

## National base for S.e. efforts

The U.S. Animal Health Assoc. *Salmonella enteritidis* Task Force, is being co-chaired by Dr. Gary Waters, DeKalb Poultry Research, and Dr. Robert Eckroade, avian pathologist at the University of Pennsylvania. The mission of the group is to develop minimum standards which could be applied for an S.e. reduction program in areas where another program is unavailable, Dr. Waters says.

Some states and regions have excellent programs in place or under development, such as New England, Pennsylvania, California, and United Egg Producers Five Star Program. Other areas have no guidelines. At the request of USAHA and FSIS, the group is exploring ways to develop a HACCP-based egg quality assurance program to address S.e. reduction.

At the group's meeting in Reno, representatives from FSIS, APHIS, FDA, and UEP, attended, and when the task is completed and USAHA had endorsed the effort, these industry affiliates and others, will cooperate in providing incentives for egg producers who want to implement the suggestions.

USAHA S.e. Task Force plans a forum for the industry to respond to proposals, January 23 in Room 169 Gold-West at the World Congress Center, Atlanta GA, from 10:00 a.m. to 5:00 p.m. for interested producers.

## ROUTE TO:

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## Canadian code for layer welfare

The Recommended Code of Practice for the Care and Handling of Poultry in Canada suggests space, and feeder and water space for layers, applicable to both floor and cage systems, which are in the best interests of the bird and encourage production, reports *The Cackler Newsletter*.

Environment	White	Brown
Sq. in/bird	64	70
In. feeder space/brd.	4	4
Water nipples/bird	4	4
Capacity/bird		
20 in. X 20 in. cage	5	5
12 in. X 18 in.	3	3
16 in X 16 in.	4	3

## Reiners becomes promotion specialist

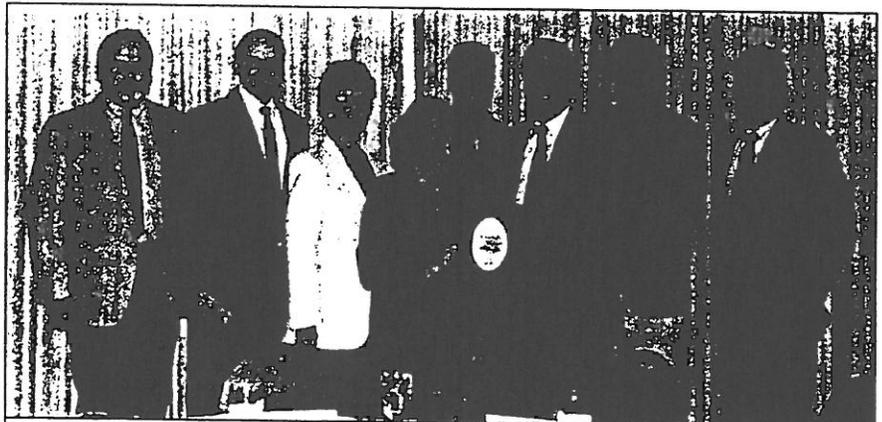
Mary E. Reiners joins the Nebraska Dept. of Agriculture, Poultry and Egg Div. as promotion specialist for the state's egg and turkey industries.



## Statler to head Lehman's

Douglas E. Statler becomes president and CEO of Lehman's Egg Service, Greencastle PA. He succeeds Galen N. Buckwalter, who has stepped down after 17 years, though Buckwalter will continue on the Board, and as a consultant.

Statler has been vp of the company's egg product division most recently.



## Washington elects commission officers

The Washington Egg Commission elected new officers for the year: Diana Stiebrs of Stiebrs Farms, Inc., becomes chairperson, and David Dynes of Dynes Poultry Farm is vice chairperson.

Commission members approved a new advertising plan for 1996, and heard positive results of market research that measures positive consumer awareness from earlier advertising on eggs.

Pictured here are: (l to r) Andy Scarborough, Dept. of Agriculture; Ted Driebelbis, Oakdell Egg Farms; Helen Tomicic, Washington Egg Commission; Diana Stiebrs, Stiebrs Farms, Inc.; David Dynes, Dynes Poultry Farm; Roger Deffner, National Foods Corp.; Steve Pawlikowski, Nest Best Egg Co.; and J.T. Wilcox, Wilcox Farms, Inc.

# Designing a HACCP Plan for Shell Egg Processing Plants

By Patricia A. Curtis, Kenneth E. Anderson and Frank T. Jones

**E**gg temperature (initial and throughout processing and storage), and wash water pH and temperature play key roles in reducing microbial growth in shell eggs, and should be key in developing a HACCP plan for shell egg processing plants. Many processors are initiating their own Hazard Analysis Critical Control Points plans to get a jump on anticipated future regulatory needs. We have compiled data from published research related to the shell egg processing environment which could be helpful when developing a HACCP plan. Board and Tranter (1995) noted that shell eggs can acquire bacteria from every surface they contact.

**Incoming eggs:** Egg temperature at processing is very important. USDA regulations require that wash water temperature be at 90°F or higher, or at least 20°F warmer than the highest egg temperature (which ever is greater). These temperatures must be maintained throughout the cleaning cycle.

Temperature of incoming eggs will vary from season to season and from operation to operation. In off-line processing plants (where eggs are brought in from off-premises) initial internal egg temperatures of 62 to 68°F (16.7 to 20°C) are likely. Although pre-processing coolers are held generally between 50 to 60°F, egg temperatures decline only slightly. Egg temperatures at processing reflect initial internal temperatures generally, because eggs are brought into the processing room and left until they are placed on the processing line. At in-line processing plants (where the processing plant is adjacent to production facilities) internal egg temperatures range generally from 88 to 96°F (31.1 to 35.6°C) when they reach the processing area.

Regulations require also, that wash water be changed every four hours or more if needed, to maintain sanitary conditions. When the difference between wash water temperature and egg temperature is  $\geq 40^\circ\text{F}$ , thermal checks and cracks increase, allowing surface microbes greater access to the interior of the egg.

Contact between wash water and eggs during processing causes internal egg temperature to increase. Although blow drying following washing causes a slight decrease, internal egg temperature rises generally

throughout the process, and can continue to rise for up to six hours after eggs are placed in a cooler.

According to USDA regulations eggs cannot be immersed at any time, but may be pre-wet prior to washing if sprayed with a continuous flow of water—of similar temperature to that of the wash water—which drains away.

**Egg washer:** Cleaning eggs during washing is related to: wash water temperature, water quality characteristics (i.e. hardness, pH), detergent type and concentration, and defoamer. Replacement water in washer tanks should be added continuously to maintain a constant overflow rate, according to USDA regulations. Chlorine or quaternary ammonium sanitizing compounds may be used as part of replacement water provided they are compatible with the detergent. Only potable water may be used to wash eggs and USDA requires a certificate to this effect (USDA, 1991). Rate and extent of bacterial growth during storage is favored by washing eggs in water with less than two ppm iron, so it is important to monitor the iron content of the wash water. USDA suggests that water with an iron content in excess of two ppm should not be used unless de-ironized (Baker and Bruce, 1994). Iron contamination may influence microbial growth when shell membranes are penetrated. As bacteria grow on membranes in an iron-rich environment, they can produce metabolic products which allow microorganisms to penetrate and diffuse into the albumen, providing a more favorable medium for microorganism growth, able to satisfy their iron requirements.

Most processors use wash water much hotter than the minimum 90°F. A survey by Anderson *et al.* (1992) found North Carolina processors' use wash water temperatures that range from 115° to 120°F. In 1955, Hillerman reported that wash water maintained at 115°F would increase internal egg temperature by 0.4°F/second.

Product chosen as detergents and the detergent dispenser must be listed as approved for use on eggs in the current List of Proprietary Substances and Nonfood Compounds (USDA), FSIS, Miscellaneous Publication Number 1419. The best approach for reducing microbial populations in wash

water tanks, and therefore on eggs, occurs when detergents are added in amounts sufficient to maintain a pH of 11.

Alkaline cleaning formulations produce an initial pH in the wash water near 11, and pH during operation continues in the 10-11 range usually, unfavorable for growth of most bacteria (Moats, 1978). However, Jones *et al.* (1995) isolated *S. heidelberg* from the shell of a commercial egg processed in water with a pH of 10.2. Two Canadian researchers, Holley and Proulx (1986), found *Salmonella* species were able to survive at 38 and 42°C (100.4 and 107.6°F) when washwater pH was less than or equal to 9.5. Alkaline pH has been reported to increase the sensitivity of *Salmonella* to heat (Anellis *et al.*, 1954; Cotterill, 1968). Kinner and Moats (1981) found that at pH 10 and 11 bacterial counts decreased regardless of water temperature. They reported that bacterial counts decreased at 50 and 55°C (122 and 131°F) regardless of pH, also. Laird *et al.* (1991) indicated, however, that current processing practices are not sufficient to prevent potential contamination of washed eggs with *Listeria monocytogenes*. Their study showed that *Listeria* is isolated readily from egg processing environments, including wash water.

Because a number of research studies have shown that a pH of 10 to 11, or above is necessary to control bacteria, pH is a relatively inexpensive variable to monitor, and offers significant protection against such bacteria as *Salmonella enteritidis*.

Many shell egg processors have no idea what the pH of their wash water is. Often, those who monitor measure pH only at the start of a shift. PH may be 10 or 11 at the beginning of the shift, but recycling wash water, overflow losses and added replacement water all contribute to reduce pH levels. Detergents elevate the pH of egg washers and are dispensed, for the most part, in concentrations necessary to clean the egg shell. Minimal thought to maintaining a constant pH occurs. When dual tank systems are used, pH in each tank can be different, depending on how the wash systems are connected.

The Food Production and Inspection (FPI) Branch of Agriculture Canada monitors egg grading stations routinely in

## HACCP PLAN

Canada, to ensure that egg washing guidelines are followed. Guidelines include: maintenance of wash water at a temperature of  $\geq 43 \pm 3^\circ\text{C}$  ( $109 \pm 6^\circ\text{F}$ ); maintenance of wash water at  $\text{pH} \geq 10$ ; maintenance and routine cleaning of washers and their parts (e.g., brushes and rollers); and complete change of wash water and cleaning of holding tanks every two to four hours (FPI, 1983). These guidelines were developed to eliminate pathogens that may be present in the wash water and to minimize microbial contamination of the washed eggs. At present, bacterial numbers in egg wash water are monitored to ensure that adequate sanitation is achieved. Total viable counts  $> 10^5$  cfu/ml are considered unacceptable (Bartlett et al, 1993). The U.S. has only regulations governing wash water temperature and time between water changes in the tank, currently.

Defoamers play an important role in egg washing. When defoamers are not dispensed properly, foam in the wash tanks builds up and overflows eventually. When foam spills from the tanks, it can interfere with water level detection, and affect water temperature and pH.

Washing, drying and candling unit operations are continuous generally.

Eggs detected as "dirties" at candling must not be soaked in water for cleaning, because soaking in water for as little as one

to three minutes can facilitate microbial penetration through the egg's shell.

**Rinse and dry:** After washing, the hot water rinse may contain chlorine, or quaternary sanitizers which are compatible with the washing compound. Iodine sanitizing rinse may not be used as part of the replacement water (USDA, 1991).

Ambient air dries the eggs. At this point the surface temperature of the egg reaches approximately  $95^\circ\text{F}$ . Anderson et al (1992) found that the internal temperature of eggs continues to rise due to high shell surface temperatures and candling lights. Five minutes after the eggs were processed, their temperature was 12 to 14 degrees above their initial temperature.

Shell eggs may be oiled then, provided operations are conducted in a manner to avoid contamination of the product. Processing oil that has been previously used and which has become contaminated, can be filtered and heat treated at  $180^\circ\text{F}$  for three minutes prior to reuse.

**Storage:** Sizing and packaging in cartons or flats follows. Cartons or flats are placed in cases and cases are palletized. Efficient packaging procedures such as these ensure that high egg temperature, due to processing, will be maintained for several days. In fact, recent industry surveys by the authors suggest as much as a week is required to dissipate temperature increases from process-

ing under these conditions. Yet, virtually everyone in the shell egg processing industry uses these or similar procedures.

Federal law requires eggs be stored at  $50$  to  $60^\circ\text{F}$ . However, state laws can and do supercede this requirement. Many states have laws requiring eggs be stored at  $45^\circ\text{F}$ . Some states have laws requiring internal egg temperatures of  $45^\circ\text{F}$ .

Researchers have found that the growth rate of *S. enteritidis* in eggs responds directly to the temperature at which the eggs were stored, and that holding eggs at  $40$  to  $45^\circ\text{F}$  reduced the heat resistance of *Salmonella enteritidis*. It has been suggested that refrigeration reduces the level of microbial multiplication in shell eggs, and lowers the temperature at which the organism is killed during cooking. This, in and of itself, may be adequate justification to store eggs at  $40$  to  $45^\circ\text{F}$ .

Humidity in the storage environment is important both in maintaining egg weight and preventing microbial growth. Storage relative humidities of  $\geq 60\%$  can cause weight loss and a corresponding increase in air cell size. However, storage in relative humidities of  $\geq 80\%$  can promote microbial growth.—*Patricia A. Curtis, Department of Food Science; Kenneth E. Anderson and Frank T. Jones, Department of Poultry Science, are with North Carolina State University, Raleigh NC.*



### Useful Internet addresses

Aside from WATT Publishing Co.'s home page on the Internet at <http://wattnet.com>—other sites that may help you gather information include:

- Agricultural Marketing Service at <http://www.usda.gov/aams/titlepag.htm>
- Center for Veterinary Medicine at <http://cvm.fdaa.gov/>
- Internet forum on Food security at <http://fao50.fsa.ulaaval.ca/>
- Institute for Food Science and Technology at <http://www.easynet.co.uk/ifst/>
- California Dept. of Food and Agriculture export branch at <http://cticsuf.cti.csufresno.edu:81/aep.html>

And consumers can buy dried egg whites on the Internet now. Just Whites. Deb-El Foods. is available from [MrNiceJob@Earthlink.Net](mailto:MrNiceJob@Earthlink.Net). An introductory offer two packages (equivalent of over 200 eggs). is \$9.99. The home page has low fat recipes and encourages readers to replace whole eggs in recipes with Just Whites which have a five year shelf life.

### More food comes from foodservice

Of food Americans buy, 40% comes from some type of foodservice, such as restaurants and cafeterias, reports *The Kiplinger Agricultural Letter*. In the 1970's about 70% of the money spent for food was purchased to be prepared and eaten at home.

In per capita spending, there is no increase, when inflation is taken into account, in the cost of food purchased to be eaten at home. The growth occurred in the food eaten away from home. The segment jumping from \$600 year in 1970 to \$943 in 1994, up 60%.

In quantity consumed, foodservice is capturing more of the market, also, with 37% in 1994, compared with 25% in 1970. That does not include prepared food from retail groceries and supermarkets. What this means is that the future for food is in value-added products that a foodservice provider or supermarket prepared food section can offer with a little added labor. Commodity-type food sold by the farmer is further processed to sell to the institutional and foodservice network, which adds more labor before the food is consumed finally. The American public has come to demand and get convenience, quality and consistency in its food. This means each time an item is purchased, the expectation is that it will be the same pleasurable experience as before.

Though the farmer gets 26 cents of what the consumer spends to eat at home for his raw product, this is reduced by 10 cents when that same consumer eats out, reports *The Kiplinger Agricultural Letter*. In 1994 the farmer averaged a return of 21 cents for all on the money consumers spent on food, down from 22 cents the year earlier.