of intended use and in cleaning and bactericidal treatment.

C3 Solution contact surfaces shall be of stainless steel of the American Iron and Steel Institute (AISI) 300 Series or corresponding Alloy Cast Institute (ACI) types (See Appendix, Section H), or metal which under conditions of intended use is at least as corrosion resistant as stainless steel of the foregoing types, and is nontoxic and nonabsorbent, or of clear heat resistant glass piping. Rubber and rubber-like materials or plastic materials conforming to C2.2.1 or C2.3.1 may be used for sealing applications and for short flexible takedown jumpers or slip-on connectors.

C4 **Nonproduct Contact Surfaces**

C4.1 All nonproduct contact surfaces shall be of corrosion-resistant material or material that is rendered corrosion resistant. If coated, the coating used shall adhere. All nonproduct contact surfaces shall be relatively nonabsorbent, durable, and cleanable. Parts removable for cleaning having both product contact and nonproduct contact surfaces shall not be painted.

C5 Main air lines and/or pulsator air lines shall be made of materials which will withstand periodic cleaning. If these lines are used as part of the product contact surface cleaning circuit, they must conform to Section C3.

C6 Paper gaskets shall not be used.

D **FABRICATION**

D1 The fabrication criteria of equipment included in the milking system for which there are 3-A Sanitary Standards or 3-A Accepted Practices shall be those of the applicable standards or accepted practices. (See Appendix, Section T.)

D2 Other equipment shall conform to the following fabrication criteria.

D2.1 **Surface Texture**

D2.1.1 All product and solution contact surfaces shall have a texture at least as smooth as a 32.0 µin. R_a (0.80 µm R_a) finish on stainless steel sheets and be free of imperfections such as pits, folds, and crevices in the final fabricated form (see Appendix, Section I), except that:

D2.1.1.1 The solution contact surfaces for castings for pumps shall be at least as smooth as on the GAR C-9 Cast Microfinish comparator, C-40 (200 µin. or 5.08 µm RMS). (See Appendix, Section K.)

D2.2 All permanent joints in metallic product contact surfaces shall be continuously welded, except that:

D2.2.1 Recessless or rolled-on fittings may be used as provided for in 3-A Sanitary Standards for Sanitary Fittings for Milk and Milk Products, Number 63-.

D2.2.2 Recessless or rolled-on fittings may be used when modifying or repairing existing on-site farm milk handling systems.

[4] Adhesives shall comply with 21 CFR 175 - Indirect Food Additives: Adhesives and Components of Coatings. Document for sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 (202) 512-1800.

D2.2.3 These fittings shall be installed with no cracks or crevices and shall meet the surface texture specified in D2.1.1.

D2.3 **Gaskets**

D2.3.1 Gaskets having a product or solution contact surface shall be removable or bonded.

D2.3.2 Grooves in gaskets shall be no deeper than their width unless the gasket is readily removable and reversible for cleaning.

D2.3.3 Gasket grooves or gasket retaining grooves in product contact surfaces for removable gaskets shall not exceed 1/4 in. (6.35 mm) in depth or be less than 1/4 in. (6.35 mm) wide except those for standard O-rings smaller than 1/4 in. (6.35 mm), and those provided for in Section D2.9.

D2.4 **Radii**

D2.4.1 All internal angles of less than 135° on product contact surfaces shall have radii of not less than 1/4 in. (6.35 mm) except that:

D2.4.1.1 Smaller radii may be used when they are required for essential functional reasons, such as those in O-ring grooves, claw assemblies, and milking machine lids. In no case shall such radii be less than 1/32 in. (0.794 mm).

D2.4.1.2 The radii in gasket grooves, gasket retaining grooves, or grooves in gaskets, and those provided for in Section D2.9 and except for those for standard 1/4 in. (6.35 mm) and smaller O-rings, shall be not less than 1/8 in. (3.18 mm).

D2.4.1.3 The radii in grooves for standard 1/4 in. (6.35 mm) O-rings shall not be less than 3/32 in. (2.38 mm) and for standard 1/8 in. (3.18 mm) O-rings shall be not less than 1/32 in. (0.794 mm).

D2.4.2 The minimum radii for fillets of welds in product contact surfaces shall be not less than 1/4 in. (6.35 mm) except that the minimum radii for such welds may be 1/8 in. (3.18 mm) when the thickness of one or both parts joined is less than 3/16 in. (4.76 mm).

D2.5 **Openings in Covers**

D2.5.1 All milk lines and/or milk transfer lines and other appurtenances entering through the lid or cover of the cooling and/or holding tank, and not permanently attached to the cover, shall be fitted with a sanitary drip deflector that overlaps the edges of the opening through the cover and is located as close as possible to the cover.

D2.6 **Drainage**

D2.6.1 The bottom of all product containers (surge tanks, distribution tanks, and receivers) which have a sanitary connection outlet shall have at least a 1/4 in. per ft. (21 mm per m) pitch to the outlet.

D2.7 **Metal tanks**

D2.7.1 Metal tanks used as surge tanks, distribution tanks, and receivers shall conform to 3-A Sanitary Standards for Uninsulated Tanks for Milk and Milk Products, Number 32-.

D2.8 **Cleaning and Inspectibility**

D2.8.1 Milking systems that are to be mechanically cleaned shall be designed so that the product contact surfaces of the milking system and all nonremoved appurtenances thereto can be mechanically cleaned and are easily accessible and readily removable for inspection and the following:

D2.8.1.1 Each separate cleaning circuit, including product and solution lines, shall be provided with a sufficient number of access points, such as valves, fittings or removable sections to make possible adequate inspections and examinations of representative interior surfaces.

D2.8.2 Product contact surfaces not designed to be mechanically cleaned shall be easily accessible for cleaning and inspection either when in an assembled position or when removed. Removable parts shall be readily demountable.

D2.8.3 All product contact and solution contact surfaces shall be cleanable, either when in an assembled position or when removed. System appurtenances shall be accessible for inspection. Removable parts shall be readily demountable.

D2.9 Plastic or rubber hoses used under vacuum, such as vacuum tubes, long pulse tubes, milk hoses, short milk tubes, inflations, and drop lines for mechanical cleaning, may utilize slip-on connectors.

D2.10 All sanitary fittings and connections shall conform to the 3-A Sanitary Standards for Sanitary Fittings for Milk and Milk Products, Number 63-, 3-A Sanitary Standards for Plug-Type Valves for Milk and Milk Products, Number 51-, 3-A Sanitary Standards for Thermoplastic Plug-Type Valves for Milk and Milk Products, Number 52-, or 3-A Sanitary Standards for Compression-Type Valves for Milk and Milk Products, Number 53-, except that plastic fittings and connections that conform to Section C2.3.1 and glass fittings and connections that conform to Section C2.1 may be used.

D2.11 Lines and fittings for the application of air under pressure shall conform to the applicable provisions of 3-A Accepted Practices for Air Under Pressure in Contact with Milk, Milk Products, and Product Contact Surfaces, Number 604-.

D2.12 **Springs**

D2.12.1 Any coil spring having product contact surfaces shall have at least 3/32 in. (2.38 mm) openings between coils, including the ends when the spring is in the free position.

D2.13 Bonded rubber and rubber-like materials and bonded plastic materials having product contact surfaces shall be bonded in a manner that the bond is continuous and mechanically sound so that when exposed to the conditions encountered in the environment of intended use and in cleaning and bactericidal treatment, the rubber and rubber-like material or the plastic material does not separate from the base material to which it is bonded.

D2.14 **Nonproduct Contact Surfaces**

D2.14.1 Nonproduct contact surfaces shall have a smooth finish, free of pockets and crevices, and be readily cleanable. Surfaces to be coated shall be effectively prepared for coating to assure adhesion.

E **FABRICATION - SPECIFIC ITEMS**

The following are requirements for specific items.

E1 **Milking Machine Pails and Transfer Stations**

A tipping handle, located near the bottom, shall be provided on a floor type pail. Handles and brackets shall be permanently attached to the equipment. A lid shall be provided for both floor and suspended-type pails. Bails, handles, chines, and legs on both types of milking machine pails shall be considered nonproduct contact surfaces.

E1.1 Lids or covers shall be provided for milking machine pails, milk carrying pails, and transfer station receptacles. Lids on transfer station receptacles shall be self closing. All ungasketed lids shall have over-lapping edges turned down at least 3/8 in. (9.52 mm) below the top of the milk pail or receptacle. The lids or covers on the milking machine pails, milk carrying pails, and transfer stations shall be pitched to an outside edge(s) so as to be free draining.

E1.2 The transparent plastic tubing used in conjunction with a transfer station shall be one continuous piece.

E1.2.1 Equipment for air drying transfer tubing shall be provided. The air drying equipment shall conform to the applicable provisions of the 3-A Accepted Practices for Air Under Pressure in Contact with Milk, Milk Products, and Product Contact Surfaces, Number 604-.

E1.3 Pumps used for product contact, if supplied, shall conform to the 3-A Sanitary Standards for Centrifugal and Positive Rotary Pumps for Milk and Milk Products, Number 02-.

E1.4 Pumps, when used, shall be actuated by a milk level sensing device. All product contact surfaces of the device shall be readily demountable for inspection and shall be located so that all of the product contact surfaces are reached by rinse, wash, and sanitizing solutions.

E1.5 The carriage shall be constructed of smooth corrosion resistant material. Tires shall be smooth and without threads.

E2 **Milker Claws**

E2.1 Nipples for long and short milk tubes shall be flush with the interior surface of the claw bowl.

E2.2 The claw shall be designed so that cleaning and sanitizing solutions will drain when the claw is in the cleaning and sanitizing position.

E2.3 Automatic cluster removers, when used, shall shut the vacuum off to the claw prior to removal to prevent extraneous material from being drawn into the cluster. The design and/or adjustment shall be such that the cluster is not dragged across the floor at removal.

E3 **Sanitary Check Valves**

E3.1 A bucket type milking machine shall be provided with a sanitary check valve or other device that will prevent moisture or any contaminating substance from entering the milk from the vacuum system. A sanitary check valve or other device that will pass the test methods found in Appendix, Section J is considered to meet this provision.

E3.2 The movable portion of the sanitary check valve shall be of one piece construction or the parts shall be bonded together.

E4 **Filters**

E4.1 Filters shall conform to the 3-A Sanitary Standards for Milk and Milk Products Filters Using Disposable Filter Media, Number 10-.

E4.2 Wire mesh or woven material shall not be used for the filter medium support.

E5 **Milk Lines and/or Milk Transfer Lines and/or Wash Lines**

E5.1 All solution contact surfaces shall be at least as smooth as a 32.0 µin. R_a (0.80 µm R_a) finish on stainless steel sheets except as provided in Section D2.1.1.1.

E5.2 Permanently mounted product and solution pipelines shall have sanitary fittings or welded joints.

E5.3 All product contact sanitary pipeline (tubing) shall conform to the 3-A Sanitary Standards for Polished Metal Tubing for Dairy Products, Number 33- or be of a clear, heat resistant glass.

E5.4 Milk lines shall be supported so that they remain in alignment and position. (See Appendix, Section S.) The support system shall be designed so as to preclude electrolytic action between support(s) and milk line(s).

E5.5 Each separate cleaning circuit, including product and solution pipelines (wash lines), shall be provided with a sufficient number of access points, such as valves, fittings, or removable sections to make possible adequate inspection and examination of representative interior surfaces. All mechanically cleaned milk line product contact surfaces shall be exposed to cleaning and sanitizing solutions during cleaning.

E5.6 The milker unit (cluster and long milk tube) cleaning manifold shall not be located in the milk line.

E5.7 Milk lines and wash lines shall be self-draining except for normal adherence, and shall have a minimum continuous slope of at least 1.0 in. per 10.0 ft (8.3 mm per m) from a high point. (Also see Section E8.2 and E8.5.)

E5.8 Milk inlets and milk inlet valves, where provided, shall be self-draining into the milk lines and/or milk transfer line and installed so that milk enters the upper half of the milk line. All milk inlet valves shall be supplied with closures which are readily applied and are of sanitary design.

E5.9 The milk line and/or milk transfer line couplings or unions shall not be located in openings in walls, solid partitions, etc. through which the milk line and/or milk transfer lines pass. Where necessary, protective shields shall be used. The openings between the milk line and wall shall be protected to prevent the entrance of flies and other insects into the milkroom.

E5.10 Milking systems shall be physically disconnected from the cleaning make-up vats during milking to avoid contamination by solution in the vat.

E5.11 Milk lines shall be installed so that the vertical distance from the platform on which the cow stands to the center of the milk line, does not exceed 7.0 ft. (2.1 m) when milk is moved by vacuum directly from the milker unit assembly to the milk line except for crossovers. Opaque long milk tubes shall not exceed 8.0 ft (2.4 m) in length.

E5.12 There shall be no risers in the milk line. Any upward slope encountered by the milk moving toward the receiver is considered a riser. Vertical sanitary pipelines, such as cross over pipelines, which do not convey milk are not considered risers.

E5.13 In a pipeline milking system, there shall be no cross-connection(s) between the safe water supply and any unsafe or questionable water supply, or any source of pollution through which the safe water supply might become contaminated. For example, a connection between the water supply piping and solution make-up tank, unless protected by an air gap or effective back-flow preventer, constitutes a violation of this practice.

E5.14 A milk transfer line connecting the milk pump or releaser and milk cooling and holding tank shall be a rigid pipe or tube with welded joints or permanently installed sanitary fittings.

E6 **Vacuum Pumps**

E6.1 Oil-containing exhaust from a vacuum pump shall not terminate in a milking barn, stable, parlor, milkroom or feedroom.

E7 **Vacuum Regulators and Air Admission**

E7.1 During the milking cycle a regulator shall not admit air directly into the milk line.

E7.2 Air may be admitted into the milk line and/or milk transfer line for purposes of "shut down" by valves or other acceptable means located in the milkroom only. A valve for "shut down" purposes may not be installed in nonproduct contact lines unless a check valve is installed adjacent to the sanitary trap and in such a manner that will permit air to travel only to the vacuum pump.

E7.3 Air admission bleed holes (or air vents), if provided, shall be in the upper half of the claw or claw bowl when it is in the milking position or in the teatcup assembly.

E7.4 An air injector, if provided, shall be located to admit clean air into the pipeline during the washing process. The timing and air-to-water ratio shall be adjusted so all surfaces are exposed to wash solution with enough turbulence to clean the system. The air injector shall be designed, installed, and operated so that air is not admitted during milking. Air injectors shall be located in the milk house or room of equivalent cleanliness, or shall be provided with an appropriate filter and properly protected from contamination. Air injectors mounted on the milk line shall be of sanitary design.

E8 **Main Air Lines and/or Pulsator Air Lines**

E8.1 Main air lines and/or pulsator air lines shall be supported in such a manner that the lines will properly drain.

E8.2 Main air lines and/or pulsator air lines shall be sloped at least 1/2 in. in 10 ft (4.2 mm per m), preferably in the direction of air flow.

E8.3 An automatic drain valve or a self draining sanitary trap shall be installed at the bottom of all risers which are not self-draining.

E8.4 Stall cocks shall enter the upper half of the line.

E8.5 In a pipeline milking machine, a self-draining sanitary trap shall be provided whenever the milk line or a permanently installed solution pipeline (wash line) is connected to a vacuum supply line. The trap shall be installed adjacent to the milk receiver, releaser, wash vacuum pipeline or vacuum milk holding tank and connected by readily disassembled sanitary piping. From the top intersection of the outlet on the receiver, the vertical rise of this connection shall not exceed 12 in. (30.5 cm) as measured to the bottom of the connecting elbow. The connecting sanitary piping shall slope toward the sanitary trap at least 1/2 in. (13 mm) in the first 2 ft (61 cm) and the remainder of the pipe shall slope a minimum of 0.8%. The sanitary trap shall be installed so that any liquid collected in the sanitary trap cannot get back into the receiver, releaser, or vacuum milk holding tank. Sanitary traps designed for mechanical cleaning may be cleaned by reverse flow.

E8.6 If a distribution tank is used, it shall be self-draining except for normal adherence.

E9 **Milk Receiver, Pump, and Releaser**

E9.1 The milk level sensing device shall be designed so that milk will not reach the lowest inlet in the milk receiver.

E9.2 When a centrifugal or positive rotary type milk pump is used to remove the milk from the receiver, it shall conform to the 3-A Sanitary Standards for Centrifugal and Positive Rotary Pumps for Milk and Milk Products, Number 02-. The pump shall be located so that it is readily accessible for cleaning and/or inspection.

E9.3 The pump shall be actuated by a level sensing device. All product contact surfaces of the device shall be readily demountable for inspection and shall be located so that all of the product contact surfaces are reached by the rinse and wash solutions.

E9.4 A releasing mechanism, when provided, shall be of a sanitary design, and operated so that the milk will not reach the lowest milk inlet of the receiver during milking.

E9.5 The pump and interconnecting piping shall be installed so that they are self-draining except for normal adherence. Drains shall terminate above the floor and shall not be connected to sewage lines.

E10 The teatcup jetters in the parlor shall be covered during milking.

E10.1 Cluster cleaning devices such as teatcup jetters, when installed outside the milkroom, shall be constructed as to prevent insects, rodents, dirt, dust, and other contaminants from gaining access to milk contact surfaces and solution contact surfaces. They shall provide complete drainage, except for normal adherence, of clusters, long milk tubes, and solution contact surfaces.

E11 **Automatic Backflush Systems**

E11.1 When backflush is used, it shall include a valve between the claw and the milk inlet which provides a complete separation, with an air gap, between the solution inlet and milk line.

E11.2 The backflush cycle shall include a pre- and post-rinse with safe water.

E11.3 After final rinse, any remaining water shall be blown from the cluster with compressed air or removed from the unit by vacuum. This is to be accomplished before the valve returns to the milking position.

E11.4 If compressed air is used to blow water from the unit or injected into the sanitizer or rinse solution, the air must be produced using equipment conforming to the 3-A Accepted Practices for Supplying Air Under Pressure in Contact with Milk, Milk Products and Product Contact Surfaces, Number 604-.

E12 **Heat Exchangers**

E12.1 When plate heat exchangers are used as milk coolers in milking systems, they shall conform to 3-A Sanitary Standards for Plate Heat Exchangers for Milk and Milk Products, Number 11-.

E12.2 When tubular heat exchangers are used as milk coolers in milking systems, they shall conform to 3-A Sanitary Standards for Tubular Heat Exchangers for Milk and Milk Products, Number 12-.

E12.3 Other types of heat exchangers, such as refrigerated receivers, if used as milk coolers in milking systems, shall conform to the applicable criteria in Sections C and D of 3-A Accepted Practices for the Design, Fabrication and Installation of Milking and Milk Handling Equipment, Number 606-.

E12.4 Recirculated cold water which is used in plate or tubular heat exchangers shall be from a safe source, shall be nontoxic, and shall be protected from contamination. Such water shall be tested semiannually and shall conform to appropriate bacteriological standards.

F **MANUFACTURER'S INSTRUCTIONS**

F1 The manufacturer shall furnish instructional charts and literature on milking systems giving the maintenance schedules and operational instructions. This shall include the recommended assembly and disassembly procedures of all components. It shall also include lubrication and maintenance schedules for vacuum pumps, milk pumps, pulsators, and vacuum regulators.

G **APPLICATION TO INSTALL PIPELINE MILKING MACHINES**

G1 Prior to the installation of a pipeline milking machine, the producer shall first make application on a suitable form, as prescribed by the control authority, or in the absence of a required form, on a form as suggested herein (See Appendix, Section U). The producer shall provide the control authority with two copies of the necessary details and flow diagrams. Approval of the application shall be obtained prior to the starting of installation.

G2 Changes in existing milking systems, affecting capacity or arrangement, shall be submitted to the control authority.

APPENDIX

NOTE: This Appendix is an adjunct to the preceding section of these practices. Its purpose is to provide supplemental information and nonnormative guidance in the design, fabrication and installation of milking machines.

H **STAINLESS STEEL MATERIALS**

Stainless steel conforming to the applicable composition ranges established by AISI for wrought products, or by ACI for cast products, should be considered in compliance with the requirements of Section C1 herein. Where welding is involved, the carbon content of the stainless steel should not exceed 0.08 %. The first reference cited in C1.2 sets forth the chemical ranges and limits of acceptable stainless steel of the 300 Series. Cast grades of stainless steel corresponding to types 303, 304, and 316 are designated CF-16F, CF-8, and CF-8M, respectively. The chemical compositions of these cast grades are covered by ASTM[5] specifications A351/A351M, A743/A743M and A744/A744M.

I **PRODUCT CONTACT SURFACE FINISH**

Surface finish equivalent to 150 grit or better as obtained with silicon carbide, properly applied on stainless steel sheets, is considered in compliance with the requirements of Section D1 herein. A maximum R_a of 32.0 µin. (0.80 µm), when measured according to the recommendations in American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME)[6] B46.1 - *Surface Texture*, is considered to be equivalent to a No. 4 finish.

J **PROCEDURES FOR TESTING SANITARY CHECK VALVE PERFORMANCE ON BUCKET-TYPE MILKERS**

J1 This procedure has been devised to test the performance of the sanitary check valve on bucket-type milking machines using a laboratory installation of the vacuum system. The only variations in the vacuum system used in this test (See Figure 1) from that used on dairy farms are: (a) a stall cock between the vacuum pump and the controller, as a means of controlling the vacuum, and (b) location of a vacuum gauge between the

[5] Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959. Phone: (610) 832-9500.

[6] Available from the American Society of Mechanical Engineers, 345 East 47th Street, New York, NY 10017-2392 (212) 705-7722.

two stall cocks to which the units are attached during the test. The test should be conducted in the following manner using only the facilities outlined in the accompanying drawing:

J1.1 Set up pump, controller, trap, and stall cocks as indicated in Figure 1.

J1.2 Assemble two clean, dry milking machine units.

J1.3 Start the vacuum pump. Attach the vacuum tube to the stall cocks and apply vacuum to both units. Adjust the vacuum and pulsator speed to those recommended by the manufacturer.

J1.4 Reduce the vacuum in the system by opening the vacuum controlling valve at the pump until the needle on the gauge just starts to drop, not exceeding 1/2 in. of mercury (1.72 kPa) vacuum below the normal milking vacuum recommended by the manufacturer. (See step J1.3.)

J1.5 While the units are under vacuum, inject 5 mL of water with a syringe into the vacuum tubes of each unit, approximately 4 in. (101.6 mm) from the check valve.

J1.6 Admit air through the teatcups to one of the units to produce a momentary 4 in. of mercury (13.7 kPa) drop in vacuum (or the maximum drop permitted by the design of the machine), indicated on the vacuum gauge.

J1.7 Close the stall cock to which the vacuum tube of this unit is attached, remove the vacuum tube, and release the vacuum in the pail in the normal manner. (The vacuum tube must be maintained in a position favoring drainage toward the check-valve, as is the case when a unit is routinely moved from one stall cock to another.) The pail or container lid is not to be removed.

J1.8 Immediately attach this unit again to the stall cock, open stall cock, and re-establish the normal operating vacuum.

J1.9 Follow steps J1.6, J1.7 and J1.8 with the other unit.

J1.10 Repeat steps J1.5 to J1.8 inclusive, alternatively with the two units, five additional times (so that 30 mL of water will have been injected into each air hose.) Then release the vacuum and carefully remove and examine the lid, the check valve, and the interior of the pail of each unit, separately. The presence of moisture on the underside of the check valve, on the underside of the lid, or in the pail indicate failure of the check valve to function effectively in preventing backflow of potential contamination and indicates nonconformance to the requirement of E3.1.

K The GAR C-9 Scale For Visual Comparison

K1 The GAR C-9 Cast Microfinish Comparator[7] is used to evaluate surface roughness of metallic castings. The GAR C-9 Scale provides a measure of the degree of smoothness typical for alloy castings made by currently available casting methods. The GAR C-9 Scale consists of nine RMS surface roughness finishes covering a range from 20 µin. (0.51 µm) to 900 µin. (22.9 µm). The scales applicable for investment castings are the C-20, C-30, and C-40 having corresponding RMS values of 60 µin. (1.52 µm), 120 µin. (3.05 µm), and 200 µin. (5.08 µm). Areas of transition, such as chamfers, fillets, beads, etc., may conform to the next roughest scale.

L INSTALLING, SIZING AND PERFORMANCE GUIDELINES

The installing, sizing, and performance guidelines outlined in American Society of Agricultural Engineers (ASAE) Standard: ASAE S-518 Milking Machine Installations, Construction and Performance[8] should be followed.

M MAIN AIR LINES AND/OR PULSATOR AIR LINES

M1 Pipe and fittings used in main air lines and/or pulsator air line installations should be capable of withstanding vacuums of 25.0 in. (635 mm) of mercury without collapsing.

M2 Pulsator air lines should be looped to (1) a vacuum distribution tank or (2) a vacuum pulsator header line. A single header line should be a minimum of one size larger than the pulsator air line, unless the pulsator air line is sized larger than the minimum size specified in ASAE S-518. (See Appendix, Section L.)

[7] Available from GAR Electroforming Division, Box 340, Danbury, CT 06813-0340 (203) 744-4300.

[8] Available from American Society of Agricultural Engineers, 2950 Niles Road, St. Joseph, MI 49085-9659 (616) 429-0300.

N **MILK LINE AND VACUUM SYSTEM CAPACITY**

N1 The milk line size should be deemed to be sufficient if, upon installation of a milking system, it meets the maximum milk line vacuum drop in accordance with Appendix, Section L.

N2 The vacuum system should be deemed to have sufficient capacity if, upon installation of a milking system, it meets the vacuum capacity and reserve performance criteria in accordance with Appendix, Section L.

O **OPERATION, MAINTENANCE, AND SERVICE**

O1 **Installation Check**

O1.1 It is recommended that immediately after installing, the installer should perform the dynamic milk test according to ASAE EP 445 - Test Equipment and Its Application for Measuring Milk Handling Equipment.

O.2 **Service Check**

O2.1 It is strongly recommended that a complete service check and milking system performance evaluation be performed by an authorized milking machine dealer on an hourly use basis as recommended by the machine manufacturer or at least once a year. The suggested test should include (1) operating vacuum level, (2) vacuum pump capacity, and (3) effective reserve. It is highly desirable that a service report and milking system test report be supplied by the milking machine manufacturer and followed closely by their authorized dealer during the service check. A copy of the completed report should be furnished to the owner.

O3 **Vacuum System**

The following recommendations, if followed, should aid in trouble-free operation of the vacuum system.

O3.1 **Vacuum Pump**

O3.1.1 Use only oil recommended by the manufacturer and maintain it at proper level. Change oil as frequently as recommended by the manufacturer.

O3.1.2 Consult a qualified dealer and the control authority before adding units to a milking system.

O3.1.3 Keep pulleys and belts free of oil and grease. Check the operator's manual for the proper belt tension. Keep shields and guards in place.

O3.2 Check the pulsator(s) as recommended by the manufacturer to see that it is properly adjusted.

O3.3 Check vacuum tubes and main air lines and/or pulsator air lines weekly, and clean as needed. Any leak in the vacuum pipeline should be corrected immediately.

O3.4 Check for vacuum leaks in all stall cocks, milk inlets, valves, gaskets, and other fittings.

O3.5 Check and clean vacuum regulator and sanitary traps weekly.

O4 **Milker Units**

O4.1 Teatcup liners or inflations should be changed as recommended by the manufacturer and damaged parts should be replaced immediately.

O4.2 Only milk hoses, short milk tubes, short pulse tubes, long pulse tubes, and vacuum tubes of the recommended inside diameter should be used. Hoses and tubes should be kept free of obstructions and kinks.

P **RELEASER**

P1 The operation of the releaser should not cause the vacuum in the system to drop more than 1 in. (25.4 mm) of mercury.

Q **TRANSFER STATIONS**

Q1 To prevent excessive agitation and incorporation of air into the milk, pump-type stations should be equipped with level sensing devices to start and stop the pump motor. Vacuum operated stations should be equipped with check valves for the same purpose.

R **CLEANING AND SANITIZING PROCEDURES**

R1 A rinsing, cleaning, and sanitizing regimen which has been demonstrated to be effective should be employed. Prior to installation, a description of the cleaning regimen that has been determined to be effective should be made available to the producer. Because of the possibilities of corrosion, the recommendations of the cleaning compound manufacturer should be followed with respect to the time, temperature, and the concentration of specific detergent solutions and bactericides. To insure proper strength of solution and to avoid corrosion, the cleaning compound should be completely dissolved or dispersed prior to circulation. One regimen found to be satisfactory is as follows:

R1.1 Immediately after concluding each milking, all connections between wash lines and milking equipment are made; equipment which is not included in the cleaning circuit is removed, the openings are capped, by-pass connections are made, and lines are rinsed thoroughly with tepid water at 90° to 105°F (32° to 40°C) entering circuit, continuously discarding the water at the downstream end of the solution return line until the discarded effluent is clear.

R1.2 All solution and product contact surfaces not cleanable by mechanical cleaning procedures such as valves, slip joints, milk inlets, etc. should be cleaned manually.

R1.3 An effective detergent solution should be circulated for a period of time at a concentration and temperature capable of effectively removing the soil residue in the circuit.

R1.4 The detergent solution should be thoroughly rinsed from the circuit with an acid solution.

R1.5 Immediately prior to the next milking, the line should be rinsed with clean water to which an approved sanitizing agent has been added. Then let drain before starting to milk.

R2 Provisions should be made for adequate warm water under pressure to be available for cleaning the outside or nonproduct contact surfaces of the cluster including tubes. Dismantling for replacing rubber parts and/or manual cleaning of product contact surfaces should be done in the milkroom.

R3 Provide means by which milk measuring devices which are not mounted permanently on the milking system but are used occasionally (for example, monthly) can be cleaned per manufacturer's recommendations.

R4 Water heating capacity is considered adequate if the detergent solution in the wash vat is maintained at a minimum of 120°F (50°C). Manufacturer's recommendations for water requirements should be followed. Use the information below to determine the amount of water to wash the milking system.

R4.1 **Hot Water Requirements**

Calculate the amount of hot water in the vat for washing per the following table. The amounts are valid for an ambient temperature down to 50°F (10°C) and when the water temperature is at least 160°F (71.1°C) at the start of the washing cycle, i.e. start of vacuum pump.

Component	Water Requirement
1 1/2 in. (33.10 mm) Drawlines, Wash Lines, and Milk Lines	0.4 gal/10 ft (0.5 L/m)
2 in. (50.80 mm) Drawlines, Wash Lines, and Milk Lines	0.6 gal/10 ft (0.7 L/m)
2 1/2 in. (63.50 mm) Milk Lines	0.8 gal/10 ft (1.0 L/m)
3 in. (76.20 mm) Milk Lines	1.2 gal/10 ft (1.5 L/m)
2 in. (50.80 mm) Discharge Line	1.4 gal/10 ft (1.7 L/m)
Weigh Jar	1.0 gal (3.78 L)/unit
Milk Meter	0.5 gal (1.89 L)/unit
Receiver	3.0 gal (11.34 L)/receiver
Vat	Additional 7.0 gal (26.5 L) or 25% of above (use larger value)

At colder ambient temperature, wash with more hot water or start at a higher water temperature. For example, at 30°F (-1.1°C) ambient temperature, 20-25% more water must be added or wash must start at 175° to 180°F (79.4° to 82.2°C). If wash starts at a lower 150°F (65.6°C) water temperature, add about 25% more hot water.

S MILK LINE OR WASH LINE SUPPORTS

S1 Permanently installed pipeline supports should not be suspended from ceiling or joists in barns in which heavy feed, etc. is stored overhead. Supports should be spaced no more than 10 ft (3050 mm) apart. A support should be provided within 2 ft (610 mm) of every direction change.

T REFERENCES

T1 3-A Sanitary Standards for Centrifugal and Positive Rotary Pumps for Milk and Milk Products, Number 02-.

T2 3-A Sanitary Standards for Milk and Milk Products Filters Using Disposable Filter Media, Number 10-.

T3 3-A Sanitary Standards for Plate Type Heat Exchangers for Milk and Milk Products, Number 11-.

T4 3-A Sanitary Standards for Tubular Heat Exchangers for Milk and Milk Products, Number 12-.

T5 3-A Sanitary Standards for Farm Milk Cooling and Holding Tanks, Number 13-.

T6 3-A Sanitary Standards for Multiple-Use Rubber and Rubber-Like Materials Used as Product Contact Surfaces in Dairy Equipment, Number 18-.

T7 3-A Sanitary Standards for Multiple-Use Plastic Materials Used as Product Contact Surfaces for Dairy Equipment, Number 20-.

T8 3-A Sanitary Standards for Farm Milk Storage Tanks, Number 30-.

T9 3-A Sanitary Standards for Uninsulated Tanks for Milk and Milk Products 32-.

T10 3-A Sanitary Standards for Polished Metal Tubing for Dairy Products, Number 33-.

T11 3-A Sanitary Standards for Plug-Type Valves for Milk and Milk Products, Number 51-.

T12 3-A Sanitary Standards for Thermoplastic Plug Type Valves for Milk and Milk Products, Number 52-.

T13 3-A Sanitary Standards for Compression-Type Valves for Milk and Milk Products, Number 53-.

T14 3-A Sanitary Standards for Sanitary Fittings Used for Milk and Milk Products, Number 63-.

T15 3-A Sanitary Standards for Sensor and Sensor Fittings and Connections Used on Fluid Milk and Milk Products Equipment, Number 74-.

T16 3-A Accepted Practices for Supplying Air Under Pressure in Contact with Milk, Milk Products, and Product Contact Surfaces, Number 604-.

U **APPLICATION TO INSTALL PIPELINE MILKING SYSTEMS**

U1 After application has been made, as in Section G, the applicant should be notified promptly of any necessary changes.

U2 Each "type" of a manufacturer's standards unit may be made available by the dealer to the proper control authority, for general approval for installation in the control authority's jurisdiction at anytime. It is recognized that any manufacturer's so-called standards does not fit all operating conditions of all users. Therefore, if any installation requires deviations from the standards already generally approved for use in the jurisdiction, the details of all deviations must be submitted with the initial application for installation and approval received prior to the installation. It is urged that deviation details thus submitted be acted upon by the control authority promptly after being received.

U3 It is recommended that all milk control authorities adopt an "Application to Install or Modify a Milking System" form.

These practices are effective November 24, 2002.

APPLICATION TO INSTALL OR MODIFY A MILKING SYSTEM

Date: _____

Name of Producer: _____

Address: _____

State and Zip Code: _____

Phone/Fax/E-mail: _____

Producer's Regulatory License or Permit Number: _____

Milk Dealer or Buyer: _____

I HEREBY MAKE APPLICATION FOR PERMISSION TO INSTALL OR MODIFY A MILKING SYSTEM TO BE MECHANICALLY CLEANED IN PLACE. THIS EQUIPMENT WILL CONFORM TO OR EXCEED 3-A ACCEPTED PRACTICES FOR THE DESIGN, FABRICATION, AND INSTALLATION OF MILKING AND MILK HANDLING EQUIPMENT, NUMBER 604-.

I INSTRUCTIONS:

A. All blanks that apply to this installation must be completed.

B. This application must be accompanied by a detailed legible drawing of the milking system showing the following:

1. High Point
2. Direction of Milk Flow
3. Receiver(s) or Transfer Station
4. Air Injector(s)
5. Inspection Point(s)
6. Wash Vat(s)
7. Milk Cooling and Holding Tank(s)
8. Milk Pre-Cooler(s)

II FABRICATION OF MILKING SYSTEM:

A. **Milk Line:**

1. Material(s) _____
2. Diameter _____ in.(mm)
3. Length _____ ft (m)
4. Welded _____
5. Gasketed _____
6. Number of Slopes _____
7. Slope _____ in. per 10 ft. (mm per m)
8. High Line _____
9. Maximum Height from Floor _____ in. (mm)
10. Low Line _____

B. **Receiver:**

1. Number of Inlets _____
2. Size of Milk Inlet(s) _____ in.(mm)
3. Size of Vacuum Inlet _____ in. (mm)
4. Sanitary Trap: **Yes** _____ **No** _____

C. **Auxiliary Milking Equipment:**

		Number	**Brand**
1.	Milk Meter(s)	_____	_____
2.	Milk Weighing Device(s)	_____	_____
3.	Automatic Take-Off	_____	_____
4.	Automatic Backflush	_____	_____
5.	End of Milking Indicators	_____	_____
6.	Milk Filtration	_____	_____

7. Transfer Station Vacuum _____ Electric _____
8. Other (specify) _____

D. **Vacuum System:**

1. Main Air Line **Material** _____ **Diameter** _____ in.(mm) **Length** _____ft (m)
2. Pulsator Air Line **Material** _____ **Diameter** _____ in. (mm) **Length** _____ft (m)
3. Automatic Drains in Pulsator Air Lines **Yes** _____ **No** _____
4. Number of Clusters _____
5. Vacuum Pump(s) **Brand** _____ **Model(s)** _____ **hp (kJu)** ____
6. Total Vacuum Pump Capacity _____ CFM/ASME at 15 in. Hg. (51.4 kPa)
7. Vacuum Regulator **Brand** _____ **Model** _____

8. Number of Distribution Tank(s) _____
9. Other (specify) _____

E **Milk Cooling and Storage System:**

1. Pre-Cooler _____ **Brand(s)** _____ **Type** _____ **Number** _____
2. Type of Coolant(s) _____
3. Milk Cooling &Holding Tank **Brand** _____ **Model** _____
   Serial No. _____
   Milk Capacity _____ **Cooling Capacity BTU/hr (kJu/h)**_____

F **Cleaning and Sanitizing System:**

NOTE: Water temperature of the wash cycle must be maintained at 120°F (49°C) or higher.

1. Automatic _____ Manual _____
2. Automatic Pre-Rinse Diverter Valve _____
3. Wash Procedure **Pre-Rinse** _____ gallons (L)
   Wash Cycle _____ gallons (L) **Time** ____ minutes
   Acid/Post Rinse _____ gallons (L)
   Sanitize _____ gallons (L)
4. Teatcup Jetters **Yes**_____ **No** _____

G **Water Heating Equipment:**

1. Type of Heater **Electric** _____ **Gas** _____ **Other** _____
2. Capacity of Heater _____ gallons (L)
3. Recovery Rate Gal/HR/100°F (38°C) Rise _____ gallons (L)
4. Additional Water Heating _____ **Type** _____

H **Manually Cleaned Components:** (Circle all that apply)

Diverter Plug(s) Manual Shut-Off Valve(s) Milk Tank Outlet Valve(s)

List other components in this system: _____

I **Physical Separation of Wash System (Lines) From:**

1. Milking System During Milking **Yes** _____ **No** _____
2. Milk Tank During Milk Storage **Yes** _____ **No** _____

J **Initial Dynamic Test**

Performed **Yes** _____ **No** _____ **Date**_____

A CLEANING PROGRAM INCLUDING WATER HARDNESS, DETERGENT AND SANITIZER MUST BE POSTED IN THE MILK ROOM

The posted chart shall be legible and protected to provide a degree of permanency. If procedure is changed in any way, a new program must be posted.

ANY FUTURE MODIFICATION OF THIS EQUIPMENT MUST HAVE PRIOR WRITTEN APPROVAL

Owner or Authorized Representative: _____
Signature

Installer/Dealer: _____

Signature

_____

Address

_____

Phone Number

OFFICIAL ACTION

1. Plan Approval

Fieldman: _____ _____

Signature Date

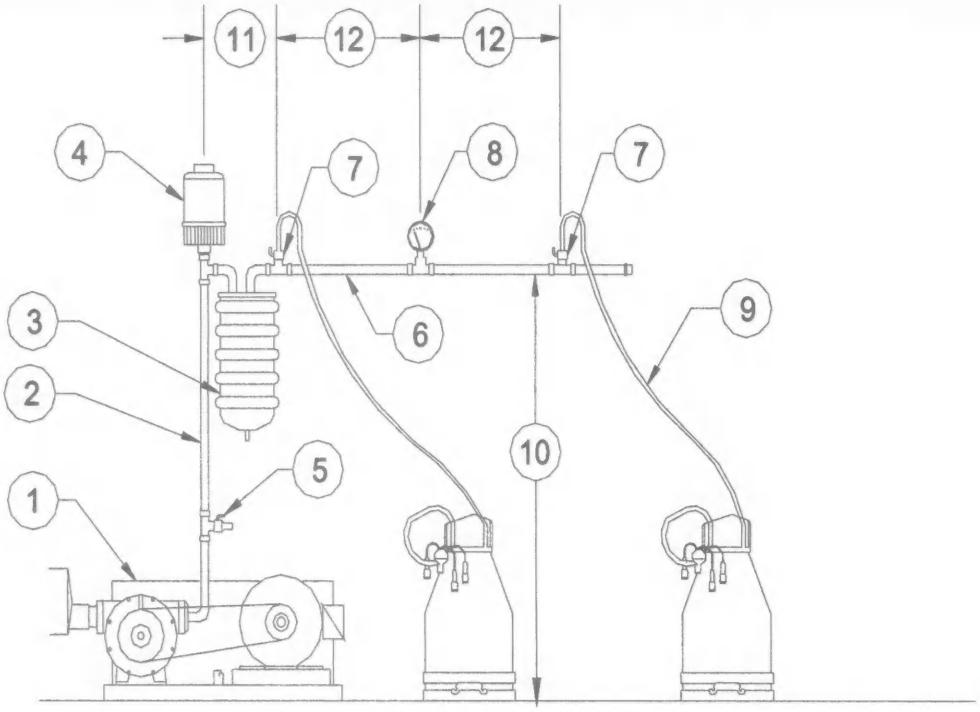
Regional Sanitarian: _____ _____

Signature Date

2. Installation Approval

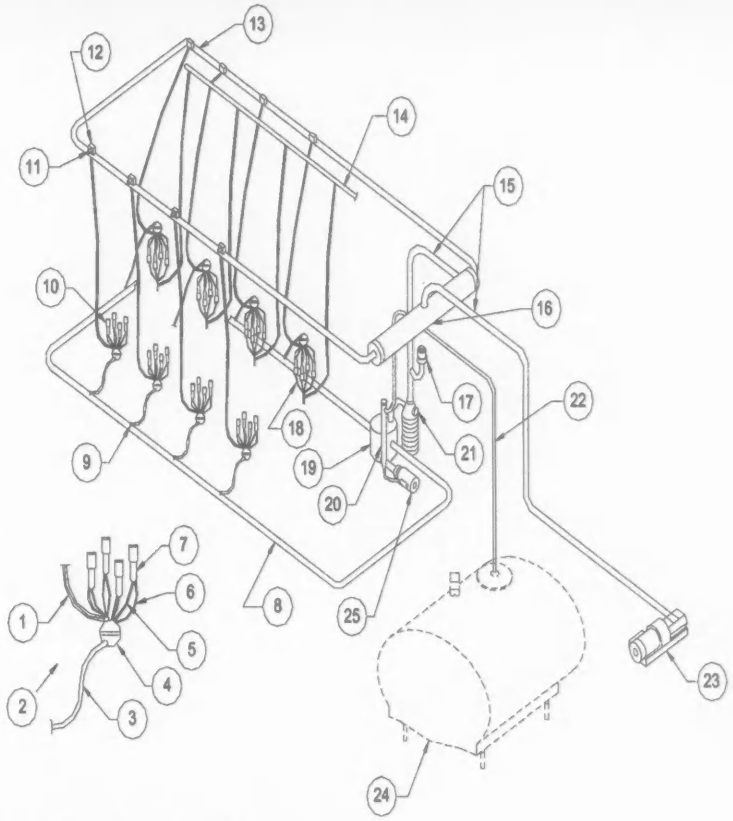
Regional Sanitarian: _____ _____

Signature Date



1. VACUUM PUMP
2. 1 PIPE
3. SANITARY TRAP
4. REGULATOR
5. VALVE FOR CONTROLLING VACUUM
6. 1 PIPE
7. STALL COCK
8. VACUUM GAUGE
9. VACUUM TUBES TO DRAIN TOWARD CHECK VALVE
10. 60
11. 12
12. 18

NOTE:
1. INSTALL REGULATOR AND VACUUM GAUGE PER MANUFACTURERS SPECIFICATIONS.
2. STALL COCKS TO BE POSITIONED PER MANUFACTURERS SPECIFICATIONS.



PIPELINE MILKING SYSTEM

1. LONG PULSE TUBE
2. MILKING UNIT
3. LONG MILK TUBE (MILK HOSE)
4. CLAW
5. SHORT MILK TUBE
6. SHORT PULSE TUBE
7. TEATCUP SHELL
8. MILKLINE
9. MILK INLET
10. MILKING UNITS
11. STALLCOCK
12. PULSATOR
13. PULSATOR AIRLINE
14. WASHLINE
15. MAIN AIRLINE
16. DISTRIBUTION TANK
17. REGULATOR (CONTROLLER)
18. TEATCUP JETTER
19. RECIEVER
20. MILK FILTER
21. SANITARY TRAP
22. MILK DELIVERY (TRANSFER) LINE
23. VACUUM PUMP
24. MILK COOLING AND HOLDING TANK
25. MILK PUMP

COMING EVENTS

MARCH

- **3-7, Dairy Technology Workshop,** Randolph Associates, Inc., Birmingham, AL. For additional information, call 205.595.6455; E-mail: us@randolphconsulting.com.
- **4-6, Principles of Food Microbiology,** Huntington Beach, CA. For more information, contact Silliker at 800.829.7879 or log onto www.silliker.com.
- **10-11, Aseptic Only, Better Process Control School,** Cook College, Rutgers, New Brunswick, NJ. For more information, call 732.932.9271.
- **12-14, Michigan Environmental Health Association 59th Educational Conference,** Valley Plaza Hotel, Midland, MI. For more information, contact Bruce DuHamel at 989.831.3637.
- **18-20, Food Safety Summit,** DC Convention Center, Washington, D.C. For more information, call 800.746.9646.
- **18-20, Idaho Environmental Health Association Annual Meeting,** Boise, Idaho. For more information, contact Frank Isenberg at 208.334.5947.
- **20, IAFIS 2003 Annual Conference,** Marco Island Marriott Resort and Golf Club, Marco Island, FL. For more information, contact Alexis de la Rosa at 703.761.2600 ext. 207; E-mail: adelarosa@iafis.com.
- **24-25, United Fresh Fruit & Vegetable Assn. Produce Inspection Training Program, Introductory Course,** Fredericksburg, VA. For more information, contact United at 703.836.3410.
- **26-28, United Fresh Fruit & Vegetable Assn. Produce Inspection Training Program, Advanced Course,** Fredericksburg, VA. For more information, contact United at 703.836.3410.
- **27, Ontario Food Protection Association Annual Spring Meeting,** Mississauga Convention Centre, Mississauga, Canada. For more information, contact Glenna Haller at 519.823.8015.

APRIL

- **2-4, Missouri Milk, Food and Environmental Health Association Annual Educational Conference,** Ramada Inn, Columbia, MO. For more information, contact Linda Haywood at 417.829.2788.
- **3-5, Fresh-Cut Produce Association's 16th Annual Conference and Exhibition, Tampa, FL.** For additional information, contact IFPA at 703.299.6282.
- **7-8, Ensuring Meat Safety: *E. coli* O157:H7 — Progress and Challenges,** Embassy Suites, Lincoln, NE. For more information, contact Pauline Galloway at 402.472.9751; E-mail: pgalloway2@unl.edu.
- **22-25, ICCR 2003 – 3rd International Conference on Cryogenics and Refrigeration,** Hangzhou, China. For more information, visit http://www.cmee.zju.edu.cn/ICCR3.htm.
- **23-24, Kansas Association of Sanitarians Annual Spring Meeting,** Rock Springs Camp, Junction City, KS. For more information, Tim Wagner at 800.527.2633.
- **26-May 1, 29th National Conference on Interstate Milk Shipments,** Doubletree Hotel, Seattle, WA. For more information, contact Leon Townsend at 502.695.0253; E-mail: ltownsend@ncims.net.
- **30-May 1, Managing Your Food Safety and Quality Systems,** Oak Brook, IL. For more information, contact Silliker at 800.829.7879 or log onto www.silliker.com.

MAY

- **6-7, Dairy and Food Plant Wastewater Short Course,** Madison, WI. For more information, contact Dr. Bill Wendorff at 608.263.2015.
- **6-8, PACex International,** Toronto International Centre, Toronto, Canada. For more information, contact Maria Tavares at 416.490.7860 ext. 219; E-mail: mtavares@pacexinternational.com.
- **8-11, 3rd International Exhibition and Conference for Food Technology,** International Trade Fairs Ground (Hall 2), Cairo, Egypt. For more information, contact Mahmoud Helmy at 202.30.50.898; E-mail: info@agd-exhibitions.net.
- **13-14, Pennsylvania Association of Milk, Food and Environmental Sanitarians Spring Meeting,** Nittany Lion College. For more information, contact Eugene Frey at 717.397.0719.
- **20-21, Associated Illinois Milk, Food and Environmental Sanitarians Annual Spring Meeting,** Bloomington, IL. For more information, contact John Ellingson at 815.490.5523.
- **21, Dairy HACCP Workshop,** Madison, WI. For more information, contact Marianne Smukowski at 608.265.6346.
- **28, Metropolitan Association for Food Protection Annual Spring Meeting,** Cook College, Rutgers, New Brunswick, NJ. For more information, contact Carol Schwar at 908.689.6693.

JUNE

- **13-20, International Workshop/Symposium on Rapid Methods and Automation in Microbiology XXIII,** Kansas State University, Manhattan, KS. For more information, contact Daniel Y. C. Fung at 785.532.5654; E-mail: dfung@oznet.ksu.edu.
- **25-27, South Dakota Environmental Health Association Annual Meeting,** Ramkota Convention Center, Pierre. For more information, contact Clark Hepper at 605.773.3364.

IAFP UPCOMING MEETINGS

AUGUST 10-13, 2003
New Orleans, Louisiana

AUGUST 8-11, 2004
Phoenix, Arizona

AUGUST 14-17, 2005
Baltimore, Maryland

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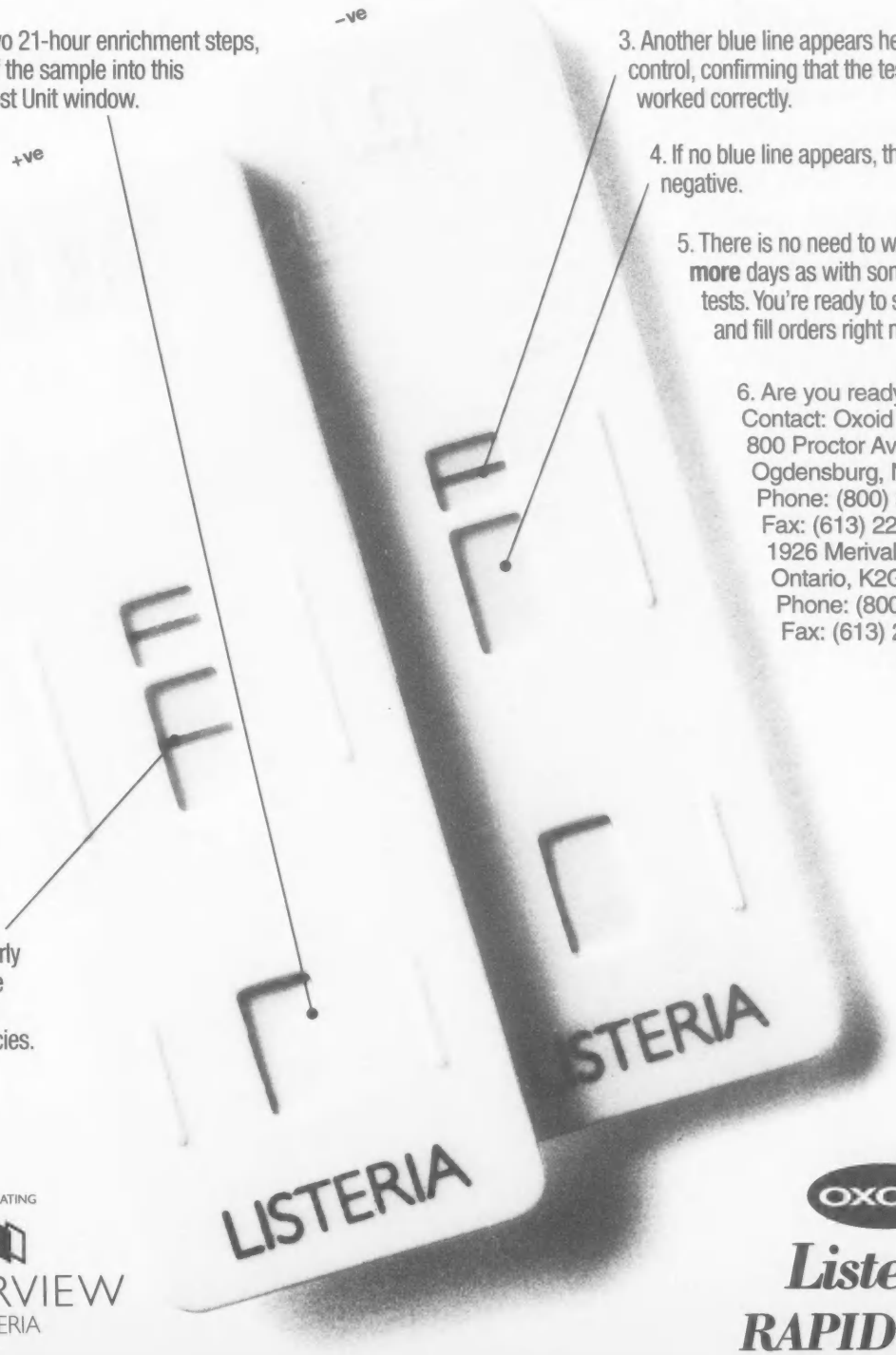

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