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FOOD PROTECTION

SCIENCE AND NEWS

FROM THE
INTERNATIONAL ASSOCIATION
FOR FOOD PROTECTION

TRENDS

APRIL 2003



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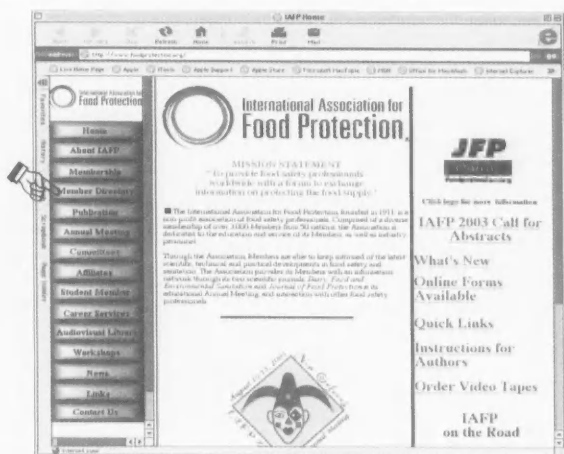
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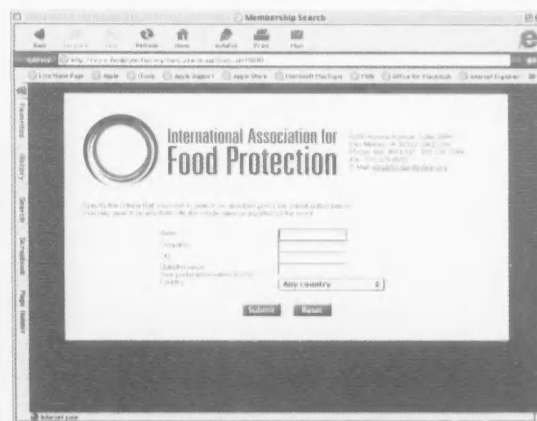
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"THOUGHTS" FROM THE PRESIDENT

In our profession, it seems many of us tend to take special note of examples of really bad food handling mistakes, those that defy logic, and of unusual circumstances that lead to unfortunate outcomes. For example, an outbreak of salmonellosis at prison, ultimately traced to the workout room, because of weightlifters who ate raw eggs and didn't wash their hands. The inmates however, were adamant that "it was the meat loaf, man."

This case is described in a three-part series on "A Day in the Life of a Public Health Inspector" in our weekly community paper, *The Guelph Tribune*. Journalist Virginia McDonald accompanied a local health inspector on his rounds of restaurants and delis, and wrote knowledgeably about what she learned. It is a well-written series, conveying lots of good food safety information. Of value are the stories and the everyday context for identifying the bad, and good, food handling practices, and the reasons why.

Communicating about safe food practices in everyday language and context, and in an everyday medium is essential today. Of course, television is probably the number one information source for many people. The huge popularity of TV cooking shows is astounding, and I am beginning to think I am the only person on this continent who doesn't have a favorite celebrity chef or show! (It used to be that one could manage small talk with "the guys" if one was up on the most current NCAA basketball team rankings, now it's Emeril's



By ANNA M. LAMMERDING
PRESIDENT

**"Communicating about
safe food practices in
everyday language and
context, and in an
everyday medium is
essential today"**

Creole cooking, or favorite
flavored oils and vinegars...)

Doug Powell, Director of the Food Safety Network at the University of Guelph and a well-known, rather forthright, food safety risk communicator, undertook a formal study of the food safety practices of TV celebrity chefs. Based on 29 hours of detailed viewing of taped broadcasts, his team observed basic food-safety errors about every five minutes, especially cross-contamination and time-temperature violations. There were virtually no messages about how to prepare food safely. Doug

presented his findings at a national conference of cooks and chefs, including the TV celebrities.

Feedback from the audience was tepid; one popular chef indicated that food safety is not sexy...it's boring and time-consuming.

That comment brought to mind a great little book written by Professor David Waltner-Toews at the University of Guelph, entitled *Food, Sex & Salmonella – The Risks of Environmental Intimacy*. The book is witty and entertaining, but more than adequately serves to inform the general reader about how our food is produced, and the how's and why's of handling food properly. On the back cover: "What sex is to interpersonal relationships, eating is to the human-environment relationship, a daily consummation of our de facto marriage to the living biosphere. This book is about the true meaning of eating, intimacy, love, vomiting and diarrhea: you and your food partner". Who says food safety can't be a little racy?!

I also note, as Frank Yiannas asks in this month's *Thoughts on Food Safety* column, "...Are Words Enough?" Not always, and so it is exciting to present in this issue the brand new *International Food Safety Icons*. Designed to convey basic food safety concepts, the members of the IAFP task force behind the *Icons* deserve to be complimented for their perseverance and thoroughness in developing these universal, easily understood symbols.

Maybe we should send complimentary copies of our *International Food Safety Icons* to all those celebrity TV chefs.

International Food Safety Icons

Available from  International Association for Food Protection®

Handwashing



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Potentially Hazardous Food



Copyright © International Association for Food Protection

Cooking



Copyright © International Association for Food Protection

Do Not Work If Ill



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Cross Contamination



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Wash, Rinse, and Sanitize



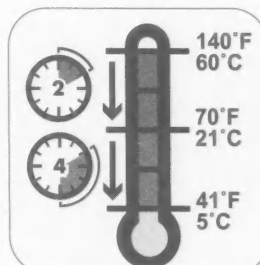
Copyright © International Association for Food Protection

No Bare Hand Contact



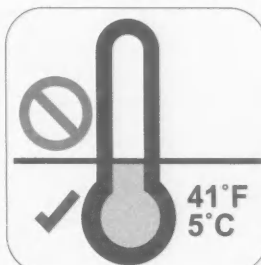
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Cooling



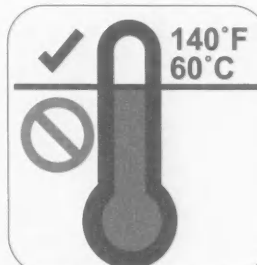
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Refrigeration/Cold Holding



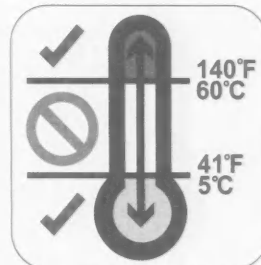
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Hot Holding



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Temperature Danger Zone



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"COMMENTARY" FROM THE EXECUTIVE DIRECTOR

This month I thought you might be interested to receive an update on various projects that have been in the works or on the drawing board. Hopefully, this is a good way to bring everyone the same information and give a progress report on the Association's business. Today we want to cover topics such as a presentation at IAFP 2003 by Elsa Murano, a possible European IAFP meeting, online submission of JFP manuscripts, the International Food Safety Icons, and status on a couple of our pamphlets. Lets get started!

Dr. Elsa Murano Presentation at IAFP 2003: We recently received confirmation from Dr. Elsa Murano, the Under Secretary for Food Safety at the United States Department of Agriculture, that she will be available to deliver a special presentation at IAFP 2003. Dr. Murano is uniquely qualified to talk with our attendees on the topic of science and food safety and I am sure she will attract a large crowd. There will also be time for questions and answers during the 45-minute plenary session. Excitement is building even at this early stage for Dr. Murano's presentation!

European IAFP Meeting: At the January Board meeting, it was decided that we should continue our research into holding an IAFP meeting in Europe and postpone our target date of October 2003. We want to have additional time to investigate potential partnering efforts and sponsorship possibilities. It now looks as if October of 2004 would be the next feasible time to hold such a meeting.

To avoid confusion, it should be stated that a European meeting would not replace the IAFP Annual Meeting; it would just provide a supplement to it. A meeting in



By DAVID W. THARP, CAE
EXECUTIVE DIRECTOR

*"I am happy to talk
with you about these
or other projects of
interest to you"*

Europe would give our European Members (and others) a place to gather around the "IAFP banner" to discuss food safety issues and to meet with colleagues.

Online Submission of JFP Manuscripts: Also at the January Board meeting, the Board approved moving forward with a system to allow online submission of manuscripts for the *Journal of Food Protection*. We set a target date of June 1st to have this system in place, but it looks like we will be ready to accept manuscripts sometime in April. So, the next time you are preparing a JFP manuscript, please consider submitting it online to speed the processing time!

International Food Safety

Icons: The International Food Safety Icons are now available! The Icons are simple pictorial representations of important food safety tasks that can be recognized and understood regardless of a person's native language. These Icons have been developed over the past year or so and are now ready for your use. See the "Thoughts on Today's Food Safety" column beginning on page 368 for additional details.

Pamphlets Updated:

Recently, two of our pamphlets have gone through extensive review and updating. They are "Before Disaster Strikes...A Guide to Food Safety in the Home" and "Food Safety at Temporary Events". Both pamphlets are designed for distribution by county or provincial health departments. The first pamphlet gives suggestions for preparing an emergency food and water supply and tips on evaluating foods after a disaster has occurred. The second pamphlet gives guidance to street vendors who operate food stands at various one-of-a-kind festival or fairs. Both are available through the IAFP office. For details, see the order form on page 366.

We are in the process of having both pamphlets translated to Spanish for wider distribution potential. It is our hope that we will be able to accommodate orders for the Spanish versions by June or July of this year.

In summary, I hope that this column gives you information that is useful whether you are a new Member or a long-time Member of IAFP. Certainly, at any time you have questions on the status of projects undertaken by IAFP, you may contact me at the IAFP office. I am happy to talk with you about these or other projects of interest to you.

Dr. Elsa A. Murano

Under Secretary for Food Safety
United States Department of Agriculture

Plenary Session

August 12, 2003 — 3:45 p.m. — 4:30 p.m.
New Orleans, Louisiana



Dr. Elsa A. Murano will deliver a special presentation during a plenary session on Tuesday, August 12 at IAFP 2003 in New Orleans, Louisiana. Dr. Murano is uniquely qualified to address the IAFP audience having obtained her doctorate in food science and technology from Virginia Tech and having held various faculty positions at both Texas A&M and Iowa State University for 10 years prior to her work with the United States Department of Agriculture. Time will be allowed for a question and answer period during the 45 minute plenary session.

Dr. Murano was sworn in as Under Secretary for Food Safety by Agriculture Secretary Ann M. Veneman on October 2, 2001. In this position, she oversees the policies and programs of the Food Safety and Inspection Service.

Dr. Murano has extensive public and private experience in the field of food safety as both a manager and educator. From 1995 until her swearing-in, Dr. Murano held several positions with Texas A&M University at College Station, Texas. Between 1997 to 2001 she served as the Director of the university's Center for Food Safety within the Institute of Food Science and Engineering. During this time she also served on the university's Department of Animal Science Research Advisory Committee and the Food Safety Response Team of the Texas Agriculture Extension Service, and served from 1999 to 2001 as the chair of the Food Safety State Initiative Committee of the Texas Agriculture Experiment Station. She held the position of the Center for Food Safety's Associate Director from 1995 to 1997. In 2000 she was appointed Professor in the Department of Animal Science, after having been an Associate Professor in that same department from 1995 to 2000. In addition, in 2000 Dr. Murano was awarded the Sadie Hatfield Endowed Professorship in Agriculture.

Dr. Murano served as a Professor-in-Charge of research programs at the Linear Accelerator Facility at Iowa State University in Ames, Iowa from 1992 to 1995. She was an Assistant Professor in the Department of Microbiology, Immunology, and Preventive Medicine at that university since 1990.

Before joining the USDA, from 2001 until her appointment, Dr. Murano served as a member of the USDA National Advisory Committee for Meat and Poultry Inspection. Since 1998 she also served on the National Alliance for Food Safety Operations Committee, which she chaired during 2000. She was a member of several professional organizations, which included the International Association for Food Protection, American Society for Microbiology, the Association of Meat Science, the Institute of Food Technologists, and the Poultry Science Association.

A native of Havana, Cuba, Dr. Murano holds a B.S. degree in biological sciences from Florida International University in Miami. She also holds a M.S. degree in anaerobic microbiology and a Ph.D. in food science and technology, both from Virginia Polytechnic Institute and State University in Blacksburg, Virginia.

LETTER to the EDITOR

In January 2003, *Food Protection Trends* published "Comparison of Intervention Technologies for Reducing *Escherichia coli* O157:H7 on Beef Cuts and Trim-mings" authored by J. R. Ransom, K. E. Belk, J. N. Sofos, J. D. Stopforth, J. A. Scanga, and G. C. Smith. We would like to offer one correction and one criticism to that article.

The correction relates to the work of Castillo et al. [1] referred on pages 28-29 of the article wherein an application of high pressure water rinse in conjunction with a subsequent application of acidified sodium chlorite (ASC) solutions reduced *E. coli* O157:H7 on beef portions by 3.8 to 4.5 log₁₀ CFU/cm² while use of the water rinse alone, without subsequent application of ASC, resulted in a 2.3 log CFU/cm² reduction. The authors speculated "that the force at which the ASC was applied (1,320 kPa) aided in the reduction of pathogens on the surface of beef carcass tissue." The ASC application pressure quoted is erroneous. The authors may have confused the application parameters of the high-pressure water pre-rinse with the application parameters for the ASC solutions. As indicated in the article by Castillo et al., water washing consisted of two phases: a 90-s hand wash at 69 kPa (~10 psi) followed by a 9-s rinse starting at an initial pressure of 1.72 mPa (~250 lb/in²) for 4 s and gradually increasing to 2.76 mPa (~400 lb/in²) within 2 s, and holding this pressure for 3 s to complete a total treatment time of 9 s. The ASC treatments consisted of the application of the appropriate solution for 10 s at 69 kPa (approximately 10 lb/in²). Therefore, the 1.5 – 2.2 log₁₀ incremental reduction achieved by the ASC spray resulted from a low pressure application of solution.

Our criticism focuses on the inadvertent misrepresentation of some of the treatment regimes. We take issue with two phrases in the abstract, namely "[O]f the treatments commonly used by industry..." and "...pathogen decontamination solutions currently approved for commercial use;" as well as the stated objective of the study [p. 25, third column] "...was to compare the effectiveness of decontamination technologies presently used as possible intervention strategies to determine their effectiveness in reducing *E. coli* O157:H7 counts on beef

carcass adipose tissue and beef trimmings." [Underlining has been added for emphasis.]

The authors conclude "...that LA and ASC were the most effective pathogen decontaminations solutions currently approved for commercial use." [Underlining has been added for emphasis.] However, the 200 ppm ASC solution as evaluated is NOT approved by either the FDA or the USDA. Acidified sodium chlorite solutions, as approved, are defined in 21 CFR 173.325. Specifically with regard to red meat, the regulation states:

"(c) The additive is used as an antimicrobial agent in accordance with current industry practice in the processing of red meat, red meat parts, and organs as a component of a spray or in the processing of red meat parts and organs as a component of a dip. Applied as a dip or spray, the additive is used at levels that result in sodium chlorite concentrations between 500 and 1,200 ppm in combination with any GRAS acid at levels sufficient to achieve a solution pH of 2.5 to 2.9."

The authors evaluated a 200-ppm concentration [treatment pH is not given] — a concentration significantly lower (6×) than the optimal level approved. In our experience (both laboratory and commercial), where the concentration of sodium chlorite has been 5 to 6 times higher (1,000–1,200 ppm), SANOVA® ASC has consistently outperformed 2% (20,000 ppm), 55°C lactic acid.

Respectfully,

C. Cayce Warf, Jr.

Director of R&D

Alcide Corporation

G. Kere Kemp

Executive VP and CSO

Alcide Corporation

References

1. Castillo, A., et al., Comparison of water wash, trimming, and combined hot water and lactic acid treatments for reducing bacteria of fecal origin on beef carcasses. *J. Food Prot.* 1998. 61(7):823–8.

SANOVA® is a registered trademark of Alcide Corporation's ASC treatment solution.

RESPONSE TO LETTER *to the* EDITOR

RESPONSE TO LETTER TO THE EDITOR AND ERRATUM NOTICE

Below is our response to a letter from the Alcide Corporation addressed to the editor of *Food Protection Trends* concerning errors in manuscript citations in our recent *Food Protection Trends* journal article [23(1):24–34]. In addition, another error in the same paper has been identified and is corrected below.

An erroneous acidified sodium chlorite (ASC) application pressure was cited on page 29; we regret this error. Furthermore, when our study was conducted, acidified sodium chlorite was not yet approved for use by the federal government and we had no guidelines for maximum ASC solution concentrations to be tested. Nevertheless, the results reported are based on the conditions of the study described and the errors in citation had no impact on the results of this study. The data collected was analyzed appropriately and the

conclusions are sound relative to the conditions tested in our study.

In addition, at the bottom of the middle column on page 25, it was stated that lactoferricin B was “recommended for preventing attachment and growth of pathogens on carcass surfaces [5, 28]” and at the bottom of the first column on page 31 it was stated that “Naidu (28) suggests that lactoferricin B is effective in preventing pathogens from attaching on the surface of carcasses.” Claims have been made by Naidu (28) that Microbial Blocking Agents (MBA), but not that lactoferricin B, prevents attachment and growth of pathogens and Bellamy et al. (5) studied lactoferricin B but did not claim that it prevented attachment and growth of pathogens on carcass surfaces.

Thank you for helping us to correct these mistakes.

Keith E. Belk

Application of ATP-Bioluminescence Technique for Assessing Cleanliness of Milking Equipment, Bulk Tank and Milk Transport Tankers

R. PÁEZ,^{1*} M. TAVERNA,¹ V. CHARLÓN,¹ A. CUATRIN,¹ F. ETCHEVERRY,¹ and L. H. DA COSTA²

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SUMMARY

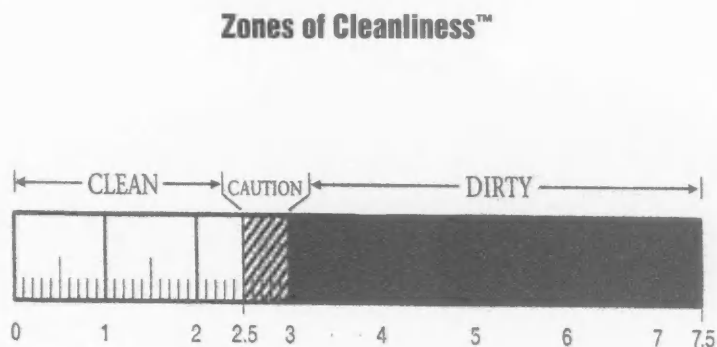
A commercial ATP-bioluminescence system was used to evaluate cleanliness of milking machines, a bulk tank, and milk transport tankers on an experimental dairy farm. The ATP levels of the equipment's different parts were determined after routine cleaning. Contamination of rinse water was also assessed by ATP-bioluminescence and by a bacteriological method. Cleanliness of the different points was indicated by "zones of cleanliness", where a zone reading of < 2.5 and > 2.5 represented "clean" and "dirty" (caution + dirty) surfaces, respectively. All of the points assessed had different degrees of washing difficulty, but the outlet of the plate cooler, the outlet pipe of the bulk tank, and the internal surface of the manway lid of the milk transport tanks were most critical. Bioluminescence results were not reliable for rinse water, so that surface swab evaluations were also needed for a complete hygienic assessment.

A peer-reviewed article.

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Figure 1. Zones of Cleanliness — Lighting (BioControl Systems, Inc.)



INTRODUCTION

Precise techniques that allow for rapid detection of bacteriological contamination of food through the different stages of production and industrial processing are useful tools in obtaining safe foods. Thus, the ATP (adenosine triphosphate) bioluminescence technique is widely recommended as an effective means of rapidly assessing the cleanliness of equipment that, if not adequately cleaned, could result in product contamination (2, 5, 6, 7).

Depending on the process or the type of food being produced, the sanitary condition of food contact surfaces could be a (CCP) Critical Control Point in a (HACCP) Hazard Analysis Critical Control Point program. With such programs, it is required that monitoring techniques provide quick results to allow for immediate corrective actions.

In most cases, the bacteriologic quality of raw milk depends on the correct and effective sanitation of all surfaces in contact with it, namely, the milking machine, bulk tank and transport tanker (8, 10, 11).

Hygienic evaluation of equipment by use of the ATP bioluminescence technique is not fully disseminated

among dairy producers in Argentina, although the method is widely accepted in other countries (3, 4, 9). The objective of this work was to establish a simple method for hygienic assessment of milking machines, bulk storage tanks, and the milk transport tankers, using the ATP bioluminescence technique.

MATERIALS AND METHODS

A series of studies was conducted to evaluate the difficulty of cleaning various sites in each piece of equipment. The relationship between bioluminescence results and viable bacterial counts was determined, on the equipment sites and in the rinse water samples.

Principles of the ATP bioluminescence technique

ATP is the chemical compound in which energy is stored in all living cells. The main sources of ATP detected by ATP bioluminescence are microorganisms and organic matter, classified respectively as microbial and non-microbial ATP. An enzymatic complex catalyzes conversion of

chemical energy of ATP into light through oxidation-reduction reactions. The quantity of light generated is directly proportional to the amount of ATP present in the sample. The results are expressed in relative light units (RLU) or as \log_{10} of RLU, measured by an instrument known as a luminometer.

Samples for assessing equipment hygiene by this technology can be obtained in two ways: by direct swabbing of the surface, or by taking aliquots of the final equipment rinse water after capturing it in a sterile container.

Instruments and kits

The lightning portable luminometer (BioControl Systems) was used. The ATP bioluminescence hygiene monitoring kits consisted of a moistening solution and sterile swabs containing a lyophilized enzymatic reagent. The swab is activated, and the bioluminescence reading is ready one minute after it is introduced into the luminometer. Results expressed as RLU are automatically transformed to decimal logarithms. These values are then compared to a scale divided into zones of cleanliness as detailed in Figure 1.

ATP standard

To ensure the sensitivity and reproducibility of readings, a positive ATP control was used (average 3.4 RLU). In each monitoring a negative control was prepared with an activated sterile swab (average 1.0–1.4).

Microbiological test

The rinse water samples (1ml) and their corresponding decimal dilutions were plated, using Plate Count Agar (PCA Merck), and incubated at 30°C for 72 hours (1) to obtain estimates of colony forming units (CFU).

Figure 2. Procedure diagram for routine hygienic evaluation of the milking machine

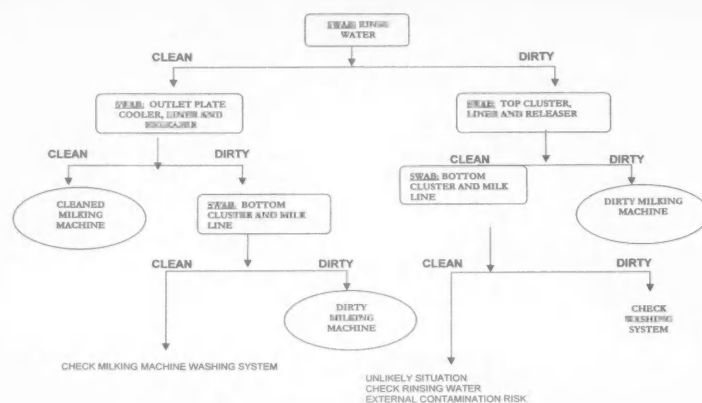


TABLE 1. Average ATP results and percentages of swab and rinse water samples with results in the "caution" and "dirty" zones from the milking equipment

Sampling Points	Number of samples	Average ATP (RLU)	Caution + Dirty (% of total samples)
Liner	7	1.8	0
Milk line	10	2.5	50
Cluster bottom	11	2.4	36
Cluster top	11	2.5	45
Releaser	10	2.2	30
Outlet plate cooler	6	3.2	83
Rinse water	11	2.6	54

Milking equipment

The milking machine evaluated (Bosio®) had the following characteristics: ten milking units with single equipment, double milking tube of 65mm diameter at 1.1m above ground level, and a clean-in-place (CIP) washing system.

The cleaning routine was as follows for the milking machine: after milking, the machine was thoroughly rinsed with warm water and then alkaline washed with water at 75°C initially, dropping to 40°C at the end.

The alkaline detergent used was previously evaluated according to a standard procedure (11). The concentration used was the one recommended by the manufacturer, and the quantity of solution was a volume equal to 40% of the machine capacity. The solution was circulated for 15 minutes and then discharged. Finally, the machine was rinsed with warm water. Two acid washes were performed each week.

As a first step, a microbiological control test and ATP bioluminescence control test were performed on wash-

ing water. To take into account the methodological suggestions of Billon et al. (4) and Pérez et al. (8), the liner, top and bottom of the clusters, releaser, milk line and outlet line in the refrigerating plate were swabbed. Each sample site was swabbed prior to the afternoon milking routine, at the same time, as which a rinse water sample was obtained from the milking machine to quantify ATP and viable bacteria counts (VBC). This final equipment rinse water sample was obtained in a sterile container. Residual ATP in rinse water was assessed from a 100-µl sample according to the manufacturer's instructions.

After half of the sampling had been completed, fewer samples were obtained from those sites that consistently provided similar results (whether these were correct or incorrect).

Refrigerated bulk tank

A Bauducco® horizontal refrigeration tank with a 6000-liter capacity and a CIP cleaning system was used in this study.

Both the cleaning routine and the cleaning evaluation were similar to those described for the milking machine, with 50 liters of alkaline washing solution used. The swab sample sites were: roof, side wall, end wall, outlet pipe, agitator and evaporator. The final equipment rinse water was taken in a sterile container. Residual ATP in rinse water was assessed in a 100-µl sample recovered from the equipment according to the manufacturer's instructions.

Milk transport tankers

Three transport tankers, which carried cold, mixed and refrigerated milk were evaluated. After the milk was discharged, the tanks were cleaned using washing routines similar to those described for the milking machine; evaluations were then conducted with procedures similar to the ones described before. In view

TABLE 2. Correlation between bioluminescence results of rinse water samples and surface swab sample sites from milking equipment

Sampling points	Correlation between bioluminescence results of rinse water samples and swab sample sites (% of total samples)	
	clean-clean	dirty-dirty
Liner	28	0
Cluster top	40	33
Cluster bottom	100	67
Milk line	60	67
Releaser	40	17
Outlet plate cooler	0	67
AVERAGE	45	50

TABLE 3. Results of bioluminescence and bacteria counts (VBC) on rinse water from milking equipment

Technique	% results per technique		
	clean	caution	dirty
Bacteria count	100	-	0
Bioluminescence	55	18	27

of the results obtained by Bell et al. (3), the swab sample sites were the internal surface of the manway lid, surface of outlet pipe and surface of vessel roof. The final equipment rinse water was taken in a sterile container. Residual ATP in rinse water was assessed in a 100- μ l sample recovered from the equipment, according to the manufacturer's instructions.

RESULTS AND DISCUSSION

Milking equipment

The average RLU values and percentage of total samples with results in the "caution" and "dirty zones" for

each sample site of the milking machine are shown in Table 1. These results include both the swab and rinse water ATP samples.

The liner was the only site that received the rating of "clean" for every measurement done, from which it is concluded that this site is easily cleaned. It is important to emphasize that the liners used were within their useful life limits (less than 2500 milkings).

On the other hand, the outlet plate cooler was the sample site with the highest degree of cleaning difficulty (83% of the samples were caution + dirty). The results from the releaser, the top and bottom of the clusters, and the milk line averaged close to the cleanliness acceptance

limits (zone 2.5) with the results on "dirty" and "caution" zones varying between 30 and 50%.

The average results of the rinsing water were close to the acceptance limits, and approximately 50% of the results fell in the range of caution + dirty.

The relationship between the bioluminescence results of rinse water and the sample sites of the milking machine was studied. Correlations between them were established by calculating the average percentage of clean-clean or dirty-dirty results for each sample site, compared to overall results for the whole study (Table 2).

The correlations presented, clean - clean or dirty - dirty, between the two procedures were approximately 50%. Nevertheless, strong differences were observed depending on the sample site being considered. For the rinse water, there was good correlation of cleaning status results for the cluster bottom and the milk line (100% and 60%, respectively). In contrast, the correlation between results with the two procedures was low for the refreshing plate, the liners and the releaser. These differences can be explained by the variability of the surface contact areas and by the action of the rinse water in the different sampling sites.

The bioluminescence results of the rinse water, arranged by zones of cleanliness were compared to the VBC of the rinse water. The bacteriological analysis results were classified as "clean" when the VBC was lower than 10,000 CFU/ml and as dirty when the VBC was over this value (Table 3). According to the bacterial count technique, all the evaluations indicated cleanliness, whereas bioluminescence results were distributed equally between "clean" and "dirty or caution."

These results show that little correlation exists between results with

TABLE 4. Average ATP results and percentages of swab and rinse water samples with results in the "caution" and "dirty" zones from refrigerated bulk tank

Sampling points	Number of samples	Caution + Dirty	
		Average ATP (RLU)	(% of total samples)
Upper wall	9	2.1	11
Lateral wall	9	2.0	22
Outlet pipe	9	3.0	89
Rear wall	9	2.6	33
Agitator blade	9	1.8	11
Evaporator	8	2.4	38
Rinse water	8	2.0	0

TABLE 5. Correlation percentage between bioluminescence of rinse water samples and swab sample sites from the refrigerated bulk tank

Sampling points	Correlation between bioluminescence results of rinse water samples and swab sample sites (% of total samples)	
	clean-clean	dirty-dirty
Upper wall	100	0
Lateral wall	88	0
Outlet pipe	12	0
Rear wall	75	0
Agitator blade	88	0
Evaporator	57	0
AVERAGE	70	0

the two test methods. This can be explained by the different criteria of evaluation for the two techniques. The VBC technique quantifies only the viable bacteria in the sample, whereas bioluminescence measures all bacterial ATP as well as the ATP of organic matter.

As a result of these evaluations, a diagram procedure was prepared in order to simplify decision making

and to reduce cleaning evaluation cost. The first step would be to verify the cleanliness of the water used in cleaning the milking machine. Water of poor quality would be an extra source of ATP contamination. Because this would interfere with the accuracy of cleanliness evaluation of the milking equipment, a source of better quality water would be needed. The next step would be bi-

oluminescence evaluation of a rinsing water sample from the milking machine. Depending on this result, the procedure would be the one detailed in Figure 2.

To confirm the results obtained with rinse water, the points with poor correlation should be swabbed and analyzed by the VBC technique.

Refrigerated bulk tank

The average RLU values and the percentage of samples with results caution and dirty zones for each sample site at the bulk tank are shown in Table 4.

The tank outlet pipe was the site most difficult to clean. The rest of the sites had average results, near or within acceptable levels, with a small percentage of results in the caution and dirty zone. All of the results for rinse water indicated that it was clean.

By using a procedure similar to that described for the milking machine, the correlation percentage was established between the bioluminescence value for rinse water and the values for swabbing sample sites from the bulk tank (Table 5). The rinse water results never indicated a site to be dirty. Consequently, the correlation percentage of dirty-dirty results between the two sampling methods is zero.

The correlation average of clean-clean results between the two alternatives was acceptable and greater than the one calculated for the milking machine (70% vs. 45%). Except for the outlet pipe, sample sites had high correlation percentages, a value equal to average. This can be explained by the small extent of contact between the outlet pipe and the rinsing water, especially in the upper surface. The relationship between bioluminescence and the VBC of rinse water samples showed total correlation in their results: All bioluminescence analysis results were in the clean zone, while all VBC were lower than 10,000 CFU/ml.

Figure 3. Procedure diagram for routine hygienic evaluation of the refrigerated bulk tank

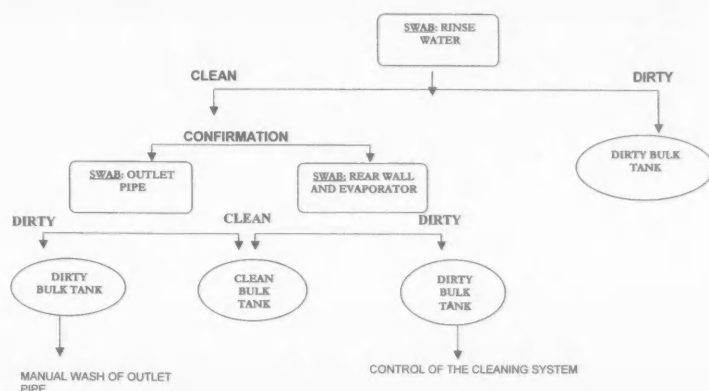


TABLE 6. Average ATP results and percentages of swab and rinse water samples with results in the "caution" and "dirty" zones from the milk transport tankers

Sampling points	Number of samples	Average ATP (RLU)	Cautious + Dirty
			(% of total samples)
Outlet pipe	18	2.3	50
Internal surface of the manway lid	18	2.6	72
Surface of vessel roof	3	2.8	33
Rinsing water	18	1.7	0

TABLE 7. Correlation between percentage of bioluminescence results of rinse water samples and surface swab sample sites from the milk transport tanker

Sampling points	Correlation between bioluminescence results of rinse water samples and swabs sample sites (% of total samples)	
	clean-clean	dirty-dirty
Discharge outlet	44	0
Manway lid	44	0
Internal wall	67	0
AVERAGE	52	0

A procedure diagram to simplify the bulk tank hygienic evaluation is shown in Figure 3. The first step consists in evaluating bioluminescence on a rinse water sample from the bulk tank, after which the steps detailed in the figure are followed.

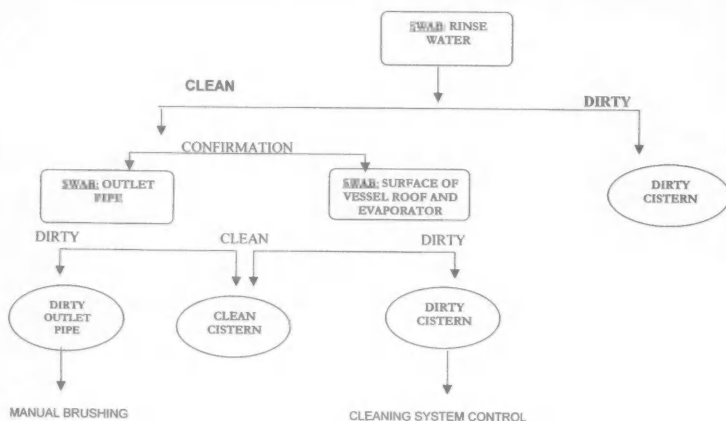
Milk transport tanker

Table 6 shows the average RLU readings for each sample site and for the rinse water from the transport tanker, as well as the percentage of total samples with caution and dirty results.

The internal surface of the manway resulted in a difficult-to-clean as evidenced by the high percentage of caution + dirty results. Samples from the outlet pipe gave inconsistent results, varying from good to bad. These results were consistent with those found by Bell (1994), who concluded that sampling sites accessible from outside the tanker can be used as a good indicator of the general hygiene status.

Fewer samples were taken from the surface of the vessel roof because of the presence of irritating odors resulting from the use of chemical detergents. One out of the three samples taken at this site showed a very high value (4.3 RLU, dirty zone), which increased the overall average. All the rinse water samples had results in the clean zone on the bioluminescence analysis. Table 7 shows the relationship between the bioluminescence rinse water results and the sample sites. The results indicate good correlation between the two sampling methods. All the rinse water samples had clean results, so the dirty-dirty correlation appears as 0%, as in the bulk tank. The correlation percentage between the two techniques for clean-clean results were similar for the different sample sites and all the results were near the overall average (52%). This average is consistent with the average for the milking machine and lower than that for the bulk tank.

Figure 4. Procedure diagram for routine hygienic evaluation of the milk transport tankers



A total correlation was found between the bioluminescence results and those of the VBC for the rinse water, as had been seen for the bulk tank. In both cases, all the sample results were in the clean range.

A procedure diagram similar to the one created for the milking machine and the bulk tank is shown for the milk transport tank in Figure 4.

Again, the first step is to evaluate a rinse water sample using the bioluminescence assay.

CONCLUSION

The rinse water ATP bioluminescence water ATP cannot be used as the only indicator of the general hygiene of the milking machine, the bulk tank and the milk transport tank, because some sites in these pieces of equipment will have little contact with rinse water. As a result, the bioluminescence of rinse water should be compared to that of swabbing points recommended in the diagrams.

The results of comparing ATP bioluminescence and VBC of rinse water showed high correlation of the two methods in evaluation of equipment hygiene. Nevertheless, the bioluminescence technique was

better than VBC in evaluating the hygienic status of the milking machine.

This simplified procedure can be used for rapid and efficient assessment of the hygienic status of this equipment and can be easily performed by almost anyone, with little training. The use of the ATP bioluminescence technique can optimize the use of sanitizers by ensuring clean surfaces prior to application of the sanitizer to the milking machine, bulk tank and milk transport tank.

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Potential for Spread of Some Bacterial and Protozoan Pathogens via Abattoir Wastes Applied on Agricultural Land

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SUMMARY

Twenty-eight commercial abattoirs were surveyed for practices related to, and quantitative levels of pathogens in, wastes to be applied on agricultural land. The abattoir wastes applied on agricultural land comprise two main groups, effluent-based wastes and animal-based wastes. The effluent-based wastes include three main types: separated solids, sludge and water. Mixing sludge and blood is a regular practice at poultry-only abattoirs. Animal-based wastes include two main sub-groups: digestive tract content-based and blood-based. All red meat abattoirs surveyed apply some of these wastes to land, and 37 such wastes were counted. In all wastes tested (lairage, lairage/stomach content, stomach content, blood and effluent), the average incidence of the most commonly isolated viable bacterial pathogen, *Campylobacter*, was 5.7%. The pathogen was found in effluent and blood from poultry abattoirs (12.5%, each) and in lairage and blood from red meat abattoirs (8.3%, each). *Listeria monocytogenes* was found in only 1.1% of all waste samples (4.2% in lairage waste), and not in any sample from poultry abattoirs. *Salmonella* and *E. coli* O157 were not isolated from any of the abattoir waste samples. A number of possible explanations exist for these relatively low levels of the bacterial pathogens in abattoir wastes, including pathogens dying off in wastes, low shedding rates by the animals, "dilution" of contaminated wastes with non-contaminated wastes (e.g., blood) and/or water, non-detection of pathogens present in small numbers by quantitative (non-enrichment) methods, and effects on isolation of the stressed status of pathogen cells. The overall incidence of the protozoan pathogens *Giardia* and *Cryptosporidium* (viability not assessed) in red meat abattoir wastes was around 52.5% and 40%, respectively. The waste type most frequently contaminated with protozoan pathogens was lairage waste, followed by effluent. In lairage wastes from single-species abattoirs, the incidence of *Giardia* and *Cryptosporidium* was higher at sheep and pig abattoirs than at cattle abattoirs. Also, the incidence of both protozoan pathogens was higher in lairage wastes at three three-species abattoirs, as the throughput was higher. On the other hand, the sampling season did not show any significant effect on either overall incidences of *Giardia* or *Cryptosporidium* or their average total counts/g in abattoir wastes. Because of the highly variable nature of abattoir wastes and the limited numbers of samples tested, a direct extrapolation of these microbiological results to all abattoirs is not appropriate.

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INTRODUCTION

During normal abattoir operations, a range of materials unsuitable or not intended for human consumption are generated as by-products of the processes. They can be divided into two main groups: (a) unfit meat and meat by-products, and (b) other waste material.

In the UK, the materials from the first main group are handled and disposed of according to two different sets of regulations: specified risk materials (SRM), regulated by the bovine spongiform encephalopathy (BSE) control-related regulations, and by-products regulated by the animal by-products-related regulations. These materials are normally sterilized (SRM are incinerated) and not used as fertilizers on agricultural land.

The materials from the second group can generally be divided into three subgroups: (a) animal by-products not for feedstuffs, (b) solid abattoir wastes, and (c) liquid abattoir wastes (effluent). The materials from the first subgroup, which includes hooves, feathers/wool, horns, hair, blood and similar materials are exempt from the sterilization requirements if not from animals having disease communicable to humans or animals. Among these materials, normally only blood can be applied to agricultural land. The materials from the second and third sub-groups (e.g., solid waste/gut content, liquid waste) all can be applied to the land under certain conditions.

Obviously, many abattoir wastes (e.g., digestive tract contents) are potential sources of foodborne pathogens, but prevalence and counts of pathogens are likely to differ significantly between different types of wastes. The potential levels of foodborne pathogens in abattoir wastes could be hypothesized via consideration of the levels of their fecal carriage by the animals pre-

sented for slaughter. *Salmonella* is the most often present in the feces of poultry (up to 50%) while their incidence is much lower in the feces of pigs, cattle and sheep (11, 18, 27). *Campylobacter* is present most frequently (and in highest numbers) in the feces of poultry and poultry abattoir effluent (13) but may also be found in the feces of all other food animals (22). The presence of *Escherichia coli* O157:H7 in feces is of major concern with cattle and sheep (6, 8, 14, 16). This pathogen has also been isolated from the cecum of inoculated poultry (4) and the feces of wild birds (28), as well as pork meat (15). *Listeria monocytogenes* is a pathogen ubiquitous in the environment and is often present in the feces of poultry and other food animals, with prevalence from a few to tens of per cent (5, 19). *Yersinia enterocolitica* is primarily present in feces of pigs, in up to 60% of samples (1). Fecal wastes primarily from cattle, and possibly from other domestic animals, are associated with transmission of certain protozoan pathogens (e.g., *Cryptosporidia/Giardia*), and vehicles for human infections have included water, vegetables, salads and fish (17). Also, *E. coli* O157, *Salmonella* and *Campylobacter* have been found in the abattoir lairage environment (3, 20, 26).

Unlike the situation with farm wastes/farm yard manure, there is a surprising lack of information in the literature on the identification, quantities, handling, and levels of pathogens of abattoir wastes intended for use on agricultural land. However, there is growing concern that such use of abattoir wastes can result in contamination of food crops with pathogens. For this reason, the present study was conducted, with its main goal to survey commercial abattoirs for wastes applied to land with respect to the types of waste and their handling at abattoirs, as well as the levels of foodborne pathogens.

MATERIALS AND METHODS

Survey of waste practices at commercial abattoirs

Twenty-eight commercial abattoirs in England and Wales were surveyed for types of wastes intended for disposal on agricultural land and for waste storage conditions at the abattoirs' premises. The survey was conducted initially via a questionnaire, and then by observational visits.

Microbiological sampling of wastes

Among the twenty-eight surveyed abattoirs, a total of twelve were selected for subsequent microbiological sampling: nine abattoirs slaughtering some or all of the red meat animal species (cattle, sheep, pigs), two slaughtering poultry only, and one slaughtering sheep and poultry. Only samples from the most common types of abattoir wastes were collected during each of the summer, autumn, winter and spring seasons (22 per season): lairage waste, inedible blood, effluent, stomach content and mixed lairage-stomach content waste (from 9, 5, 4, 3, and 1 abattoirs, respectively), which makes 88 samples in total.

With the use of protective clothing and disposable gloves, 3-5 sub-samples of each waste type were collected so as to obtain a homogenous sample of the waste. The samples were placed in a sterile wide-mouth, high-impact-resistant clear polycarbonate jar, with a nominal capacity of 60 ml, fitted with a polypropylene screw closure (Nalgene Techmate Ltd., Cat No. 2116-0060). All samples were transported to the laboratory in a chilled bin (1-5°C) within three hours. In the laboratory, each set of five sub-samples was pooled to form the final sample for a given waste.

Determination of bacterial pathogens

A 25 g sample of abattoir waste was placed into a stomacher bag with integrated mesh (Seward 6041/STR) to which 225 ml phosphate buffered saline (PBSa) was added, mixed thoroughly and stomached for 1 minute. At least 50 ml of stomacher bag contents was transferred to centrifuge tubes and centrifuged at 2000 rpm for 2 min. The supernatant was decanted, filtered through a glass-fibre filter (Sartorius), and serially diluted with PBSa.

For determination of *Campylobacter* spp., 10 ml of each dilution of the sample was filtered separately, using a 0.1 µm cellulose nitrate filter housed in a sterile filter housing unit. Filters were removed from housings and placed onto the surfaces of absorbant filter pads saturated with Blood Free Enrichment Broth (BFEB; Oxoid CM0739) and contained in Petri dishes, ensuring that no air bubbles were trapped between the 0.1 µm filter and the media-saturated filter. After incubation at 37°C for 24 h (microaerophilically in a 5% oxygen atmosphere), filters were removed from the BFEB-soaked filter pads with sterile tweezers and transferred to the surface of *Campylobacter* Blood-Free Selective Agar (CCDA; Oxoid CM739) plates. The plates were incubated microaerophilically at 37°C for 24 and 48 h, and typical colonies enumerated by use of a plate microscope. The *Campylobacter* counts (per g or ml of the original waste sample) were determined by multiplying the number of *Campylobacter* colonies on the filter by the dilution factor. Where required, confirmation of *Campylobacter* was done by latex agglutination (Oxoid Dryspot *Campylobacter* Test kit; DR150M).

For determination of *Escherichia coli* O157, 10 ml of each dilution of the sample was filtered through a 0.45 µm cellulose nitrate filter housed

in a sterile filter housing unit. Filters were removed from housings and placed onto the surfaces of glass fibre filters saturated with Modified Tryptone Soya Broth (mTSB, Oxoid CM129, supplemented with 40 µg/ml novobiocin added just before use) contained in Petri dishes, ensuring that no air bubbles were trapped between the 0.45 µm filter and the media-saturated filter. After incubation at 37°C for 6 h (although overnight incubation of approximately 18 h is not detrimental), filters were removed from the mTSB-soaked filter pads with sterile tweezers, transferred to the surface of CHROMagar O157 (M-Tech Diagnostics Ltd) plates, and incubated at 37°C for 16 h. Typical (mauve) colonies were enumerated with a plate microscope, and counts of β-glucuronidase negative *E. coli* (per g or ml of the original waste sample) calculated by multiplying the number of mauve colonies on the filter by the dilution factor. Confirmation of O157 serotype was conducted by latex agglutination using an *E. coli* O157 test kit (Oxoid DR620M) and by biochemical testing using API 20E (bioMérieux).

For determination of *Listeria monocytogenes*, 10 ml of each dilution of the sample was filtered separately, using a 0.45 µm cellulose nitrate filter housed in a sterile filter housing unit. Filters were removed from housings, placed onto the surfaces of glass fibre filters saturated with Selective Enrichment Broth (FDA; Oxoid CM862) contained in Petri dishes, ensuring that no air bubbles were trapped between the 0.45 µm filter and the media saturated filter, and incubated at 37°C for 24 h (microaerophilically in a 5% oxygen atmosphere). With sterile tweezers, filters were removed from the Selective Enrichment Broth-soaked filter pads and transferred to the surface of BCM *Listeria* Agar (Biosynth C-0608 & C-0610) plates. They were then incubated microaerophilically at 37°C for 24 and 48 h.

Typical (blue) colonies were enumerated using a plate microscope. Counts of *Listeria* (per g or ml of the original waste sample) were calculated by multiplying the number of convex turquoise colonies (both with and lacking a turquoise halo) by the dilution factor. Differentiation of *Listeria* species was performed using *Listeria* API strips (bioMérieux).

For determination of *Salmonella* spp., 10 ml of each dilution of the sample was filtered separately through a 0.45 µm cellulose nitrate filter housed in a sterile filter housing unit. Filters were removed from housings and placed onto the surfaces of glass fibre filters saturated with Tetrathionate Broth (Oxoid CM671, supplemented with novobiocin at a final concentration of 20 µg/ml added just before use) contained in Petri dishes, ensuring that no air bubbles were trapped between the 0.45 µm filter and the media saturated filter, and incubated at 37°C for 16 h. With sterile tweezers, filters were removed from the tetrathionate-soaked filter pads and transferred to the surface of a 14-cm diameter Rambach CHROM-Agar (M-Tech Diagnostics Ltd.) agar plate. Plates were incubated at 37°C for 24 and 48 h. Typical (pink) colonies were enumerated by use of a plate microscope. *Salmonella* Enteritidis and *S. Typhimurium* may be detected reliably at 24 h, but *Salmonella* Dublin should be enumerated after 48 h. Counts of *Salmonella* (per g or ml of the original waste sample) were calculated by multiplying the number of fluorescent colonies on the filter by the dilution factor. Confirmation of *Salmonella* was done by biochemical testing with API 20E (bioMérieux) and latex agglutination, using an Oxoid test kit (FT203).

Determination of protozoan pathogens

A 1-g sample was placed into a 50 ml plastic centrifuge tube (Corning); 25 ml of 0.01M PBSa in deion-

TABLE 1. Survey of effluent-based wastes at abattoirs to be applied to land

Effluent component	Treatments (Number of abattoirs)	Fate where identified (Number of abattoirs)
Solids	Screened (18)	Incinerated (11)
	Trapped (4)	Rendered (8)
	Sedimentation (2)	Landfill (1)
	Hydrofilter (1)	Composted (1)
	Belt press (1)	To land (4)
	Drum separated (2)	
Sludge	DAF (5)	Septic pit (2)
	Removal (2)	Composted (1)
	Bacterial tower (1)	To land (14)
	Separation (1)	
	Mixed with blood (7)	
	Untreated (1)	
	NA (11)	
Water	Untreated (16)	To public sewer (15)
	Biological (2)	To stream (2)
	DAF (4)	Irrigation (1)
	DAC (1)	Soakway (2)
	DAFF + Biological (1)	To land (3)
	Lagoon (2)	
	Soakaway tank (1)	

DAF – Dissolved air flotation system; DAC – Dissolved air concentration

ized water was added; the mixture was vortexed for 1 min, brought to 50 ml with 0.01M PBSa and left to settle for 1 h. Using a 10-ml pipette, 45 ml of supernatant was transferred to a clean 50 ml centrifuge tube, taking care not to disturb the sediment. The volume of the supernatant was brought to 50 ml with deionized water and tubes were centrifuged at 1050 × G for 5 min. Using a 10-ml pipette, 45 ml of supernatant was re-

moved and discarded, and the remaining pellet was analyzed by immunomagnetic separation performed with a procedure based on use of the GC-Combo IMS kit (Dynal UK). The samples (pellets described previously) were analyzed for *Cryptosporidium* and *Giardia* separately, according to the manufacturer's instructions.

Samples were stained by use of a 12 mm diameter well slide for each

sample. Ten µl (± 2 µl) of 1.0 N standardized NaOH (Sigma UK) was added to a sample well on each sample slide. For each sample, the liquid from the microcentrifuge tube in the MPC-M was transferred to the corresponding slide well containing NaOH, without disturbing the beads at the back wall of the tube. The well slides were placed in an incubator at 37°C and evaporated to dryness. A drop of methanol was applied to each well containing the dried sample and air-dried at room temperature. The sample well was overlaid with 50 µl of either FITC labelled *Giardia* monoclonal antibody or FITC labelled *Cryptosporidium* monoclonal antibody or FITC labelled combined *Cryptosporidium* and *Giardia* monoclonal antibody (TCS Microbiology UK). The slides were placed in a humidity chamber and incubated at 37°C (± 1°C) for at least 60 but no longer than 120 min. The humidity chamber consisted of a tightly sealed plastic container containing damp paper towels on which the slides were placed. After incubation, the slides were removed and, with a clean gel loading pipette tip attached to a venturi pump, excess FITC-labelled mAb was aspirated (at minimum vacuum) from the side of each well. One drop of 4',6-diamidino-2-phenylindole (DAPI) working solution (0.4 µg/ml) (Sigma UK) was applied to each well and allowed to stand at room temperature for 2 min (± 10 s). The solution was prepared by diluting 1 mg DAPI in 0.5ml methanol (2 mg/ml), and then adding 10µl of this to 50 ml PBS. This diluted solution was prepared monthly and kept in the dark. The excess DAPI solution was removed by aspiration as previously described. The sample wells were overlaid with deionized water and aspirated as described. The last steps were repeated, and the samples were allowed to air dry at room temperature.

The prepared samples were examined by using epifluorescence mi-

croscopy (Leica DMLB microscope) at $\times 40$ objective magnification, $\times 10$ eyepiece magnification, and 340 – 380 nanometers (UV) wavelength.

Methods' validation and limits of detection

No published standard methods are available for quantitative determination of foodborne pathogens from abattoir wastes. Therefore, the methods described for both the bacterial and the protozoan pathogens were developed and then validated through recovery of known concentrations of the pathogens from spiked samples of the most common types of abattoir wastes: lairage waste, blood, and effluent. Because of the large number of various types of wastes (37) identified at abattoirs surveyed, it was not possible to validate the methods for each individual type of waste. The limits of detection for the bacterial pathogens, as determined with use of spiked samples of manure/lairage type of waste, were 10 CFU/g (for *E. coli* O157), 50 CFU/g (for *Salmonella* and *Campylobacter*) and 100 CFU/g (for *L. monocytogenes*). The limits of detection for the protozoan pathogens (microscopy-based methods) were not determined.

Statistical analysis of results

Differences in mean counts of pathogens between different sets of samples were assessed by one-way ANOVA (SPSS 10.1).

RESULTS AND DISCUSSION

The relatively narrow scope of this study was essentially limited to establishing which types of wastes from abattoirs are being applied to agricultural land, and what levels of the main foodborne pathogens they contain. Therefore, the study design was based on surveys rather than determining the mechanisms behind

the prevalence of foodborne pathogens.

The results relate to 28 commercial abattoirs, selected to be as representative as possible of the UK meat industry as a whole. Nevertheless, since the total number of abattoirs in the UK is above 400, the number surveyed represents only 6-7% of the total. Approximately 75% of the abattoirs included slaughter one or more red meat animal species (30% are single-species, 15% two-species and 30% three-species), and the remaining 25% slaughter poultry only. The red meat group contains one abattoir slaughtering both sheep and poultry.

Types of abattoir wastes applied to agricultural land

The abattoir wastes identified as used on agricultural land comprise two main groups, effluent-based wastes and animal-based wastes. The abattoirs apply them to land either directly or via contractors.

The effluent-based wastes included three main types: separated solids, sludge and water (Table 1). Approximately 70% of abattoirs surveyed apply one or more types of effluent-based wastes to land. These abattoirs most commonly apply sludge-type wastes (60%), including previously treated (digestion or dissolved air flotation) sludge, untreated sludge, and sludge mixed with blood. Mixing sludge and blood is a regular practice at poultry-only abattoirs. Around 20% of the abattoirs applied separated effluent solids on land, either alone or mixed with other types of wastes (e.g., lairage). Around 15% of the abattoirs also applied the water phase of the effluents to land, either after treatment in aerated lagoons or untreated.

The identified "animal-based wastes" (Table 2) included two main sub-groups: digestive tract content-based and blood-based.

All 21 red meat abattoirs surveyed applied some of these wastes to land (37 wastes were counted in total). Approximately 70% of these wastes were digestive tract-based: 40% were lairage wastes mixed with lorry waste, and/or with stomach content, and/or with some other wastes types; 14% were lairage-only wastes; and 16% were stomach content wastes. The remaining 30% of "animal-based wastes" comprised blood, either alone (16%) or together with some other component (14%) such as sludge.

All 7 poultry-only abattoirs disposed of some wastes by applying it to land; most commonly it was a mixture of blood and sludge (70%) or blood alone and sludge alone (15% each).

Presence of bacterial pathogens in abattoir wastes

There are no published data on the levels of pathogens in abattoir wastes stored at abattoirs and intended for agricultural land. The overall incidences of viable forms of bacterial pathogens found in this study generally were lower than had been hypothesized before the start of the survey (Table 3).

The overall incidence of the most commonly isolated pathogen, *Campylobacter*, was 5.7%. It was found in relatively low numbers in blood and effluent wastes (12.5%, each) in poultry abattoirs, and in lairage and blood wastes (8.3%, each) in red meat abattoirs. It is known that *Campylobacter* can be present in poultry feces in particularly high numbers but is also shed by red meat animals (12, 21, 23). This pathogen was also found in 1.1% and 5.6% of environmental swabs from lairages at cattle and sheep abattoirs, respectively (20).

Listeria monocytogenes was found in only 1.1% of all waste samples (4.2% in lairage waste), with

TABLE 2. Survey of animal-based wastes at abattoirs to be applied to land

Types of wastes or mixtures of wastes	Number of abattoirs where recorded (28 surveyed)	Storage conditions	Quantities (range)	Time stored at abattoir (range)	Agricultural land and method of applications
Lairage/lorry	9	Trailer Bulkier Manure heap	1–20 ton	0–2 days 2 years	Arable: spread/ploughed Arable: spread Pasture: harrow, spread
Stomach content	6	Concrete pit Field stored Underground tank Trailer	2–175 ton	0–1 day to 1 month	Arable: spread Arable: spread/ploughed Pasture: spray
Lairage	5	Field stored Deep litter Trailer	0.1–90 ton	0–1 day to 2 month	Arable: spread/ploughed Pasture: spread
Lairage/lorry/ stomach contents	5	Muck heap Manure pit Designated bay	3–5 ton	2 days to 3 months	Pasture: harrow, spread Arable: spread/ploughed Arable: spread
Blood/sludge	7	Mobile tank Static tank	8–60 ton	0–3 days	Arable: injection Arable/pasture: injection
Blood	1	Mobile tanker Static tanker	5–12 ton	0–2 day	Pasture: injection, spray Arable: injected, spray
Blood/stomach content	1	Digester first, then solids with lairag waste	Variable	1–2.5 months	Arable/pasture: spread

around 4 log/g, and not in any sample from poultry. However, literature data confirm that this pathogen can be fecally shed by all animal species included in this study (29).

Salmonella was not isolated from any abattoir waste samples, which is surprising, particularly with poultry abattoirs. However, the high-throughput poultry abattoirs surveyed in this study were reporting *Salmonella* isolation rates of < 3% of farm and factory samples during the period of this project. In cattle, *Salmonella* was found with 25% incidences (10). More recently, *Salmonella* was isolated from approxi-

mately 6.1% and 2.2% of swabs from lairages at cattle and sheep abattoirs, respectively (20). It seems that this pathogen is relatively rare in pigs in the UK (2).

E. coli O157 was not found in any of the abattoir waste samples taken. However, this pathogen has been isolated from feces of 4–16.1% of cattle and 2.2% of sheep (7, 9), as well as from the coats of 28.8% of cattle and 5.5% of sheep at abattoirs (20). This pathogen is very rare in pigs 0.4% (7), and currently considered not to be shed by poultry.

A number of possible explanations could be offered for the low levels of bacterial pathogens in abattoir wastes found in this study.

The bacterial pathogens may have been shed only by a small proportion of slaughtered animals and/or be present in their feces-based wastes in low numbers, whereas a larger proportion of other slaughtered animals may have not shed the pathogens. In such cases, wastes from the latter group of animals would “dilute” the wastes from the former group, which could reduce the overall pathogens’ level below the limits of detection — and the lower the fecal shedding rate in animals, the higher the dilution factors. This “diluting” effect could have been further enhanced if other pathogen-free components, such as blood and

TABLE 3. Overall incidence and counts of bacterial pathogens in abattoir wastes

Waste type	Samples (%) positive for bacterial pathogens (mean count/g)			
	<i>E. coli</i> O157	<i>Salmonella</i> spp.	<i>L. monocytogenes</i>	<i>Campylobacter</i> spp.
Samples (64 in total) from abattoirs (n=9) slaughtering only red meat animals				
Lairage	ND	ND	4.2% (80800)	8.3% (5327)
Lairage/Stomach contents	ND	ND	ND	ND
Stomach contents	ND	ND	ND	ND
Blood	ND	ND	ND	8.3% (64)
Effluent	ND	ND	ND	ND
Samples (24 in total) from abattoirs (n=3) slaughtering poultry only (n=2) or poultry and sheep (n=1)				
Lairage	ND	ND	ND	ND
Stomach contents	ND	ND	ND	ND
Blood	ND	ND	ND	12.5% (4412)
Effluent	ND	ND	ND	12.5% (1400)
All samples				
Overall	ND	ND	1.1% (80800)	5.7% (2635.6)

ND – Not detected

water were mixed with the contaminated fecal wastes.

Much of the microbiological sampling was conducted before the official end of the Foot & Mouth epidemic, during which time significantly increased amounts of both water and disinfectants were used at abattoirs. This practice would have both "diluted" and possibly eliminated a proportion of pathogens in abattoir wastes at the time.

A proportion of pathogens could have died in stored wastes before sampling, which could decrease their counts to below the limits of detection. However, unfortunately, determination of survival rates of the pathogens in abattoir wastes was not

included in the objectives of this study.

Because the quantitative microbiological methods used in this study did not include an enrichment step, viable bacterial pathogens could have been present at very low levels, below the levels at which they could be detected.

The low incidence of bacterial pathogens in abattoir wastes did not allow any quantitative analysis of between-abattoir, between-wastes, or between-season differences, and similarly, between-pathogens differences. More in-depth research, with a much larger number of samples, is required to confirm and understand the reasons for the low incidence of bacterial pathogens found in this study.

Presence of protozoan pathogens in abattoir wastes

Giardia and *Cryptosporidium* were not expected to be found in poultry (17) and as such, they were not examined for in samples collected from poultry-only abattoirs. Unlike bacterial pathogens (i.e., their viable forms), the overall incidences of *Giardia* and *Cryptosporidium* (viability not assessed) in red meat abattoir wastes were relatively high, around 52.5% and 40%, respectively (Table 4). Reasons for this may include the following:

These pathogens can be relatively frequently shed by all animal species included in the study (except poultry), particularly by young animals, as indicated in the literature. The prevalence of cryptosporidiosis

TABLE 4. Overall incidence and counts of protozoa in abattoir wastes

Waste type (No. of samples)	Samples (%) positive for protozoa pathogens (mean count/g) from abattoirs slaughtering red meat animals*	
	<i>Cryptosporidium parvum</i>	<i>Giardia lamblia</i>
Lairage (36)	69.4% (840.9)	75.0% (722.6)
Stomach content (12)	25.0% (1740.2)	8.3% (5382.6)
Lairage/Stomach content (4)	ND	ND
Blood (16)	ND	18.7% (10.1)
Effluent (12)	33.3% (11.1)	66.7% (81.4)
Overall, all samples (80)	40.0% (821.5)	52.5% (660.5)

* Protozoa were not tested in samples from poultry-only abattoirs; ND – not detected

in cattle and sheep in the UK increased 10-fold and 5-fold, respectively, between 1983 and 1994 (25).

An unknown proportion of these protozoa in wastes may originate not from incoming animals on the day, but from some other sources at abattoirs, such as from pests. It appears that there is now a background level of *Cryptosporidium* in mammals, in particular in wildlife, in the UK, and the wildlife can serve as a permanent source of domestic animal infections and environmental contamination (24).

It is possible that protozoan cysts/oocysts counts determined included both viable and non-viable forms, whereas the bacterial pathogens' counts determined included only viable forms; this difference could have contributed to higher overall incidence of the protozoan than of the bacterial pathogens. However, the relevance of this factor for the results is unclear, as the protozoan methods did not include viability assessment.

On the other hand, when considering the protozoan results as a whole, the large majority of observed total counts-based differences between samples were statistically in-

significant. This was due to relatively large variations in protozoan counts/g within any given set of samples, so the analysis of the results was primarily based on their incidence.

The waste having the highest number of samples tested, as well as being most frequently contaminated with protozoans, was lairage waste. For this reason, any comparisons described below were based on protozoan results obtained from lairage wastes only.

When lairage wastes from single-species abattoirs are considered, it can be seen that the incidence of *Giardia* and *Cryptosporidium* was higher at sheep and pig abattoirs than at cattle abattoir (Table 5). Because only three abattoirs were included in this comparison, and as it is not clear from the literature data whether sheep generally shed more of these protozoa than cattle, this observation cannot be simply extrapolated to all other single-species red meat abattoirs without collecting further supportive evidence.

The incidence of both protozoan pathogens in lairage wastes at three-species abattoirs increased as the throughput increased, and *vice versa* (Table 6). However, no association

was observed between the throughput and the actual counts/g of these pathogens.

The sampling in different seasons did not show any significant effect of season on either the overall incidence of *Giardia* and *Cryptosporidium* or their average counts/g in abattoir wastes (Table 7). Some literature data indicate that *Cryptosporidium* shedding by cattle may be increased in autumn and winter, which may be linked with calving and the prevalence in wildlife (24).

Waste practices at the abattoirs and general public health considerations

The quantities of wastes, and the conditions and duration of their storage at abattoirs before disposal to land, were highly variable (Tables 1 and 2), and no clearly defined system was observed to be generally applied at all comparable (particularly red meat) abattoirs in this study. Nevertheless, some general related trends were noticeable from the survey.

In red meat abattoirs, lairage/lorry-based wastes were commonly stored as a manure/muck heap, in quantities ranging from a few tons to few tens of tons, often for periods

TABLE 5. Comparison of protozoan pathogens between single-species abattoirs

Lairage waste samples	Cattle abattoir (C2: weekly throughput 400)	Sheep abattoir (S7: weekly throughput 10000)	Pig abattoir (P1: weekly throughput 10700)
<i>Cryptosporidium parvum</i>			
Count/g (mean: all seasons)	26.1	1977.2	18.1
% positives	50%	100%	100%
<i>Giardia lamblia</i>			
Count/g (mean: all seasons)	674.8	2150.5	50.6
% positives	75%	100%	100%

ND – Not detected

of only 0–2 days, in some cases for longer (1–2 months), and only exceptionally for 3–24 months. Stomach content, where handled separately, was observed stored in a concrete pit (175 ton) for around one month.

Blood at red meat abattoirs, where handled separately, was usually stored in a tank, in quantities of 5–10 tons, and for periods of 0–2 days. However, where blood was mixed with sludge and/or water, the quantities may be much larger (up to 300 tons), but commonly not stored for longer than 3 days. If sludge was handled separately, it was usually treated and stored for much longer periods of time than other abattoir wastes.

In poultry abattoirs, almost invariably, handling of the wastes was much simpler and more standardized than in red meat abattoirs. Regularly, blood or blood/sludge mixture was stored in a tanker (often mobile) in quantities of up to 60 tons, for 0–3 days, and handled entirely by a tractor.

In the UK, current regulatory requirements for handling wastes at abattoirs are quite general (Fresh

Meat Regulations 1995) and include the following requirements: (a) Dirty and clean areas must be separated, and separation of edible and waste materials must be ensured; (b) drainage from the abattoir and other parts of the premises should be efficient so as to prevent pooling of effluent and accumulation of debris; (c) the method of effluent disposal should not represent a risk to hygiene; and (d) there must be satisfactory and hygienic facilities for disposal of liquid and solid wastes. These requirements do not state further specifics for the storage of wastes.

It could be assumed that, from an abattoir hygiene perspective, it is desirable to keep waste materials (potentially or actually containing pathogens) for as short a time as possible at abattoir premises. Under routine abattoir operations, continuously producing and handling large quantities of wastes, it is difficult to store/handle wastes for extended periods of time without increasing the risks of general abattoir contamination and reduction of meat hygiene. In the case where waste storage is very short, any significant pathogen dieoff

at abattoir premises (before its disposal to land) is unlikely, and the application of fresh abattoir wastes on land would increase land contamination.

Therefore, in simple terms, from the abattoir hygiene perspective wastes should be not be stored on the abattoir premises, whereas from the agricultural land contamination perspective they should be stored at abattoirs as long as possible. To balance these opposing interests, more information is required on pathogens' time/survival rates during abattoir storage and through treatment processes. If waste is to be stored at abattoirs, further research would be needed to address the issue of optimizing and standardizing the storage conditions so to minimize risks for both the meat and the environment and to develop related control and monitoring mechanisms.

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TABLE 6. Comparison of protozoan pathogens between abattoirs of different throughputs

Lairage waste samples	High weekly throughput	Medium weekly throughput	Low weekly throughput
	S1:	C5:	P6:
	Cattle 100 Sheep 2500 Pigs 1000	Cattle 70 Sheep 325 Pigs 180	Cattle 60 Sheep 30 Pigs 6
<i>Cryptosporidium parvum</i>			
Count/g (mean: all seasons)	1038.8	128.3	12.0
% positives	100%	75%	25%
<i>Giardia lamblia</i>			
Count/g (mean: all seasons)	502.1	79.2	19.7
% positives	100%	75%	50%

TABLE 7. Between-season comparison of protozoan pathogens in samples from abattoirs slaughtering red meat animals*

Season	Samples (%) positive for protozoan pathogens (mean count/g)	
	<i>Cryptosporidium parvum</i>	<i>Giardia lamblia</i>
Summer	40% (806.4)	45% (805.9)
Autumn	40% (1987.6)	55% (924.1)
Winter	35% (209.1)	65% (418.1)
Spring	45% (812.5)	45% (543.1)
All seasons	40.0% (821.5)	52.5% (660.5)

*Protozoa were not tested in samples from poultry-only abattoirs

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Food Safety Knowledge and Practices of Low Income Adults in Pennsylvania

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SUMMARY

The purpose of this study was to assess the food safety knowledge and behavior of low income adult audiences. One hundred thirty-nine usable surveys were received from participants in the Pennsylvania Expanded Food and Nutrition Education Program (EFNEP) and Food Stamp Nutrition Education Program (FSNEP). The 58 survey questions included items related to three scales measuring (i) knowledge of food safety, (ii) consumption of high risk foods, and (iii) food safety practices. Results indicate that certain risky food practices and beliefs are fairly common among this population. Temperature abuse was a frequent problem. The majority of respondents (65%) incorrectly thought food should be allowed to cool before being placed in the refrigerator and 64% did not acknowledge that keeping the refrigerator above 40°F will make food poisoning more likely. Respondents tended to indicate that they infrequently ate high-risk foods; however, the most frequently consumed high-risk foods were those made at home from raw/undercooked eggs. Persons with higher income levels and males consumed certain risky foods significantly more often than other respondents did. On average, respondents indicated that they "usually" engaged in food safety practices that prevent cross-contamination. Of these practices, respondents were least likely to wash cutting boards with disinfectant or in the dishwasher between using them for different foods. Older respondents were most likely to engage in safe food procedures. Information obtained from this study may provide direction to EFNEP, FSNEP, and other nutrition education programs for more effective educational programming in food safety.

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INTRODUCTION

An estimated 76 million cases of foodborne illnesses occur in the United States each year, with 325,000 of these resulting in hospitalizations and 5,000 leading to death (17). In addition, experts speculate that the unreported cases resulting from foods prepared in the home are much more common than those reported in outbreak data (12). Consumers have frequently been found to perform unsafe food-related practices such as failing to wash hands and/or cutting boards after cutting raw meat or chicken (2, 3, 16, 29), consuming raw or undercooked eggs (10, 16, 29), hamburger (1, 10, 21) or dairy products (19), and improperly thawing (14, 19) and cooling (14, 19, 25, 27) foods. Reaching the consumers through effective food safety education programs is one strategy to combat foodborne illnesses (5, 28, 29). As a result, the 1997 National Food Safety Initiative recognized consumer food safety education as a top priority.

The Expanded Food and Nutrition Education Program (EFNEP) plays a vital role in food safety education for limited-resource consumers, who are particularly susceptible to foodborne illness because it is not easy for them to acquire medical attention (29). Over the past 32 years, EFNEP has become the largest federally funded program devoted entirely to food and nutrition education. Established in 1969 by the US Department of Agriculture (USDA) Cooperative Extension Service, EFNEP assists limited-resource audiences in obtaining the knowledge, skills and behavioral changes needed for a nutritionally sensible and safe diet. Among the focuses of EFNEP are safe food selection and preparation, food sanitation and storage, food preservation, and safe food handling.

The Food Stamp Nutrition Education Program (FSNEP), another federally funded program targeted

toward limited-resource audiences, provides food and nutrition education to food stamp recipients and those eligible to receive food stamps, working to improve their dietary quality and increase self-sufficiency. Much like EFNEP, FSNEP includes projects devoted to developing safe food handling practices among its participants.

The purpose of this study is to assess the food safety knowledge and behavior of low-income adult audiences reached through EFNEP and FSNEP. Information obtained from this study may provide direction to EFNEP, FSNEP, and other nutrition education programs for more effective educational programming in food safety.

METHODS

The population for the study was EFNEP and FSNEP participants in Pennsylvania. The questionnaire was composed of 57 questions pertaining to food safety knowledge and practices, which were adapted from relevant literature (4, 8, 19, 24-26). Among the questions were three sets of scaled questions which measured (i) knowledge pertaining to food safety (19, 24), (ii) consumption of high-risk foods (4, 19) and (iii) food safety practices (4). The survey was administered in a pilot study with 31 (13) limited-resource participants of the Food Stamp Nutrition Education Program in Clearfield County. Cronbach's alpha reliability coefficients were determined for the three scales. Cronbach's alpha values for the scales ranged from 0.63, for consumption of high-risk foods, to 0.78, for food safety knowledge and food safety practices. Based on comments received, the survey was revised to increase the reliability of the scale measuring high-risk food consumption.

A copy of the final survey was sent to all EFNEP and FSNEP nutrition education advisors (NEAs), who

had been trained to obtain consent from EFNEP/FSNEP participants and dispense the self-administered survey to them during a scheduled meeting time. Surveys were completed under the supervision of the NEA, collected, and mailed to the researcher in a sealed envelope. After two follow-ups, a total of 139 usable surveys had been received. This compares to approximately 2,316 EFNEP participants and approximately 250 FSNEP participants who were enrolled in a series of educational classes at any one time, during the reporting period of 10/01/00 to 09/30/01. The number of EFNEP/FSNEP participants who received a copy of the survey was limited by (i) whether the NEA agreed to administer the survey during a class session and (ii) the number of clients present at that particular meeting time.

All study participants and NEAs completed informed consent forms. The project was approved by the Institutional Review Board of the Pennsylvania State University.

DATA ANALYSIS

The Statistical Package for Social Sciences (SPSS) software, Version 10.0 for Windows, was used to perform statistical calculations (23). Descriptive statistics were calculated for all survey questions. Percentages were utilized to describe nominal and ordinal level data (9). In addition, means and standard deviations were used to describe ordinal level data. The three scales utilized in the survey were tested for reliability by running Cronbach's coefficient alpha tests of internal consistency.

Responses to all ordinal level questions were stratified by demographic data (race, age, gender, last grade of school completed, household income and marital status) and assessed for significance at the $P < .05$ level. These measurements of knowledge and behaviors pertaining to food safety were correlated with

TABLE 1. Percentage of respondents choosing correct responses on food safety statements

Question	% Correct
Foods that have passed their expiration date should be thrown out (n=138)	72%
Foodborne illness can result from the contamination of ready-to-eat foods with juices from raw meat, poultry, fish or seafood (n=139)	71%
Bacteria that cause foodborne illness grow quickly at room temperature (n=139)	70%
Food should be served immediately after it is cooked (n=136)	69%
<i>E. coli</i> O157:H7 in undercooked meat could be deadly (n=137)	64%
Leftovers can be stored in the container they are cooked in (n=137)	63%
Ground beef needs to be cooked to a higher temperature than steaks or roasts to assure adequate safety against disease-causing bacteria (n=138)	57%
Foods that can make you sick always smell and/or taste bad (n=136)	52%
Soaking vegetables in cold water will completely remove any pesticide residues (n=138)	49%
Leftovers should be stored in a shallow container 2-4 inches deep (n=135)	48%
Freezing kills all bacteria that may cause foodborne illness (n=135)	47%
Leftovers should be allowed to cool to room temperature before being refrigerated (n=138)	35%
Chicken treated by irradiation leaves the food radioactive (n=132)	26%
Fresh or frozen chicken treated with ionized radiation is a safer choice than chicken not treated with radiation (n=130)	26%

demographic variables using Spearman's rho correlation statistics.

RESULTS

Three-fourths (75%) of the respondents were white, one-fifth (19%) were black, and a small percentage (6%) was either Hispanic or other. The most common age range of respondents (40%) was 25-37 years, followed by under 25 years (28%), 38-50 years (16%) and over 50 years (16%). The sample was comprised of mostly women (90%) and mostly participants who had either completed high school or obtained their GED (57%). Thirty percent (30%) had not graduated from high school, and ten percent (10%) indicated that they had completed an associates degree or higher. The majority of the respondents had a household income of less than \$15,000 (72%) and were single (67%).

Tables 1 through 3 show responses to questions assessing knowledge of food safety (Table 1), consumption of high-risk foods (Table 2) and food safety practices (Table 3). The mean scores across all consumption of high-risk foods (Cronbach's $\alpha=0.70$) and food safety practices (Cronbach's $\alpha=0.86$) are presented in Tables 2 and 3, respectively. A mean score across knowledge of food safety items was not compiled because of the low Cronbach's α (0.51).

The percentage of respondents responding correctly to statements on food safety can be found in Table 1. Nearly three-fourths (72%) recognized that foods that have passed their expiration date should be thrown out, and that 71% recognized foodborne illness can result from contamination of ready-to-eat foods with juices from raw meat, poultry,

fish or seafood. Many respondents were also aware that bacteria that cause foodborne illness grow quickly at room temperature (70%) and that food should be served immediately after it is cooked (69%). About two-thirds of respondents (64%) knew that *Escherichia coli* (*E. coli*) O157:H7 in undercooked meat could be deadly.

Although the majority of respondents (63%) were aware that leftovers should not be stored in the container they are cooked in, twenty-three percent (23%) thought this was acceptable. Numerous respondents recognized that ground beef needs to be cooked to a higher temperature than steaks or roasts (57%) and that foods that can make you sick do not always smell and/or taste bad (52%). However, forty-two percent (42%) believed they could distinguish a food that could make them ill by looking at it or smelling it.

TABLE 2. Mean consumption scores of high-risk food items

How often do you:	Mean ^a	Std. Dev.
Eat foods made at home with uncooked eggs (n=135)	2.2	1.1
Purchase food from an unlicensed vendor (n=136)	2.1	1.2
Eat hamburger or ground beef that is pink inside (n=135)	1.5	1.0
Eat cheese made with raw or undercooked milk (n=131)	1.4	0.8
Eat fish that is raw or undercooked (n=135)	1.3	0.8
Eat chicken or turkey that is still pink inside (n=135)	1.2	0.6
Eat oysters, clams, or mussels that are raw or undercooked (n=135)	1.2	0.5
Drink milk that is raw or unpasteurized (n=132)	1.2	0.7

^aThe scale ranged from never (1) to very frequently (5).

Only half of respondents knew that pesticide residues are not completely removed by soaking vegetables in cold water (49%), and that leftovers should be stored in a shallow container 2–4 inches deep (48%). Additionally, only forty-seven percent (47%) knew that freezing does not kill all bacteria that may cause foodborne illness.

Just thirty-five percent of respondents (35%) were aware that leftovers should not be allowed to cool to room temperature before being refrigerated. In addition, a mere one-fourth of respondents (26%) realized that irradiated chicken is not radioactive and that it is a safer choice than chicken not treated with radiation.

Table 2 shows the mean consumption scores of high-risk food items. Values ranged from 1=never to 5=very frequently. A mean score for responses to questions in this section of the survey was 1.52 (std. dev.=0.48), indicating that respondents tended to indicate that they infrequently engage in these behaviors. Likely to be eaten more frequently were foods made at home with uncooked eggs, such as raw cookie dough (mean=2.2), and foods purchased from an unlicensed ven-

dor, such as a roadside fruit or vegetable stand (mean=2.1). High-risk items that respondents were least likely to consume were chicken or turkey that is pink inside (mean=1.2), raw or undercooked oysters, clams, or mussels (mean=1.2), and raw (unpasteurized) milk (mean=1.2). Paired t-tests indicated that consumption of the two high-risk foods most likely to be consumed was significantly greater than consumption of the three foods least likely consumed (uncooked eggs vs. pink poultry: $t=9.625$; $df=125$; $P<.001$; uncooked eggs vs. raw/undercooked shellfish: $t=10.223$; $df=126$; $P<.001$; uncooked eggs vs. raw milk: $t=8.329$; $df=122$; $P<.001$; food from unlicensed vendors vs. pink poultry: $t=8.291$; $df=126$; $P<.001$; food from unlicensed vendors vs. raw/undercooked shellfish: $t=9.209$; $df=127$; $P<.001$; food from unlicensed vendors vs. raw milk: $t=8.005$; $df=123$; $P<.001$).

The mean scores for food safety practices can be found in Table 3. Values ranged from 1=never to 4=always. The mean score across responses to these questions was 3.07 (std. dev.=0.76). On average, respondents indicated that they "usually" engaged in the food safety practice

listed in Table 3. Practices that respondents were most likely to perform were use of hot, soapy water to wash plates after they come into contact with raw meat (mean=3.6) and washing of cutting boards and knives between use for different foods (mean=3.5). Many respondents also wash counters, sinks, and faucets after preparing raw chicken (mean=3.4) and wash fruits and vegetables with running water before consuming them (mean=3.4). Behaviors that were least likely were use of household disinfectant in cleaning of cutting boards (mean=2.7) and washing of cutting boards in the dishwasher between use for different foods (mean=2.4).

In addition to the scaled questions, several other multiple-choice questions assessed respondents' practices and opinions regarding food safety. A large portion of the respondents (81%) did not think anyone in their household had experienced a foodborne illness within the past six months. Of those who did, seventy-six percent (76%) said a physician did not confirm it. The vast majority of respondents (94%) recognized that contamination of food by microorganisms was a food safety problem.

TABLE 3. Mean Scores for Food Safety Practices

How often do you:	Mean ^a	Std. Dev.
Wash with hot, soapy water the plate used for raw meat before returning the cooked meat back on it (n=134)	3.6	0.8
Wash cutting boards and knives with hot soapy water between using them for different foods (n=134)	3.5	0.8
Wash fruits/veggies with running water before you eat them (n=136)	3.4	0.9
Wash counters, sink, and faucet with hot water and soap after preparing raw chicken (n=134)	3.4	0.9
Use household disinfectant when you clean countertops (n=136)	2.9	1.1
Use household disinfectant when you clean the sink (n=132)	2.9	1.1
Use household disinfectant when you clean cutting boards (n=132)	2.7	1.3
Wash cutting boards in the dishwasher between using them for different foods (n=128)	2.4	1.4

^aThe scale ranged from never (1) to always (4).

A majority of respondents (65%) did not know the temperature of their refrigerator. One-fifth (19%) indicated they keep their refrigerator temperature at 41°F, and twelve percent (12%) said they keep their refrigerator at either 45°F or 50°F. When asked which refrigerator temperature makes food poisoning most likely to occur, thirty-six percent (36%) acknowledged that it is keeping it above 40°F, although the majority either said keeping it less than 40°F or said that it makes no difference (28%).

Three-fourths (77%) of the respondents indicated that they prepare the meals in their home all or nearly all the time. The vast majority of respondents (98%) were aware that hands should be washed with soap and water before food is prepared or handled. However, fewer respondents acknowledged that hand washing should occur at various other times, such as after handling raw meat, poultry and seafood (80%) and after using the restroom (82%) (see Figure 1).

Most respondents correctly thaw meat, poultry and fish products, either in the refrigerator (51%) or in the microwave (17%). However, a quarter of the respondents (23%) thaw these products on the counter. When asked to indicate the frequency with which "Perishable foods in my home are left at room temperature for greater than 2 hours" over half of the respondents (65%) indicated this never happened, although over one-fourth (27%) said this situation happens frequently or occasionally in their homes. When respondents were asked "How concerned would you be about cooked meat or poultry being left at room temperature for over four hours?" the majority of respondents (83%) indicated they would be concerned or very concerned. Eleven percent (11%) said this situation would not concern them. However, as in any questionnaire, responses may be influenced by the question format. Thus the two questions about food left at room temperature, if reworded, could have been answered differently.

When asked to circle all applicable reminders found on food handling labels on raw meat and poultry, several respondents were able to correctly identify proper cooking (65%), proper thawing methods (53%), proper storage temperatures (53%), and avoidance of cross contamination (27%). Twenty-one percent (21%) incorrectly chose use of appropriate sanitizing agents, and twenty-seven percent (27%) were not sure. Respondents were asked whether the instructions on the safe food-handling label has resulted in changes in the way they prepare raw meat or poultry items; fifty-eight percent (58%) indicated that it has.

When asked how food could be made safe if it has *Salmonella* in it, forty-one percent (41%) knew to cook it thoroughly, followed by those who thought food could not be made safe (35%) and those who did not know (21%). Two percent (2%) said food could be made safe by chilling or freezing it. When asked how food could be made safe if it has *E. coli* in it, answers were evenly divided between those who were aware that it

Figure 1. Percentage of respondents who acknowledged that handwashing should occur at various appropriate times

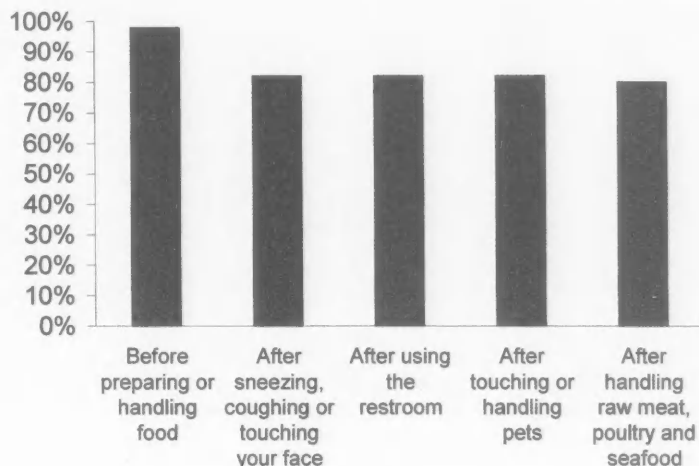
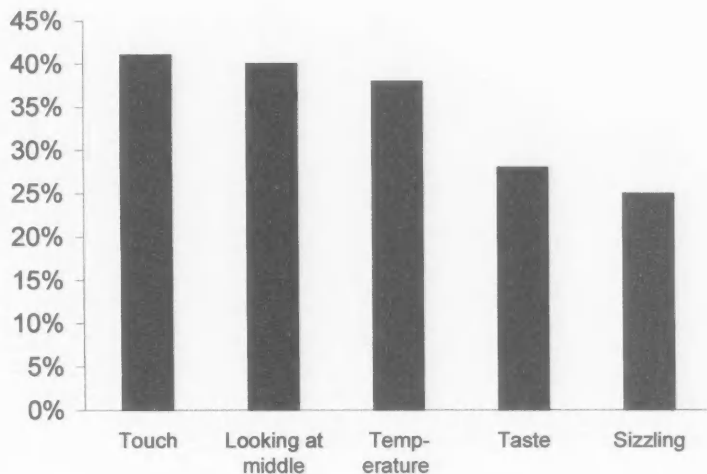


Figure 2. Indicators used by respondents to determine when reheated meat and chicken are ready for consumption (respondents circled all that applied)



could be cooked thoroughly (32%), those who thought it cannot be made safe (31%), and those who did not know (31%).

Several respondents (42%) knew that cooking meat only until it is rare is the situation in which food poi-

soning is most likely to occur. However, forty percent (40%) thought it makes no difference and seventeen percent (17%) believed that cooking it until it is at least medium rare is most likely to cause food poisoning. Respondents were asked which heat indicators they use to determine

when reheated meat and chicken are ready for consumption. Only thirty-eight percent (38%) appropriately use temperature as measured by a thermometer. Other popular choices are illustrated in Figure 2.

When asked if there is anything that keeps them from adopting safe food handling practices, many respondents (80%) said they always do what they can. Twelve percent (12%) indicated that they just do it the way they have always done it in the past. When asked what contributes most to the number of foodborne diseases, thirty-five percent of respondents (35%) attributed it to food prepared in the home, followed by thirty-two percent (32%) who chose food prepared in a food service establishment. Fewer respondents (18%) thought food processors and manufacturers made the biggest contribution and 15% said the source (e.g., the farm, water). Regarding the amount of control consumers have over foodborne illness, about one-third of respondents (30%) think they have "a lot." One-fifth (20%) are not sure how much control consumers have, and half (49%) said the amount of control consumers have is moderate or less.

About two-fifths of respondents (42%) think the best way of informing people how to correctly handle food is through additional food handling labels on products. Twenty-one percent of respondents (21%) believe that TV and radio messages would be the best way to convey this information, one-fifth (19%) said it didn't matter, because people will do it the way they want, and a few respondents (12%) chose print media, point of sale, newspaper, magazines, etc. Respondents were also asked to list what they consider their main source of current food safety information. Television/television news was the most frequently mentioned source (n=22), followed by family (n=14), friends (n=12), radio news (n=9), magazines (n=9), and classes (n=9).

Other sources given included the newspaper (n=7), nutrition education advisor (n=6), product labels (n=5), work (n=4) and the Internet (n=3).

Table 4 summarizes the relationships between the scaled survey questions for which statistically significant differences were apparent ($P < .05$), and respondents' demographic characteristics based on Spearman rho correlation statistics. Variables related to knowledge of food safety include age, race, last grade of school completed, and marital status.

Demographic variables significantly related to eating high-risk foods included household income, gender, last grade of school completed, and race. Consumption of certain high-risk foods, such as cheese made with raw/undercooked milk, undercooked poultry and raw/undercooked fish, was found to increase with household income and was higher among males than among females. Certain high-risk foods, such as undercooked ground beef and foods purchased from an unlicensed vendor, were consumed in large quantities by those with a higher grade level and by white respondents.

Age, race, gender, household income, and marital status were found to influence food safety practices. Respondents who were older and nonwhite who had lower household incomes, and who were female and single were found to follow certain ideal food safety practices more often. Examples of these practices include washing raw fruits and vegetables with running water before consumption, and using household disinfectant to clean countertops, sink and cutting boards.

DISCUSSION

Results of this survey indicate that among the Pennsylvania EFNEP/FSNEP population, certain risky food safety practices are fairly common,

namely temperature abuse, consumption of high-risk foods and improper food storage and preparation techniques. In addition, there are areas in which this population may lack the knowledge necessary to provide a safe food environment.

Some of the more common problems regarding temperature abuse included allowing cooked food to cool before refrigeration, thawing products on the counter, and leaving foods at room temperature for more than two hours. Respondents also reported storing leftovers in unsuitable containers in the refrigerator and many were not aware of the proper temperature of their refrigerator. Meer and Misner (19) discovered similar patterns of temperature abuse and use of improper storage containers among EFNEP participants in Arizona, as did Bruhn and Shutz (6) among the general public. Despite these risky practices, the majority of respondents in this investigation recognized that foodborne illness-causing bacteria grow quickly at room temperature.

Foods prepared with raw eggs, such as raw cookie dough, were the most commonly eaten high-risk food by survey respondents. Several other studies (16, 22, 24) have similarly reported raw or undercooked eggs as the most frequently consumed risky food item. This investigation found that persons with a higher income level and males were the most likely to consume certain high-risk foods. This coincides with results of an investigation by Alektruse et al. (2), who found these persons to be the most frequent consumers of pink hamburgers and raw oysters. This study also found that several respondents consumed foods purchased from an unlicensed vendor. Although many foods sold by unlicensed vendors are not likely to be high risk, these foods have the potential to pose a health threat to consumers (20). Meer and Misner (19) similarly found that food purchased from an

unlicensed vendor was the second leading high-risk food consumed by respondents.

Although many respondents reported washing their hands and cleaning cutting boards and food preparation areas after handling raw meat or chicken, there is still room for improvement. Results are comparable to results of a 1993 FDA survey (16) and Alektruse et al. (3), who found that about one-fifth of the respondents did not wash their hands or cutting boards after handling raw meat or poultry. Interestingly, the majority of respondents in this study were aware that juices from raw meat, poultry, seafood or fish can contaminate ready-to-eat foods and cause foodborne illness. This survey found age, race, gender, household income and marital status to be related to avoidance of cross-contamination. Likewise, other investigators have found that women, people over age thirty (2), and those with lower socioeconomic status (3) had better food safety behaviors.

This study was limited by the small sample size (n=139) in relation to the Pennsylvania EFNEP/FSNEP population (approximately 2,566 program participants enrolled at any one time). To be truly representative of all EFNEP/FSNEP participants in Pennsylvania, a sample size of at least 334 is needed (14). As a means of validating our sample data, the gender distribution of the sample was compared to that of the EFNEP population; the figures were not significantly different ($\chi^2=0.034$; $df=1$; $p=0.855$). Still, caution should be utilized when drawing conclusions about the entire population. Another limitation of this study was that survey questions regarding food safety knowledge, attitudes and behaviors may suffer from the reporting bias often encountered with self-reported data (7). It is likely that assessment of food safety behavior would be more accurate through in-home ob-

TABLE 4. Scaled survey questions significantly related to demographic variables ($P < .05$)

Survey Question	Demographic Variable Related to Survey Question	Results	Spearman's rho
Knowledge Regarding Food Safety			
What is your opinion on: Foods that make you sick always smell and/or taste bad?	Last grade of school completed	Those with a lower education are more likely to agree.	$r = -0.197^*$
What is your opinion on: Bacteria that cause foodborne illness grow quickly at room temperature?	Race	Non-white respondents are more likely to agree.	$r = 0.240^{**}$
What is your opinion on: Foods that have passed their expiration date should be thrown out?	Age	Those who are younger are more likely to agree.	$r = -0.215^*$
	Marital status	Those who are single are more likely to agree.	$r = -0.185^*$
What is your opinion on: Soaking vegetables in cold water will completely remove any pesticide residues?	Race	Non-white respondents are more likely to agree.	$r = 0.270^{**}$
	Age	Those who were younger are more likely to agree.	$r = -0.191^*$
Consumption of High-Risk Foods			
How often do you eat fish that is raw or undercooked, such as in sushi or sashimi?	Gender	Males eat more often.	$r = -0.180^*$
How often do you eat chicken or turkey that is still pink or red inside?	Household income	Those with a higher household income eat more often.	$r = 0.228^{**}$
How often do you eat cheese made with raw or undercooked milk?	Gender	Males eat more often.	$r = -0.307^{**}$
	Household income	Those with a higher household income eat more often.	$r = 0.184^*$
How often do you eat hamburger or ground beef that is pink inside?	Last grade of school completed	Those with a higher education eat more often.	$r = 0.294^{**}$
	Household income	Those with a higher household income eat more often.	$r = 0.222^*$
How often do you purchase food from an unlicensed vendor?	Race	White respondents purchase more often.	$r = 0.207^*$
	Household income	Those with a higher household income purchase more often.	$r = 0.229^{**}$

TABLE 4. (Continued)

Food Safety Practices

How often do you wash fruits or vegetables with running water before you eat them raw?	Age	Those who are older wash more often.	$r = 0.239^{**}$
	Gender	Females wash more often.	$r = 0.185^*$
	Marital status	Those who are single wash more often.	$r = -0.196^*$
How often do you use household disinfectant, such as bleach when you clean countertops?	Race	Non-white respondents use more often.	$r = 0.192^*$
	Age	Those who are older use more often.	$r = 0.196^*$
How often do you use household disinfectant, such as bleach, when you clean the sink?	Race	Non-white respondents use more often.	$r = 0.198^*$
How often do you use household disinfectant, such as bleach, when you clean cutting boards?	Race	Non-white respondents use more often.	$r = 0.231^{**}$
	Age	Those who are older use more often.	$r = 0.219^*$
How often do you wash counters, sink, and faucet with hot water and soap after preparing raw chicken?	Age	Those who are older wash more often.	$r = 0.287^{**}$
	Gender	Females wash more often.	$r = 0.244^{**}$
How often do you wash with hot, soapy water the plate used for raw meat before returning the cooked meat back on it?	Household income	Those with a lower household income wash more often.	$r = -0.174^*$
How often do you wash cutting boards and knives with hot soapy water between using them for different foods?	Age	Those who are older wash more often.	$r = 0.189^*$
	Household income	Those with a lower household income wash more often.	$r = -0.280^{**}$

*Significant at $P < .05$; **Significant at $P < .01$

servation (15).

Nevertheless, results from this study can help structure future food safety education programs. Food safety programs often put great emphasis on keeping foods at a safe temperature. Although this was a common problem in this study,

Medeiros et al. (18) suggest that this topic should represent a smaller portion of the lesson, because illnesses caused by pathogens linked with temperature abuse (*Staphylococcus aureus*, *Clostridium perfringens*, and *Bacillus cereus*) are relatively mild, and less than 500,000 illnesses per

year are estimated to result from these three pathogens. More emphasis should be placed on adequate cooking of foods and the avoidance of cross contamination. Illnesses caused by contaminants related to these can be more frequent and severe in nature (11, 18). For a food

safety education program to be effective, consumers need specific messages that increase awareness of risks and encourage audiences to modify their current food handling and consumption behaviors (21). In addition, lessons should be tailored to meet the individual needs of the class, such as prevention of cross contamination in food handling practices of young adults and the danger associated with consumption of high-risk foods by men.

Future research should assess the barriers of limited-resource persons to adopting safe food handling and consumption patterns, in addition to exploring strategies that will motivate the people to adopt safe practices. Studies should also investigate the effectiveness of proposed food safety education delivery methods among this population.

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NEW MEMBERS

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UPDATES

Connie Tipton Named IDFA Executive VP

Connie Tipton has been named executive vice president of the International Dairy Foods Association (IDFA) and its constituent organizations. She will succeed E. Linwood Tipton as IDFA president and CEO beginning in 2004.

Prior to joining IDFA in 1981, Connie was a development officer with the Corcoran Gallery of Art in Washington and a division director for the United Way of Columbus, OH.

In more than 21 years at IDFA, she has held responsibility for management of issues, programs, and activities in legislative and international affairs; economic policy analysis; communications and public relations; marketing programs; education and training; trade shows; and office management.

Dr. Ann Marie McNamara Joins Silliker, Inc. as Vice President of Food Safety and Scientific Affairs

Silliker, Inc. has appointed Ann Marie McNamara as vice president of food safety and scientific affairs. Dr. McNamara will be responsible for developing risk management and safety programs for clients of the food testing and consulting company.

Dr. McNamara most recently served as corporate vice president of food safety and technology for the Sara Lee Corporation. From 1992 to 1999, she served as director of microbiology for the Office of Public Health and Science

(USDA-FSIS), and played a role in developing safety initiatives to improve the United States food supply. She directed and coordinated scientific and research activities at USDA-FSIS laboratories and co-authored the "Pathogen Reduction and HACCP Rule," the President's "Food Safety Initiative," and other programs under the Clinton administration.

Dr. McNamara will work with Silliker food safety experts to help companies incorporate effective risk management programs in their operations to minimize potential risks, such as inadvertent pathogen or chemical contamination, developing prevention strategies, including crisis management and recall papers, and developing corporate biosecurity programs.

New Food Standards Australia New Zealand Chief Executive Appointed

Graham Peachey has been appointed as the new chief executive officer of Food Standards Australia New Zealand (FSANZ). He succeeds Mr. Ian Lindenmayer who is about to retire after five years as managing director of Food Standards Australia New Zealand and its predecessor the Australia New Zealand Food Authority (ANZFA).

His current position is executive head of the Trans-Tasman Group of the Therapeutic Goods Administration. In this role he has had responsibility for the planning and negotiation of arrangements with New Zealand government authorities to harmonize the regulatory systems for therapeutic goods for the two

countries. He has also been director of the Chemicals and Non-Prescription Medicines Branch of the Therapeutic Goods Administration.

In 1993, Mr. Peachey was appointed to the then National Food Authority where he played a major role in the development of the treaty between Australia and New Zealand to establish a common food standards system and a new binational food regulator, the Australia New Zealand Food Authority. He continued as a general manager with ANZFA until 1998.

IFT Names Gargano as Marketing Communications Coordinator

Theresa M. Gargano has been named marketing communications coordinator for the Institute of Food Technologists. Gargano's primary responsibilities will be the development and implementation of marketing projects related to advertising and exhibit sales, attendance promotion, membership recruitment and retention and web activities.

Gargano joins IFT from Kraft Foods where she was product information analyst after having served as research scientist. Her background includes a bachelor's degree in food and nutrition communications from Mundelein College at Loyola University Chicago, a master's degree in dietetics, restaurant and institution management from Kansas State University and a master's degree in business administration from Dominican University.

UPDATES

Chr. Hansen Adds Farro, Chopek, and Cox for Human Health and Nutrition

Jeannine Farro, Andrea Chopek, and Alan Cox join the human health and nutrition business unit for Chr. Hansen, Inc. Ms. Farro is appointed marketing manager for human health and nutrition, with the responsibility of developing marketing strategies and identifying new business opportunities for this

business unit. She holds a BS in accounting from Seton Hall University and an MBA in marketing from Fairleigh Dickinson University.

Andrea Chopek joins Chr. Hansen as account manager for human health and nutrition, serving accounts on the East Coast. She previously was at Pfizer, Inc. where she spent over three years in sales of their cardiovascular pharmaceutical line. Ms. Chopek holds a BS in environmental science and biology from Boston University. She also

graduated from the Navy Supply Corps School in Athens, GA.

Alan Cox also joins Chr. Hansen as account manager for human health and nutrition, serving accounts in the western US. He has over five years of sales experience with Fortitech, Inc. working in the pharmaceutical, nutritional, and food ingredients industries. Prior to that, Mr. Cox spent 14 years in flavor manufacturing, and transportation and distribution.



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NCFST National Center for Food Safety and Technology OUTREACH



A razão pela qual eu gosto de estudar no Centro Nacional para Segurança e Tecnologia de Alimentos é a oportunidade que tenho de interagir profissionalmente com pessoas de várias indústrias de alimentos.

(Portuguese)
Renata Meneghel
Graduate Student

INTERPRETING THE SCIENCE OF FOOD SAFETY

CONSENSUS • Research • Education • Training

For an interpretation of the message, visit our NCFST web site at www.ncfst.org
or call 1-800-451-4511

Reader Service No. 171

President Bush to Propose Record-Level Funding for USDA Food Safety Programs

President Bush will seek record-level support for USDA's meat and poultry food safety programs as well as increase efforts to strengthen agricultural protection systems in his FY2004 budget, Agriculture Secretary Ann M. Veneman announced. USDA's food safety budget will increase to \$797 million, an increase of \$42 million over the FY2003 request and represents a \$148 million (or 20%) increase in food safety programs since FY2000. The FY2004 request will fund 7,680 food safety inspectors, provide specialized training for the inspection workforce, increase microbiological testing and sampling, strengthen foreign surveillance programs and increase public education efforts.

In addition, USDA's budget will also include \$70 million in new funding through other USDA programs to strengthen agricultural protection systems, that would include increased laboratory security measures; biosecurity, animal disease and vaccine research; and additional animal and plant pests and disease monitoring programs. "The President cares deeply about ensuring a strong food safety system and the protection of agriculture against potential threats. This additional funding continues to build upon a strong record of achievement in further strengthening our protection systems to ensure the integrity of our food systems," said Veneman.

The Secretary outlined the following details that will be

contained in USDA's FY2004 budget for food safety and agricultural protection systems:

- \$42 million increase to provide record-level funding for USDA's Food Safety and Inspection Service (FSIS). These additional resources will support FSIS food safety activities, including increasing its inspection workforce to 7,680 meat, poultry and egg products inspectors and veterinarians; providing specialized training for food safety authorities to ensure the safety of the commercial supply of meat, poultry and egg products; increasing microbiological testing to ensure effective controls or elimination of pathogens in products; increasing foreign product surveillance; and new food safety public education efforts.
- \$23 million increase for Animal and Plant Health Inspection Service (APHIS) programs for inspections at certain ports of entry; increase the availability of foot-and-mouth disease vaccines; and an expansion of diagnostic and other scientific and technical services.
- \$47 million increase for USDA's various research agencies for strengthening laboratory security measures; conducting additional research on emerging animal diseases; new vaccine development; new biosecurity database systems; and continued

development of the unified Federal-State Diagnostic Network for identifying and responding to high risk biological pathogens.

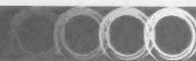
Secretary Veneman made the announcement during remarks at the US Poultry and Egg Association International Poultry Exposition in Atlanta, Georgia. The Secretary toured exhibits highlighting new food safety research and technologies. She also conducted a round-table discussion with local farmers to discuss food safety, homeland security and other farm-related issues.

For more information on these programs and services, visit <http://www.usda.gov>.

More People are Getting Sick from Eating Fresh Fruits and Vegetables, Prompting Plant Disease Scientists to Ask Why?

Salmonella, *E. coli*, shigellosis, hepatitis A, and Norwalk — these foodborne diseases can produce symptoms that run from mild to life-threatening. The young and old are particularly vulnerable and while consumption of beef and poultry have been the most common sources of such infections, fresh fruits and vegetables are being increasingly implicated in such outbreaks. So much so, that plant disease scientists are now taking a closer look at this issue.

"Historically, human pathogens like *E. coli* and *Salmonella* have rarely been associated with plants, so plant disease scientists have not looked at them directly," says J.W. Buck, a



plant pathologist at the University of Georgia. But that is changing, says Buck, as such incidences continue to increase. Buck says there is no single reason why the number of reported produce-related outbreaks in the US per year doubled between 1973-1987 and 1988-1992 and why they continue to rise. Possible explanations include the simple fact that we are eating more fruits and vegetables than ever before. But experts agree that there is more to it than that and that our food production practices likely bear some responsibility.

But identifying the exact point along the way, from field to grocery store, where a strawberry or head of lettuce, for example, might have become contaminated can be difficult, if not impossible. Unlike other commodities such as beef and chicken, which are rigorously inspected, methods to detect pathogens on fresh produce are less advanced and the sporadic nature of most contamination further limits the effectiveness of testing.

"Plant disease scientists know a lot about how other microorganisms interact with plants and the environment to create an outbreak. This same knowledge can be applied to human pathogens as well. An exchange of research tools and experiences between plant pathologists and food microbiologists could result in tremendous advances towards managing foodborne diseases related to produce consumption," says Buck.

According to Buck, one impediment to this kind of research, however, is that plant pathology laboratories currently lack the appropriate facilities for working with human pathogens, which are considered biosafety hazards. Until such changes can be made, says Buck, plant pathology models and practices, such as integrated pest management, that have worked well in controlling other plant diseases

would likely work in helping to minimize the risk of human disease as well. "No doubt plant disease scientists can, and should, play a more significant role in food safety issues in the future," says Buck.

Oils and Waxes in Packaging Pose No Health Risk

People's health is unlikely to be affected by the transfer of oils and waxes from food packaging into food, the Food Standards Agency survey has found. The amounts of mineral hydrocarbons from oils and waxes that would be consumed via our food have been found to be within safety limits defined by independent, international experts.

These conclusions were made following a survey by the Food Standards Agency into the types and amounts of mineral hydrocarbons in food contact materials and into the amounts that might migrate from packaging into food.

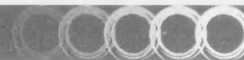
The survey tested a wide variety of retail samples of packaging and food because mineral hydrocarbons might transfer into food from several sources, for example wax used on some corks and on bread and confectionery wrappers, or lubricating oil used in making cans.

Mineral hydrocarbons were found in 42 out of 64 samples of materials or articles in contact with food. Levels varied depending on the type of packaging. The research concluded that consumer intakes of wax and oils migrating into food were within ranges of Acceptable Daily Intakes set by the European Union's Scientific Committee for Food, and the Joint Food and Agriculture Organization/World Health Organization Expert Committee on Food Additives.

Is Alternative Food Production Safe?

In terms of food safety, alternative livestock production (organic, free-range, etc.) has mostly been looked upon positively. There has been little attention to the fact that some alternative livestock production methods can increase the risk of herd infections with microbial pathogens. It seems to be a big difference between consumers' perception of the safety of food from alternative production and what can be found scientifically, which may cause a series of problems. Looking at outdoor bred pigs as an example, it has been shown that pig herds with access to outdoor facilities have a higher prevalence of *Salmonella*, *Toxoplasma* and helminth parasites than indoor bred pigs. Microbial pathogens such as *Listeria* occur naturally in the soil, but free ranging herds are also infected by soil and water contaminated with feces from previously infected livestock or by contact with rats or other wild fauna. Bacteria and parasitic cysts can survive in the soil for years. Thus an important part of the management scheme is to keep new herds in areas, which have not previously – or at least not for a long time – been used for stocking farm animals. Areas free from pathogens can be limited on small farms with a long tradition for outdoor herds, and as the production increases, the problem of herds using areas where the soil is contaminated will probably increase.

Poultry from free ranging production systems have been shown to harbor *Campylobacter* more frequently than indoor-bred poultry, probably due to exposure to *Campylobacter* from wild fauna and the environment. When consumers turn to food from alternative production systems, health, animal welfare and environmental



concerns are the primary reasons, and studies suggest that food safety plays a significant role in some consumers' choice of food in the EU. The EU FAIR study from 1997 showed that 58-68% of the consumers were "very concerned" about pathogenic bacteria when buying fresh beef, pork or chicken. Thus, there appears to be a discrepancy between the consumers' perception of the risk and the actual measurable risks of animal products from alternative production systems.

This is a potentially dangerous situation of two reasons: If food products from alternative production systems harbor more pathogenic bacteria, the consumers are more at risk and more gastrointestinal diseases may occur within the community when these production systems are enlarged over the next few years. Secondly, consumers when informed may react strongly against alternative food products if they get the impression that they are marketed under "false pretence". This in turn could lead to a severe set back for this expanding industry and could potentially affect the future development of agricultural production systems that are desirable from the perspective of the environment and animal health and welfare. Government inspection programs are primarily designed for conventional large-scale production systems, whereas they are less capable of addressing food safety issues in small and heterogeneous alternative production systems.

Furthermore, own-control programs and modern quality assurance systems, increasingly being implemented in large-scale conventional food production, are not nearly as rapidly implemented

in small-scale alternative production. This is probably because of the huge administrative burden of this undertaking, which will threaten any small-scale production. Another reason can be a resistance to these programs due to their lack of recognition of the special characteristics of alternative production. The combination of a potentially higher risk of pathogenic microorganisms in the primary production, limited surveillance and control of products and production facilities, and the use of minimal processing may constitute a potential food safety problem.

If consumers' confidence in the alternative production systems is to remain, risk management tools must respect the specific qualities of these production systems which are highly valued by consumers. The dilemma is that this proviso, to some extent, may be in conflict with a food safety objective. In order to solve this dilemma, it seems necessary to involve the consumers of alternative products. We need to know to which extent these consumers would be willing to run a comparatively greater risk in order to ensure the small scale and other specific characteristics of alternative production.

USDA Marks Progress on BSE Prevention

The US Department of Agriculture more than tripled the number of cattle it tested for bovine spongiform encephalopathy (BSE) during the last fiscal year and has made significant steps on other prevention measures aimed at keeping the disease from entering the United States. "We remain vigilant at

strengthening programs to keep BSE out of this country," said Agriculture Secretary Ann M. Veneman. "Our surveillance level far exceeds international testing standards and is just one component of a multi-faceted regulatory and compliance system that is keeping the United States free of BSE."

In fiscal year 2002, USDA tested 19,990 cattle for BSE using a targeted surveillance approach designed to test the highest risk animals, including downer animals (animals that are non-ambulatory at slaughter), animals that die on the farm, older animals and animals exhibiting signs of neurological distress. During FY2001, USDA tested 5,272.

Both figures are significantly higher than the standards set by the Office International des Epizooties (OIE), the standard setting organization for animal health for 162 member nations. Under the international standard, a BSE-free country like the United States would be required to test only 433 head of cattle per year. The USDA is now testing 41 times that amount.

In addition to surveillance, OIE guidelines also require a risk analysis and management strategy, an education and awareness program and compulsory notification requirements in order for a country to claim that it is BSE free. The United States exceeds these criteria in all categories.

In November 2001, Harvard University published a land-mark three-year risk analysis on BSE, representing the most comprehensive risk assessment ever done on BSE. The detailed assessment showed that the occurrence of BSE in the United States is highly unlikely.

INDUSTRY PRODUCTS



Thermo Orion Corporation

Thermo Orion Introduces the New Dissolved Oxygen Auto-Stir™ Probe

Thermo Orion has introduced a new Dissolved Oxygen Auto-Stir™ Probe. This dissolved oxygen (DO) probe is designed for fast and easy BOD analysis with the Thermo Orion 862A DO/BOD/Temperature Meter. The built-in stirrer provides vigorous sample agitation, preventing oxygen stratification and can easily be disassembled for cleaning. The probe stand, which is free standing, can be used to store the probe when not in use, and also functions as an air calibration beaker.

Additional product features include an ergonomic one-touch™ control, dual automatic temperature compensation and a low maintenance polarographic design. Thermo Orion also offers electrolyte solution, a polishing disk and membrane caps, which may be purchased individually or together as a probe maintenance kit.

Thermo Orion is an ISO 9001-registered manufacturer of quality chemical measurement products. Thermo Orion's line of products

includes pH, ion selective electrode (ISE), colorimeters, conductivity and dissolved oxygen meter, electrodes, accessories, and solutions. Thermo Orion also offers a complete line of syringe pumps, microbalances, titrators and Pure Water™ online process monitors. Most recently, the company expanded its already extensive product offering to include a complete line of liquid-handling systems, autosampler, the award-winning EZ-Flash® gas chromatography accessory, and the TEA Analyzer® detector for HPLC and GC. These systems prove that Thermo Orion is committed to providing the best instrumentation for a wide array of laboratory analyses.

Thermo Orion Corporation,
Waltham, MA

READER SERVICE NO. 251

C&S Equipment Co. New UVC Tumbling Machines Use Germicidal Light to Decontaminate Food Surfaces

Using patent-pending technology, the UVC tumbling machines incorporate either a rotating drum or screw conveyor that gently lifts and tumbles the product to ensure exposure of all surfaces to the germicidal UVC energy. The equipment utilizes shatter-resistant, plastic-sheathed "UVC Emitters™" from Steril-Aire, Inc. with the proven ability to kill or inactivate mold, yeast, viruses and bacteria including *Listeria*, *E. coli*, *Staphylo-*

coccus, *Salmonella*, *Pseudomonas* and phage. The innovative UVC tumbling machines offer a cost-effective solution to a wide range of food safety challenges.

Benefits include reduced food safety risk, reduced operating costs and longer shelf life. They are available in standard or custom sizes with features that are designed to the individual user's needs.

C&S Equipment Co. LLC,
Caldwell, ID

READER SERVICE NO. 252

CEA Instruments' New Portable Formaldehyde Monitor

The new TG-1900KBP Formaldehyde (HCHO) gas monitor is a direct reading, compact instrument with digital display that uses a patented gas membrane galvanic sensor which never needs to be replaced. This unique sensor is unaffected by alcohols and other interfering gases and can detect as little as 0.01 ppm. Adjustable audible and visual alarms can be set as low as 0.1 ppm. The unit will operate for thirty days continuously on one set of batteries.

Weighing less than nine pounds, the TG-1900KBP is quick responding and very specific. The unit is completely self-contained with a recorder output and built-in sample pump. The TG-1900KBP will also detect Glutaraldehyde over a range of 0-2 ppm.

CEA Instruments, Inc., Emerson,
NJ

READER SERVICE NO. 253

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INDUSTRY PRODUCTS

Innovative Products and Services for the Nuclear Power Industry from Syncor Radiation Management

For many years, Victoreen has been a major international provider of dependable radiation monitoring systems to the nuclear power industry.

Radiation monitoring is important to the nuclear power industry for many reasons. The power plant is monitored for proper performance through measurement of radiation levels inside its coolant loops. Environmental compliance is assured through the measurement of effluent liquids and gases. Protection for power plant employees is attained through area monitoring and personal accumulated dose tracking.

For this reason, Victoreen takes great pride in offering a range of products from individual instruments to large sophisticated systems that automatically monitor, analyze, display and log radiation data from areas inside and around the power plant.

Victoreen's line of Universal Digital Ratemeters (UDR) are radiation monitoring instruments capable of being directly interfaced to pulse producing or low current producing detectors and displaying the radiation signal in various engineering units. The Victoreen I060AM 30-Channel Area Monitoring System is suitable for stand-alone operations as well as in a network environment employing multiple channels communicating via an RS-485 interface. These are just a few of Victoreen's many product offerings.

A full array of our products and services can be found in our Nuclear Power Systems Catalog. The catalog also features our Global Calibration Laboratory (GCL) as your authorized calibration service and repair facility. Nuclear power facilities may contract

for "wet" isotopic calibrations, transfer calibrations or high-range containment monitoring recertification. GCL offers its customers a one-stop for all radiation instrument calibration and repair needs.

Syncor Radiation Management, Cleveland, OH

READER SERVICE NO. 254



Venmark International

Venmark International Pulsed UV Sterilization System Benchtop Unit Adapts to Production Requirements

A new, in-house benchtop pulsed UV system that meets government standards of 10⁻⁶ log reduction to optimize sterilization or decontamination applications is being introduced by XENON Corporation of Woburn, MA.

The SteriPulse-XL3000® UV Pulsed Light System delivers up to 6 joules/cm² per pulse of high peak energy, depending upon configuration, which eradicates microorganisms without excessive heat buildup and overheating the product or package. Developed for in-house sterilization applications, this benchtop system has a test chamber with a slide-out shelf, provides flexibility in establishing process variables, and can be modified for on-line production.

Consisting of a control unit, lamp module, and sterilization chamber

where the pulsed UV light penetrates deeply, the modular SteriPulse-XL3000® UV Pulsed Light System is designed for starting and stopping, consumes less energy than continuous wave mercury lamp systems, and doesn't create or use VOC's or suspended airborne particulates; making it environmentally safe.

Venmark International, Wellesley, MA

READER SERVICE NO. 255

Sterile Sampling Bags from Remel

Remel has announced the availability of Labplas Twirl'em® Sterile Sampling Bags. Labplas Twirl'em® Sterile Sampling Bags are the ideal container for collecting, transporting, testing, and storing a wide range of liquid, solid, or semi-solid materials. To assure sterility, each Twirl'em® Sterile Sampling Bag is made using FDA-approved virgin polyethylene. Confirmed sterility documentation is available upon request. To provide maximum leak proof protection, each Twirl'em® Sterile Sampling Bag has a double sealed bottom. For flexibility and ease of labeling samples, Twirl'em® Sterile Sampling Bags are available plain, or with a printed-write-on marking area.

Twirl'em® Sterile Sampling Bags provide a protective, contamination free environment with applications ranging throughout the food, dairy, environmental, water, industrial, pharmaceutical, veterinary, or any other sector where sample integrity is a priority.

Samples are only as good as the collection device used. Wrap up confidence in the integrity of your samples with Labplas Twirl'em® Sampling Bags.

Remel, Lenexa, KS

READER SERVICE NO. 256

INDUSTRY PRODUCTS

The Witte Co., Inc. New Literature Showcases Innovative Clamps

New literature from industrial equipment design and manufacturing firm the Witte Company profiles its innovative clamps, which permanently mount on process, packaging, material handling and other machinery and equipment to deliver up to 1,000 pounds of clamping force. The full color spec sheet illustrates how the clamps open and close with one hand for instant access to the entire machine or system without requiring removal of the clamps.

The new spec sheet details the original stainless steel and aluminum design and the pioneering, 100%, FDA-approved stainless steel design developed to meet USDA regulations and 3-A standards for cleanliness in sanitary operations. Depicting the clamps in operation on a conveyor, the spec sheet demonstrates how the clamps grip multiple material thicknesses, stifle vibration and speed cleaning and maintenance while minimizing downtime.

The new spec sheet provides specification and retrofit recommendations for design engineers, process engineers, plant managers and other professionals responsible for increasing production, streamlining operations and controlling maintenance costs. Detailed pricing including quantity discounts is included for both designs.

The Witte Company, Inc., Washington, NJ

READER SERVICE NO. 257

New Handwashing System from Meritech, Inc.

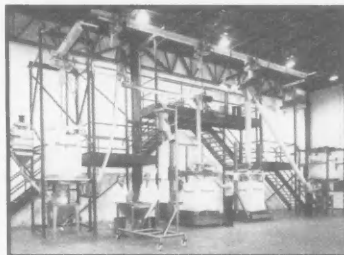
Meritech, Inc. announces the new CleanTech® model 400 automated handwashing system. This new model is designed to be smaller, more affordable, and is available with several options such as in-counter, wall-

mount and additional faucet to please your inspectors. Like our other models, the 400 is still a totally automated method of sanitizing hands and gloved hands in ten seconds! And, it feels great. Just imagine, your employees will love washing their hands!

We've listened to the requests of our customers. You wanted a smaller, more affordable model. And we've made it! Now there is no reason to put it off any longer. Increase your handwashing compliance and efficacy today.

Meritech Inc., Englewood, CO

READER SERVICE NO. 258



Flexicon Corporation

Flexicon Test Laboratories for Pneumatic and Mechanical Bulk Handling Equipment and Systems

Flexicon pneumatic and mechanical test laboratories are equipped with full-size bulk handling equipment and systems that are readily reconfigured and accessorized to simulate customer installations, according to David Gill, president.

Using customer supplied bulk materials, engineers and laboratory technicians can verify system performance prior to final equipment design and fabrication, and demonstrate newly constructed equipment for visiting customers prior to shipment. In addition, Flexicon engineers utilize the laboratories to study the performance of new designs.

The test laboratory for pneumatic bulk handling systems is

equipped with blowers, vacuum pumps, filter receivers, cyclone separators, inlet/discharge adapters and valves, and conveyor lines in a wide range of diameters and lengths—the test laboratory for mechanical bulk handling systems is equipped with flexible screw conveyors in a comprehensive range of diameters, lengths and screw configurations.

Both test laboratories are also equipped with bulk bag dischargers, bulk bag fillers, manual dumping stations, automated weigh batching systems and other equipment designed to interface with pneumatic and/or mechanical conveying systems.

"The array of equipment with interchangeable accessories in a virtually unlimited combination of system configurations, enables Flexicon to establish repeatable performance ranges for entire systems as well as components using customer supplied bulk materials, taking the risk and guesswork out of purchasing highly customized bulk handling equipment," says Gill.

Side-by-side installation of flexible screw and pneumatic conveyor test equipment reportedly allows the relative merits of each to be compared in terms of conveying over short and long distances, moving problematic materials, preventing the separation of blends, and meeting other application-specific requirements.

The ability of bulk bag unloaders to promote complete discharge and allow dust-free loading, untying, retying and removal of bulk bags can be proven using customers' own bulk bags and materials.

Similarly, the performance of weighing systems, bulk bag fillers, bag dump stations, drum dumpers and a range of other pneumatic and mechanical process equipment and integrated systems can be evaluated prior to, and following manufacture.

Flexicon Corporation, Bethlehem, PA

READER SERVICE NO. 259

Iwan Parkin Lecture

presented by

Donald L. Zink, Ph.D.

Lead Scientist, Food Processing
Food and Drug Administration
Center for Food Safety and Applied Nutrition
Office of Plant, Dairy Foods, and Beverages
College Park, Maryland

*"On the Trail of Food Safety —
From the Early Days to the Future"*

Sunday, August 10, 2003
Opening Session — 7:00 p.m.



Dr. Donald L. Zink received his undergraduate degree from Abilene Christian University. He earned an M.S. degree in Microbiology and a Ph.D. in Biochemistry and Biophysics from Texas A&M University.

Between 1978 and 1983, he held faculty positions at Texas A&M University's College of Veterinary Medicine and at The University of Arizona in the Department of Microbiology and Immunology and the Department of Food Science. He joined Campbell Soup Company in 1983 as Manager of Process Microbiology where he worked in the area of refrigerated food safety and aseptic processing. In 1990, he joined

Nestlé, where he held various positions in Quality Assurance for the Carnation Company and later served as Director of Food Safety for Nestlé USA. In 2000, he joined a new beef processing venture company, Future Beef Operations, as Vice President of Research and Development and Product Safety. Recently, he joined the US Food and Drug Administration's Center for Food Safety and Applied Nutrition in the Office of Plant, Dairy Foods, and Beverages, where he serves as the Lead Scientist for Food Processing.

Dr. Zink has served as a member of several advisory committees including the Committee on Program and Technical Review of the US Army Natick RDEC for the National Research Council and the National Advisory Committee on Microbiological Criteria for Foods.

Preliminary Program



Sunday, August 10, 2003 — 7:00 p.m.

Opening Session — Ivan Parkin Lecture:

Donald L. Zink, Ph.D., Lead Scientist, Food Processing, Food and Drug Administration, Center for Food Safety and Applied Nutrition, Office of Plant, Dairy Foods, and Beverages, College Park, Maryland

**"On the Trail of Food Safety —
From the Early Days to the Future"**

Monday, August 11, 2003

Morning — 8:30 a.m. — 12:00 p.m.

Symposium Topics

- Use of Food Safety Objectives and Other Risk-based Approaches to Reduce Foodborne Listeria
- Intervention Strategies for Ready-to-Eat Meat Products
- Hazard Identification in the Fresh Produce Industry
- Recipe for Food Safety at Retail

Technical Session

- Microbiological Methods

Poster Session (10:00 a.m. — 1:00 p.m.)

- Pathogens and Their Controls

Afternoon — 1:30 p.m. — 5:00 p.m.

Symposium Topics

- Effective Food Worker Hygiene Interventions: A Risk Assessment Approach
- Cost of Food Safety
- Current Issues in the Microbiological Safety of Dairy Foods — From Farm to Table
- Hot Topics in Seafood Quality and Safety

Technical Session

- Food Safety Management and Communication

Poster Session (3:00 p.m. — 6:00 p.m.)

- Microbiological Methods

Tuesday, August 12, 2003

Morning — 8:30 a.m. — 12:00 p.m.

Symposium Topics

- Detection Methods for Foodborne Pathogens
- Food Allergens: Past, Present, and Future
- Molecular Investigative Techniques and Their Application to Food Safety
- Spoilage and Pathogenic Fungi and Yeasts

Technical Session

- Produce Microbiology

Poster Session (10:00 a.m. — 1:00 p.m.)

- Foods of Animal Origin

Afternoon — 1:30 p.m. — 3:30 p.m.

Symposium Topics

- Assuring Food Safety and Security
- Applied Microbiological Genomics for Food Safety and Quality
- *Campylobacter*: A Pathogen in Need of Resolution
- Current Issues in Food Toxicology
- Microbial Stress Response to Intervention Technologies

Technical Session

- Food Handling in the Domestic Food Service Environment

Plenary Session — 3:45 p.m. — 4:30 p.m.

- Dr. Elsa A. Murano, Under Secretary for Food Safety

Business Meeting — 4:45 p.m. — 5:30 p.m.

Wednesday, August 13, 2003

Morning — 8:30 a.m. — 12:00 p.m.

Symposium Topics

- Science-based Shelf Life Dating of Ready-to-Eat Refrigerated Foods
- All the Latest Jazz — Recent Foodborne Outbreaks
- Food on the Move
- Aquaculture: Safety and Quality Issues

Technical Session

- Foodborne Pathogens

Poster Session (9:00 a.m. — 12:00 p.m.)

- Jambalaya

Afternoon — 1:30 p.m. — 5:00 p.m.

Symposium Topics

- The Evolution of Foodborne Pathogens
- Natural Antimicrobials — Current Trends and Future Perspectives
- Risk Communication — Putting Food Safety in Perspective
- Emerging Issues in Water Quality for the Food Industry

Technical Session

- Risk Modeling

Poster Session (2:00 p.m. — 5:00 p.m.)

- Produce and Seafood Microbiology

Visit our Web site at www.foodprotection.org for detailed program information



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.

OPENING SESSION

Sunday, August 10, 2003 • 7:00 p.m. – 8:00 p.m.

Join us to kick off IAFP 2003 at the Opening Session. Listen to the prestigious Ivan Parkin Lecture delivered by Donald L. Zink, Ph.D., Lead Scientist, Food Processing, FDA, CFSAN, OPDFB, College Park, Maryland. The presentation will be "On the Trail of Food Safety — From the Early Days to the Future."

CHEESE AND WINE RECEPTION

Sunday, August 10, 2003 • 8:00 p.m. – 10:00 p.m.

An IAFP tradition for attendees and guests. The reception begins immediately following the Ivan Parkin Lecture on Sunday evening in the Exhibit Hall.

IAFP JOB FAIR

Sunday, August 10 through Wednesday August 13, 2003

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.

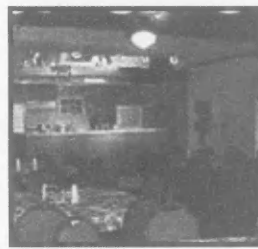


Sit back, relax and enjoy a delightful journey along the River Road, back in time to an era when sugar was king and a massive plantation was a sugar planter's kingdom! A native tour guide will point out sites and tell tales of the bygone antebellum period on the excursion to two magnificent plantations, 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	8:00 p.m. – 10:00 p.m.
<i>Sponsored by Kraft Foods North America</i>	
Monday, August 11, 2003	
Exhibit Hall Reception	5:00 p.m. – 6:30 p.m.
<i>Sponsored by Qualicon Inc.</i>	
Monday Night Social at Mardi Gras World	6:30 p.m. – 10:00 p.m.
<i>Sponsored by IGEN International, Inc.</i>	
Tuesday, August 12, 2003	
Creole Queen Dinner and Jazz Tour	7:00 p.m. – 10:00 p.m.
<i>Ticket sales will benefit the IAFP Foundation Fund</i>	
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



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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: * <input type="checkbox"/> Mon. <input type="checkbox"/> Tues. <input type="checkbox"/> 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 ☐ ☐ ☐

TOTAL AMOUNT ENCLOSED \$ _____
US FUNDS on US BANK

Account Number _____ Expiration Date _____

Name on Card _____

Signature _____

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

EXHIBITORS DO NOT USE THIS FORM



Workshops



Sponsored by
International Association for
Food Protection.

Workshop 1

Acquiring Confidence in Laboratory Data

This workshop will present principals for understanding and implementing microbial control in a food production environment by providing skills to address limitations in your current laboratory testing and documentation. You will learn, in an interactive environment, how to perform statistically sound food and environmental sampling and microbial testing that can be implemented into your standard operating procedures and will conform to today's QA and ISO requirements. Workshop participants will review and discuss material from practical case studies and present their findings to the group in an informal presentation that will facilitate open discussion. Workshop includes a binder of tools and references to reinforce the practical experience gained from the workshop.

Workshop Topics

- Outsourcing/Auditing: What should you expect from an outside food-testing laboratory relative to quality systems and capabilities
- Laboratory quality assurance and preparing your laboratory to address ISO 17025
- Microbial control: where and how raw ingredient and finished product testing fit into the big picture
- Microbial control: where and how environmental/investigational sampling fit into the big picture
- Practical approaches to incorporating rapid methods into the laboratory
- IQ, OQ, PQ: what food companies can learn from pharmaceutical validation principals
- Using data management and trend analysis techniques to drive continuous improvement

Instructors

Robert Ferer, Vectech Pharmaceutical Consultants, Inc. Farmington Hills, MI

Michael Sole, Canadian Food Inspection Agency, Ottawa, Ontario, Canada

W. Payton Pruett, Jr., Ph.D., ConAgra Refrigerated Prepared Foods, Downers Grove, IL

Cindy Ryan, Nestlé USA, Dublin, OH

Robert Behling, Independent Consultant, Madison, WI

Organizers and Instructors

Patricia Rule, bioMérieux, Inc., Hazelwood, MO

Jeff Kornacki, Ph.D., University of Georgia, Griffin, GA

Who Should Attend?

Laboratory managers, supervisors, scientists and technicians responsible for product sampling, as well as performing and documenting microbial tests in a food production environment.

Hours for Workshop

Registration -

7:30 a.m. Continental Breakfast

7:30 a.m. Continental Breakfast

Workshop -

8:00 a.m. - 5:00 p.m.
(Lunch Provided)

Workshop -

8:00 a.m. - 4:00 p.m.
(Lunch Provided)

Workshop II

A Hands-on Course in Quantitative Microbial Risk Assessment

This workshop will cover fitting data to statistical distributions, creating and using predictive models in risk assessment, developing a process risk model, using sensitivity analysis, and testing proposed mitigations to reduce risk. Over the course of the workshop, the participants will build an actual working quantitative microbial risk assessment in Excel (Microsoft Corporation) using BestFit and @Risk software (Palisades Corporation).

Participants will build, run, interpret, and determine the impact of various changes to the model. Two-way risk model will be run to show the value of separating variability and uncertainty in quantitative risk assessment. Students will learn to determine whether additional data, better process control or a redesigned process will produce the greatest reduction in risk.

You are encouraged to bring actual data and real world problems to the workshop, but a fictitious example will also be developed during the workshop. Each participant is also strongly encouraged to bring his or her own laptop (with CD drive) and have a working copy of Excel (Microsoft Corp.). Thirty-day demonstration copies of BestFit and @Risk software (Palisades Corporation) will be provided.

Workshop Topics

- Overview of QRA
- Fitting data to distributions
- Use of predictive modeling in QRA
- Building a process risk model in Excel

- Conducting a sensitivity analysis
- Separating variability and uncertainty in QRA
- Hands on exercise:
 - Distributions
 - Modeling
 - Process Risk Model
 - Sensitivity Analysis
 - Variability and Uncertainty

Organizers and Instructors

Richard Whiting, Ph.D., Food and Drug Administration, Center for Food Safety and Applied Nutrition, College Park, MD

Don Schaffner, Ph.D., Rutgers University, New Brunswick, NJ

Who Should Attend?

This workshop will serve as an "advanced introduction" intended for anyone interested in gaining direct hands-on experience with tools and techniques used in quantitative microbial risk assessment.

Hours for Workshop

Registration -

12:30 p.m.

7:30 a.m. Continental Breakfast

Workshop -

1:00 p.m. - 5:00 p.m.

Workshop -

8:00 a.m. - 5:00 p.m.
(Lunch Provided)

Workshop I Assuring Confidence in Laboratory Data

	Early Rate	Late Rate
IAFP Member	\$525.00	\$600.00
Non-Member	\$625.00	\$700.00

Workshop II A Hands-on Course in Quantitative Microbial Risk Assessment

	Early Rate	Late Rate
IAFP Member	\$315.00	\$390.00
Non-Member	\$415.00	\$490.00

(Registration form on page 354)



Workshop Registration Form

Friday-Saturday, August 8-9, 2003

Workshop I: Assuring Confidence in Laboratory Data

Workshop II: A Hands-on Course in Quantitative Microbial Risk Assessment

First Name (will appear on badge) _____

Last Name _____

Company _____

Job Title _____

Address _____

City _____

State/Province _____

Country _____

Postal Code/Zip + 4 _____

Area Code & Telephone _____

Fax _____

E-mail _____

Member # _____

☐ Check Enclosed



Total Amount Enclosed
(US Funds on US Bank) \$ _____

Credit Card # _____

Signature _____

Expiration date _____

Register by July 18, 2003 to avoid late registration fees

Registration

WORKSHOP I: Assuring Confidence in Laboratory Data

	Early Rate	Late Rate
IAFP Member	\$525.00	\$600.00
NonMember	\$625.00	\$700.00

WORKSHOP II: A Hands-on Course in Quantitative Microbial Risk Assessment

	Early Rate	Late Rate
IAFP Member	\$315.00	\$390.00
NonMember	\$415.00	\$490.00

GROUP DISCOUNT:

Register 3 or more people from
your company and receive
a 15% discount. Registrations
must be received as a group.

Refund/Cancellation Policy

Registration fees, less a \$50 administrative charge, will be refunded for
written cancellations received by July 25, 2003. No refunds will be made
after that date; however, the registration may be transferred to a colleague
with written notification. Refunds will be processed after August 18,
2003. The workshop may be cancelled if sufficient enrollment is not
received by July 18, 2003.

For further information, please contact the Association office at 800.369.6337;
515.276.3344; Fax: 515.276.8655; E-mail: jcattanach@foodprotection.org.

4 Easy Ways to Register

To register, complete the Workshop Registration Form and submit it to the International Association for Food Protection by:



Online: www.foodprotection.org

Phone: 800.369.6337; 515.276.3344

Fax: 515.276.8655

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

Contribute to the Sixth Annual Foundation Fund Silent Auction Today!



The Foundation of the International Association for Food Protection will hold its Annual Silent Auction during IAFP 2003, the Association's 90th Annual Meeting in New Orleans, Louisiana, August 10-13, 2003. The Foundation Fund supports the:

- * Ivan Parkin Lecture
- * Travel support for exceptional speakers at the Annual Meeting
- * Audiovisual Library
- * Developing Scientist Competition
- * Shipment of volumes of surplus *JFP* and *FPT* journals to developing countries through FAO in Rome

Support the Foundation by donating an item today. A sample of items donated last year included:

- | | |
|------------------------------------|---|
| * Black Tahitian Pearl Necklace | * Oscar Mayer Remote Controlled Wiener Mobile |
| * Food Safety Information Handbook | * 2001 United States Congressional Ornament |
| * Hand Crocheted Table Coverings | * Wine |
| * Stadium Blanket with IAFP Logo | * Cougar Gold Cheese |
| * Zoo Wall Hanging | * Missouri Ham |

Complete the form and send it in today.



Description of Auction Items _____

Estimated Value _____

Name of Donor _____

Company (if relevant) _____

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

City _____ State or Province _____

Postal Code/Zip + 4 _____ Country _____

Telephone # _____ Fax # _____

E-mail _____

Return to:

Donna Gronstal
International Association for Food Protection
6200 Aurora Avenue, Suite 200W
Des Moines, IA 50322-2864, USA
800.369.6337; 515.276.3344
Fax: 515.276.8655
E-mail: dgronstal@foodprotection.org



International Association for
Food Protection®

Promotional Opportunities

Advertising and sponsorship opportunities are available to enhance the promotion of your organization.

Sponsorships

We invite you to participate as a sponsor for IAFP 2003. Sponsorship participation provides an excellent opportunity to position your company or organization as a supporter of the Association.

Please review the event listing to select the one that will best position your organization. Reservations will be taken in order received for any open sponsorship events. A waiting list for events with a right of first option will be established.

Sponsorship Event List

<u>Amount</u>	<u>Event</u>
\$16,000	Monday Evening Social
\$15,000	Opening Reception (Sunday)
\$14,000	Exhibit Hall Reception (Monday)
\$10,000	President's Reception (Tuesday)
\$7,500	Badge Holders w/Lanyards
\$5,000	Exhibit Hall Pastries and Coffee (Monday Morning)
\$3,000	Exhibit Hall Coffee Break (Monday Afternoon)
\$5,000	Exhibit Hall Pastries and Coffee (Tuesday Morning)
\$3,000	Coffee Break (Tuesday Afternoon)
\$3,000	Coffee Break (Wednesday Morning)
\$2,500	Coffee Break (Wednesday Afternoon)
\$3,500	Notepads with Sponsor's Logo
\$3,500	Spouse/Companion Hospitality Room
\$3,500	Student PDG Luncheon (Sunday)
\$2,500	IAFP New Member Orientation (Saturday)
\$3,000	Affiliate Reception (Saturday)
\$2,000	Awards Banquet Flowers (Wednesday)
\$1,750	Committee Day Refreshments (Sunday)
\$1,500	Exhibitor Move-in Refreshments (Sunday)
\$1,000	Speaker Travel Support

Partial sponsorship for the above events is available.

Contact David Larson for details.

Phone: 515.440.2810

Fax: 515.440.2809

E-mail: larson6@earthlink.net

Sponsorship Participant

Name _____

Company _____

Address _____

City _____ State or Province _____

Country _____ Postal Code/Zip + 4 _____

Phone _____ Fax _____

E-mail _____

Desired Event to Sponsor _____

Amount Paid \$ _____

U.S. Funds on U.S. Bank

Return form to:

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Des Moines, IA 50322-2864

Phone: 515.276.3344

Fax: 515.276.8655

E-mail: info@foodprotection.org

Payment: ☐ Check

☐ Mastercard

☐ VISA

☐ American Express

Account Number _____

Expiration Date _____

Cardholder Signature _____

COMING EVENTS

MAY

- **5-9, Diploma in Food Hygiene and Safety**, Guelph, Ontario, Canada. For more information, contact Guelph Food Technology Centre at 519.821.1246; E-mail: gftc@gftc.ca.
- **6-7, Dairy and Food Plant Waste-water Short Course**, Madison, WI. For more information, contact Dr. Bill Wendorff at 608.263.2015.
- **6-8, HACCP for Juice Processors**, Springfield, MA. For more information, contact Jennifer Epstein at 202.637.4818; E-mail: jepstein@nfpa-food.org.
- **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.
- **15-16, Consumer Complaint Conference**, Santa Fe, New Mexico. For more information, contact Jennifer Epstein at 202.637.4818; E-mail: jepstein@nfpa-food.org.
- **19-21, Advanced Sanitation Short Course**, Cincinnati, OH. For more information, call 205.595.6455; E-mail: us@randolphconsulting.com.
- **19-21, Extending Shelf Life of Bakery Foods**, AIB, Manhattan, KS. For more information, call 785.537.4750.
- **20-21, Associated Illinois Milk, Food and Environmental Sanitarians Annual Spring Meeting**, Bloomington, IL. For more information, contact John Ellingson at 815.490.5523.
- **20-22, Ingredients and Ingredient Functionality Workshop**, University of Nebraska Food Processing Center, Lincoln, NE. For more infor-

mation, contact Pauline Galloway at 402.472.9751; E-mail: pgalloway2@unl.edu.

- **21, Dairy HACCP Workshop**, Madison, WI. For more information, contact Marianne Smukowski at 608.265.6346.
- **21, Microbiology VI: Salmonella Control**, Guelph, Ontario, Canada. For more information, contact Guelph Food Technology Centre at 519.821.1246; E-mail: gftc@gftc.ca.
- **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

- **3-5, Penn State Food Microbiology Short-course Detection and Control of Foodborne Pathogens**, Pennsylvania State University, Berks-Lehigh Valley College, Reading, PA. For more information, contact Dr. Hassan Gourama at 610.396.6121; E-mail: hxg7@psu.edu.
- **5, Functional Foods and Nutraceuticals**, Guelph Food Technology Centre, Guelph, Ontario, Canada. For more information, contact Marlene Inglis at 519.821.1246; E-mail: minglis@gftc.ca.
- **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.
- **14-18, AFDO Annual Educational Conference**, Oakbrook Hills Resort, Chicago, IL. For more information, contact Cheryl Bortner at 717.757.2888; E-mail: afdo@afdo.org.
- **25-27, South Dakota Environmental Health Association Annual Meeting**, Ramkota Convention Center, Pierre. For more information, contact Clark Hepper at 605.773.3364.

- **26, Processing Foods Safely**, Guelph Food Technology Centre, Guelph, Ontario, Canada. For more information, contact Marlene Inglis at 519.821.1246; E-mail: minglis@gftc.ca.

JULY

- **6-9, Home Economics International Consumer Science Conference**, University of Wales Institute, Cardiff, Wales. For more information, contact Ms. Zoe Fearn at 44.29.2041.6306; E-mail: zfearne@uwic.ac.uk.
- **9-10, 2003 Hawaii Lodging, Hospitality and Foodservice Expo 2003**, Honolulu, HI. For more information, contact Ken Kanter at 800.525.5275; E-mail: kanter@lava.net.
- **16-20, 12th World Congress of Food Science and Technology**, Chicago, IL. For more information, visit the Congress site at www.worldcongress.org.

AUGUST

- **8-13, IAFF 2003, the Association's 89th Annual Meeting**, Hilton New Orleans Riverside. For more information, contact Julie Cattnach at 515.276.3344; E-mail: jcattnach@foodprotection.org.

SEPTEMBER

- **10-14, International Food, Drink and Technology Exhibition**, National Expocenter of Ukraine, Kiev. For more information, contact Ken Cardelle at 203.357.1400; E-mail: Kcardelle@iegexpo.com.

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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International Association for
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Vol. 66

April 2003

No. 4

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Detailed knowledge of the food safety vocabulary, working knowledge of conformity standards including GMP (Good Manufacturing Practices), SSOP (Sanitation Standards Operating Procedures), HACCP (Hazards Analysis Critical Control Points) industry standards and regulatory issues.

Demonstrated ability to apply project handling concepts including application to complex, new, or unusual products and services. Detailed knowledge of state of art analytical and field instrumentation.

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Qualified NFPA-SAFE (National Food Processor Association-Supplier Audits for Food Excellence). Administer and support implementation and use of contract resources. Food safety trainer and technical resource (internal/external). Develop content for intra/internet websites to facilitate food safety marketing and customer service. Enact and maintain customer, government and regulatory relationships via participation in conferences and trade shows. Other duties as assigned.

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In the next phase of the project, the eleven concepts identified by the task force, along with creative suggestions, were given to a graphics team for development. The artists then created 3 draft icons (A, B, & C) per concept.

To validate and critique the drafts created, task force members (as well as regulatory and industry partners) conducted numerous, standardized focus-group sessions. A total of 58 focus groups were held with a total of 391 foodservice workers participating in these sessions. The vast majority of focus group participants did not speak English as their primary language. Participants ranged from foodservice personnel working in small ethnic establishments in the community to cruise ships out at sea. For each set of draft icons provided per concept, focus group participants were asked to describe what they thought the icons were trying to communicate and to vote for their favorite icon out of the three. Also, participants were instructed to rate how well they thought the most favored icon communicated the concept.

Once all of the focus groups were completed, the feedback received was summarized and used to select the preferred icon for each concept. In most cases, the food safety concept that the icon was supposed to communicate could be easily determined by a majority of the participants and there was a clear or preferred winner. Feedback was also used to further enhance the most favored icons.

As shown on page 303, the finalized set of International Food Safety Icons is now complete. In the coming months, IAFP will be making them available to interested parties and individuals.

With the icons now available, the next phase of the project will be to monitor how they are being used in real world settings. Only when the icons are embedded in food safety training and management systems in the workplace, will we be able to evaluate their practical value. Keeping track of practical experiences with the icons will enable us to develop a sense of "best practices" that can be shared with the larger food safety community. Such information will greatly facilitate their adoption.

In closing, as cultural diversity increases within foodservice settings, remember that there remains one universal language—serving safe food. IAFP's *International Food Safety Icons* are an important contribution to this vocabulary. Please take a moment to review them, consider their use, and share them with others.

Special thanks to the following individuals who participated as task force contributors: Barbara O'Brien, Susan Conley, Marjorie Davidson, Joseph Eifert, Robert Gravani, Laura Green, Jorge Hernandez, Peter Hibbard, Daryl Kellenberger, Kiyotoshi Yamauchi, Franz Kranzfelder, Alan Levy, Jeanette Lyon, Jennifer Morrell, Charles Otto, and John F. Schulz. Their insight and assistance is sincerely appreciated.

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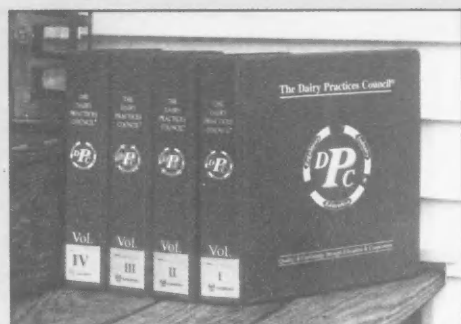


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THOUGHTS

On Today's Food Safety

Communicating Food Safety — Are Words Enough?

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In the coming years, it's predicted that the foodservice industry in the US will continue to see an increase in the number of employees who do not speak English as their primary language. And as our global community expands, this same trend (the need to communicate with people who do not share the same primary language) is increasing in many parts of the world. In order to train such a diverse workforce, it's important that we continue to look for creative ways to enhance the communication and education process.

Clearly, the ability to communicate ideas quickly and effectively is critical. One way to do this is to make thoughts or concepts visible through drawings. There's no doubt that visualization accelerates learning and facilitates communication. In fact, that's why we've all heard of the saying, "a picture is worth a thousand words."

The use of simple drawings or pictures to communicate with others is well documented throughout human history. It is estimated that as early as 50,000 BC pictures first appeared as paintings or carvings in caves for communication purposes. Today, standardized drawings, better known as symbols or icons, remain important tools for communication in settings where you expect to find individuals from different cultural backgrounds. For example, standardized symbols are frequently used for communication purposes at the Olympic Games, international airports, in theme parks, and on traffic signs.

Accordingly, in February of 2002 under the auspices of the International Association for Food Protection's Retail Food Safety & Quality Professional Development Group, a task force was assembled to participate in a

pioneering project to develop *International Food Safety Icons*. International Food Safety Icons are simple pictorial representations of important food safety tasks that can be recognized and understood regardless of a person's native language.

Individuals from the following organizations (which include representation from regulatory, industry, and academia) participated in this groundbreaking project.

Centers for Disease Control and Prevention (CDC)

Cornell University
Darden Restaurants, Inc.
Food and Drug Administration (FDA)
Marriott International, Inc.
McDonald's Corporation
The International Food Safety Council of the National
Restaurant Association Educational Foundation
United States Department of Agriculture (USDA)
Food Safety and Inspection Service (FSIS)
Virginia Tech
Walt Disney World Company

At the start of the project, the task force jointly identified eleven food safety concepts for which International Food Safety Icons would be useful. They include the following critical concepts and contributing factors of foodborne disease: (1) refrigeration/cold holding; (2) handwashing; (3) cooking; (4) hot holding; (5) cooling; (6) wash, rinse, and sanitize; (7) cross contamination; (8) no bare hand contact; (9) temperature danger zone; (10) do not work if ill; and (11) potentially hazardous food.

The task force did not prescribe the intended use or application of the icons, since they are expected to be used many different ways. For example, International Food Safety Icons could appear in food safety training materials, as signs or reminders at food and beverage workstations, on food preparation and storage equipment, on recipe cards, or on food packages. Also, the task force agreed that if any temperatures were to be used on the icons, they should be the same as those cited in the FDA (Model) *Food Code 2001*.

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