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PRESIDENT'S COUNCIL ON FOOD SAFETY



December 10, 1999

The Honorable William J. Clinton
President
The White House
Washington, DC 20500

Dear Mr. President:

We are transmitting by this letter "Egg Safety From Production to Consumption: An Action Plan to Eliminate *Salmonella* Enteritidis Illnesses Due to Eggs," which was developed by your Council on Food Safety. The action plan is an important part of your Administration's initiative to improve the safety of the nation's food supply, a high priority for American consumers. While the Council is continuing its work on developing a comprehensive food safety strategic plan by July 2000 as well as a coordinated federal food safety budget for FY 02, it recognizes that egg safety is a food safety issue that warrants immediate federal agency attention. Americans consume an average of 234 eggs per person per year. An estimated one in 20,000 eggs in the nation's food supply will contain the *Salmonella* Enteritidis (SE) bacteria and can cause illness if eaten raw in foods or not thoroughly cooked before consumption. From 1985 to 1998, there were 28,644 illnesses and 79 deaths associated with 794 SE outbreaks reported to the Centers for Disease Control and Prevention (CDC).

The Egg Safety Action Plan being transmitted to you today identifies the systems and practices that must be implemented to reduce and ultimately eliminate eggs as a source of human SE illnesses. While the plan's overarching goal is eventual total elimination, its interim goal is an ambitious, but achievable, 50 percent reduction in egg-associated SE illnesses by 2005.

The Council identified 1998 baseline values on numbers of SE cases, isolates, and outbreaks against which the plan's progress can be measured.

Sincerely,

Dan Glickman
Secretary of Agriculture

Donna E. Shalala
Secretary of Health
and Human Services

Neal Lane
Assistant to the President



DEPARTMENT
OF AGRICULTURE



DEPARTMENT
OF COMMERCE

PRESIDENT'S COUNCIL ON FOOD SAFETY



DEPARTMENT OF
HEALTH & HUMAN SERVICES



ENVIRONMENTAL
PROTECTION AGENCY

EGG SAFETY

FROM PRODUCTION TO CONSUMPTION:

AN ACTION PLAN

TO ELIMINATE SALMONELLA ENTERITIDIS ILLNESSES

DUE TO EGGS

December 10, 1999

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**EGG SAFETY FROM PRODUCTION TO CONSUMPTION:
AN ACTION PLAN TO ELIMINATE SALMONELLA ENTERITIDIS ILLNESSES DUE TO EGGS**

EXECUTIVE SUMMARY

PURPOSE. The President's Council on Food Safety has identified egg safety as one component of the public health issue of food safety that warrants immediate federal, interagency action. The Egg Safety Action Plan presented in this report identifies the systems and practices that must be implemented to reduce and, ultimately, eliminate eggs as a source of human *Salmonella* Enteritidis (SE) illnesses. The overarching public health goal of the Council is to eliminate SE illnesses associated with the consumption of eggs by 2010. The interim goal of the Egg Safety Action Plan is a 50 percent reduction in egg-associated SE illnesses by 2005.

BACKGROUND. Americans consume an average of 234 eggs per person per year. While eggs are an important source of protein in the diet, an estimated 1 in 20,000 eggs in the U.S. supply will contain the SE bacteria and can cause illness if eaten raw in foods or not thoroughly cooked before consumption. Because eggs can become contaminated internally from the hen, common egg-handling practices are now considered to be unsafe. These practices include temperature abuse (i.e. holding eggs and egg-containing foods at room temperature instead of under refrigeration), inadequate cooking, and pooling eggs to prepare a large volume of an egg-containing food that is subsequently temperature abused or inadequately cooked.

The SE risk assessment model for shell eggs and egg products, developed jointly by the Food Safety and Inspection Service (FSIS) and Food and Drug Administration (FDA) in 1998, predicted that using multiple interventions could achieve a more substantial reduction in SE illnesses than using any one intervention alone. This finding suggests that a broadly based policy is likely to be more effective in eliminating egg-associated SE illnesses than a policy directed solely at one stage of the egg production to consumption continuum.

On August 26, 1999, the President's Council held a public meeting to obtain input during the development of the action plan to address egg safety. A single theme resounded from representatives of the consumer groups and the egg industry: The federal government needs a set of mandatory national standards. These standards should: (1) provide consumers an assurance that all eggs are subject to the same safety standards across the U.S. and (2) provide egg producers and processors a "level playing field" industry-wide.

RECOMMENDATIONS. The President's Council on Food Safety concluded that the development and implementation of the Action Plan outlined in this report is an effective way to prevent human SE infections due to the consumption of SE-contaminated eggs. The Action Plan reflects our current understanding of the steps needed to reduce egg-associated SE illness. As we move forward with the Plan and develop the proposals, we will assess the impact of the individual action items, consult with stakeholders, and refine the Plan to reflect the best information available to achieve our public health goal.

At each stage of the egg production-to-consumption continuum, the Plan identifies the systems and activities necessary to achieve our food safety public health goals. The Plan offers industry the flexibility to choose from two equivalent SE reduction strategies, each delivering eggs into distribution and to the consumer at an equivalent level of safety. The strategy selection by egg producers and packer/processors determines the point at which the pathogen reduction steps are taken:

- Strategy I: SE testing-egg diversion system on farm
- Strategy II: Lethal treatment, or "kill step" at packer/processor

For the distribution and retail stages, the Plan specifies the safe handling practices necessary to ensure consumers receive a safe food product. Furthermore, the Plan clearly describes the surveillance, research, and education activities that must also be conducted to achieve the elimination of egg-associated SE illnesses. The relative difference in emphasis between the two strategies is highlighted in Figure 1 on page 6.

A comparative summary of the activities in Strategy I and Strategy II is provided in Table 1 on page 7.

To consolidate egg safety oversight responsibilities and provide clarity, the President's Council on Food Safety identified one responsible agency for each stage of the farm-to-table continuum, based on the strengths of each agency, as follows:

- FDA develops standards for the producer and the States provide inspection and enforcement on the farm.
- FSIS develops standards for both shell egg packers and egg products processors and provides inspection and enforcement for both.
- FDA and CDC conduct surveillance and monitoring activities. CDC focuses on human health and FDA on the food supply.

The performance measures that will be used to assess the progress of the Plan toward its goal are the numbers of SE cases, isolates, and outbreaks annually. The data will be collected using the following existing systems: (1) Foodborne Diseases Active Surveillance Network (FoodNet), (2) National Salmonella Surveillance System (via PHLIS), and (3) National SE Outbreak Surveillance System and Foodborne Diseases Outbreak Surveillance System. The new data will be compared to the 1998 baseline values of: (1) 1.9 cases per 100,000 persons; (2) 5,900 SE isolates; and (3) 45 SE outbreaks, respectively.

Figure 1. DEPICTION OF PROGRAM STRATEGIES FOR ACTION PLAN

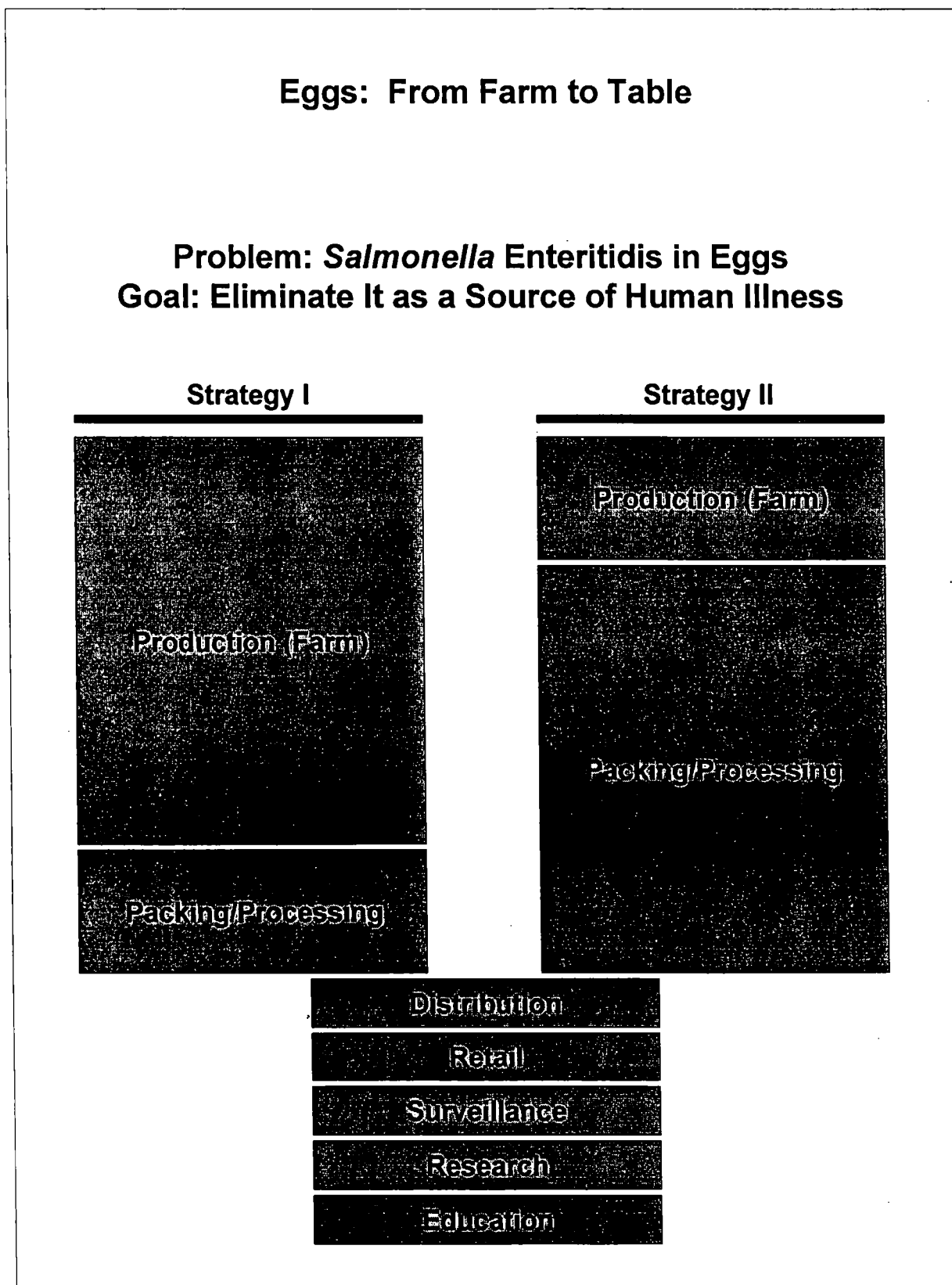


Table 1. COMPARISON OF PROGRAM STRATEGIES FOR ACTION PLAN

Activity	Strategy I	Strategy II
PRODUCTION (On-Farm): Objective 1.1		
Chicks from SE-free breeder flocks	√	√
SE Environmental Testing (chicks, pullets, layers)	√	
SE Environmental Testing (at depopulation)	√	√
SE Egg Testing (w/positive environmental results)	√	
Diversion of shell eggs to pasteurization	√	
Biosecurity	√	√
Rodent/Pest control	√	√
Decontamination (Cleaning & Disinfection)	√	√
PACKING: Objective 1.2		
Prerequisite programs	√	√
HACCP system with a "kill" step		√
PROCESSING: Objective 1.3		
Prerequisite programs	√	√
HACCP system with a "kill" step	√	√
DISTRIBUTION: Objective 1.4		
Refrigeration during transport and storage	√	√
RETAIL: Objective 2		
Food Code (egg-relevant provisions)	√	√
SURVEILLANCE: Objectives 3-6		
Monitoring human and poultry SE infections	√	√
RESEARCH: Objective 7		
	√	√
EDUCATION: Objective 8		
	√	√

¹ Prerequisite programs must address: basic sanitation of facilities and premises; rodent and pest control; employee hygiene and health; safety of water and food packing materials; and washing, sanitizing, and packaging.

² FSIS Final rule; FDA Proposed Rule

**EGG SAFETY FROM PRODUCTION TO CONSUMPTION:
AN ACTION PLAN TO ELIMINATE SE ILLNESSES DUE TO EGGS**

INTRODUCTION

Americans consume an average of 234 eggs per person per year. While eggs are an important source of protein in the diet, an estimated 1 in 20,000 eggs in the U.S. supply will contain the *Salmonella* Enteritidis (SE) bacteria and can cause illness if not thoroughly cooked before consumption. The federal agencies responsible for ensuring the safety of eggs, under the auspices of the President's Council on Food Safety, have jointly developed an Action Plan to eliminate SE illnesses due to the consumption of contaminated eggs.

The Action Plan presented in this report is an aggressive, comprehensive approach to address egg safety that will reduce the number of SE illnesses attributed to eggs in the United States by 50 percent by the year 2005. The Plan identifies systems that must be designed and implemented and activities that must be conducted at each stage of the farm-to-table continuum to reach the overarching goal of eliminating egg-associated SE illnesses. The Plan also recognizes and encompasses federal, state, and local systems already in place and industry activities already occurring. The Action Plan reflects our current understanding of the steps needed to reduce egg-associated SE illness. As we move forward with the Plan and develop the proposals, we will assess the impact of the individual action items, consult with stakeholders, and refine the Plan to reflect the best information available to achieve our public health goal.

SCOPE

This comprehensive, science-based plan contains elements identified by the National Academy of Sciences' Committee to Ensure Safe Food from Production to Consumption as necessary components of an effective food safety system.³

³ Institute of Medicine/National Research Council, NAS. *Ensuring Safe Food: From Production to Consumption*. National Academy Press, Washington, DC, 1998.

- To promote consistency, the Plan calls for a consistent, nationwide program that addresses each stage of the farm-to-table continuum, including on the farm, at the packer or processor, during distribution, as well as for proper handling and preparation practices at retail. The Plan also highlights the proposed and final rules requiring refrigeration at retail and during distribution, respectively, as well as a proposed rule that would require a safe handling statement on the package.
- To provide a science-based foundation, the development of the Plan began with a review of the comprehensive, quantitative risk assessment of SE for shell eggs and egg products. The findings and research needs identified in the risk assessment report were incorporated into the Plan.
- The Plan identifies promising developments in science and technology, such as SE vaccines and in-shell pasteurization, for further research including field and pilot studies.
- The Plan recognizes the need for adequate surveillance, including active surveillance of SE illnesses in regions of the country where the most contaminated eggs are produced and consumed, and calls for expansion of FoodNet activities.
- The Plan identifies gaps in the scientific understanding of the SE bacterium and its route of on-farm transmission to SE-free chicks. The Plan also highlights the federal government's current education efforts focused on the use of safe egg handling practices by food preparers at retail and at home.
- In development of the Plan, the personnel and funds necessary to implement and maintain the specific systems and activities listed, through FY2005, were considered. Therefore, the Plan highlights existing partnerships and encourages the formation of new ones.
- The Plan clearly identifies the agencies responsible for the development and implementation of the new egg safety activities proposed.

The Egg Safety Action Plan presented in this report clearly and concisely describes a way to reduce the number of SE-contaminated eggs in the marketplace and to eliminate SE illnesses caused by consumption of eggs. By combining new and existing systems and activities targeted at both eggs and illnesses, the plan presents a comprehensive, integrated nationwide approach to address an important food safety and public health concern so that Americans can continue to enjoy one of the safest food supplies in the world.

BACKGROUND

President's Food Safety Initiative. On January 25, 1997, the President directed the Secretaries of Agriculture and Health and Human Services and the Administrator of the Environmental Protection Agency to identify specific steps to further improve the safety of the food supply and to further reduce the incidence of foodborne illness to the greatest extent feasible.⁴ In May 1997, they presented the President with a report entitled, "Food Safety from Farm to Table: A National Food Safety Initiative." Under this initiative, the federal government, in concert with state and local governments, industry and academia, are conducting research, risk assessments, and cost-benefit analyses to determine how foodborne illnesses occur and can be prevented or controlled in the most efficient and cost-effective manner. The federal government is also improving surveillance and investigative efforts to locate and monitor illnesses caused by food, updating its approach to inspections of food processors to monitor the safety of the food supply, and reinvigorating education of food preparers focusing on the use of safe practices.⁵

President's Council on Food Safety and Its Strategic Plan. In August 1998, the President established a Council on Food Safety under Executive Order No. 13100 to protect the health of the American people by preventing foodborne illness using science-based regulation and well-coordinated surveillance and investigation,

⁴ EPA/HHS/USDA. *Food Safety From Farm To Table: A National Food-Safety Initiative*. A Report to the President. May 1997.

⁵ Ibid.

inspection, enforcement, research, and educational programs.⁶ In the Order, the President directed the Council to "develop a comprehensive strategic food safety plan for Federal food safety activities" and "advise Federal agencies in setting priority areas for investment in food safety."⁷ He also ordered the Council to make recommendations to him on how to implement a comprehensive science-based strategy to improve the safety of the food supply and enhance coordination among Federal agencies, State, local, and tribal governments, and the private sector. The Council's Food Safety Strategic Plan will focus on "core food safety activities" including activities intended to enhance the safety of the nation's food supply and to protect public health by reducing the annual incidence of acute and chronic foodborne illness. The strategic plan will include Federal programs for research, monitoring, surveillance, regulation, prevention, voluntary and mandatory certification and inspection, enforcement, labeling, and education.⁸ The plan will be used to set priorities, improve coordination and efficiency, identify and close gaps in the current food safety system, enhance and strengthen prevention and intervention strategies, and develop performance measures to monitor progress.⁹

Council's Egg Safety Action Plan. The President's Council on Food Safety has identified egg safety as one component of the overall public health issue of food safety that warrants immediate federal, interagency action. Under the auspices of the President's Council, the Strategic Planning Task Force commissioned an Egg Safety Task Force composed of designees of the federal food safety agencies responsible for egg safety to develop an action plan to eliminate egg-associated SE illnesses. Those agencies are DHHS' Food and Drug Administration (FDA) and Centers for Disease Control and Prevention (CDC) and USDA's Food Safety and Inspection Service (FSIS), Animal and Plant Health Inspection Service (APHIS), Agriculture Marketing Service (AMS), and Agriculture Research Service (ARS). The Egg Safety Action Plan

⁶ President's Council on Food Safety. *Charter*. Dec. 16, 1998.

⁷ President Clinton. *Executive Order 13100: President's Council of Food Safety*. Aug. 25, 1998.

⁸ President's Council on Food Safety. *Scope of the Council's Comprehensive Strategic Food Safety Plan*. Dec. 16, 1998.

⁹ President's Council on Food Safety. *Discussion Paper: Process for developing a Food Safety Strategic Plan for all Federal food safety agencies*. Dec. 16, 1998.

developed by the Task Force and presented in this report identifies the systems and practices that must be implemented to reduce and, ultimately, eliminate eggs as a source of SE illnesses.

Salmonella Enteritidis Contamination of Eggs. *Salmonella* of various serotypes are commonly found in the digestive tracts of animals and frequently contaminate our environment. Originally, *Salmonella* contamination of shell eggs was believed to occur primarily when organisms present on the egg passed through the shell into the egg's contents. However, more recently transovarian SE contamination of egg contents has been determined to occur from SE-infected laying hens. The rate of transovarian egg contamination has been estimated at about 1 SE-positive egg in every 20,000 eggs produced in the U.S.¹⁰

Human SE illnesses. From 1985 to 1998, there have been a total of 794 SE outbreaks reported to CDC involving 28,644 illnesses, 2,839 hospitalizations, and 79 deaths.¹¹ In 1997 alone, an estimated 300,000 infections may have occurred.¹² A typical case of salmonellosis is characterized by diarrhea, abdominal cramps, nausea, vomiting, fever, and headache. Symptoms usually begin within 6 to 72 hours after consuming food, last 4 to 7 days, and resolve without antibiotic treatment for most people who do not have underlying health problems. However, the infection can enter the bloodstream leading to severe and fatal illness. The invasive, life-threatening form of the disease is more likely in highly susceptible populations, including children, the elderly, and persons with weakened immune systems. CDC reported that 54 of the 79 deaths associated with outbreaks of SE between 1985 and 1998 were of individuals in

¹⁰ Food Safety and Inspection Service, USDA. *Salmonella Enteritidis Risk Assessment for Shell Eggs and Egg Products*. Final Report. June 12, 1998.

¹¹ Potter, M.E. Testimony before the Subcommittee on Oversight of Government Management, Restructuring, and the District of Columbia, Committee on Governmental Affairs, United States Senate. July 1, 1999.

¹² Ibid. Based on 7,924 cases, reported to CDC, multiplied by a factor of 38. The estimated degree of underreporting of nontyphoidal *Salmonella* is 38-fold. Ref: Mead, P.S. et al, 1999. *Food-related Illness and Death in the United States*. Emerging Infectious Diseases 5(5): 619.

nursing homes.¹³ In addition, about 2 percent of those who recover from salmonellosis may later develop recurring joint pains and arthritis.

CDC surveillance data show that the rate of isolation of SE from infected humans increased throughout the U.S. during 1976-1994 from 0.5 to 3.9 per 100,000 population. Evaluation of regional trends for the years 1990-1994 actually indicates a decrease in the SE isolation rate from 8.9 to 7.0 per 100,000 population in the Northeast, where egg quality assurance efforts had been the most intensive. In contrast, the rate increased approximately threefold in the Pacific region, with California reporting an increase in SE isolates from 11% in 1990 to 38% in 1994.¹⁴

The benefits associated with preventing human salmonellosis are: (1) the economic benefits of reducing loss of productivity associated with human illness, (2) reduced pain and suffering, and (3) reduced expenditures on medical treatment. The costs associated with human salmonellosis due to SE are estimated to range from \$150 million to \$870 million annually.¹⁵

Egg-Handling Practices. Traditionally, practices such as the use of raw eggs in foods and the undercooking and non-refrigeration of eggs were not considered unsafe. More recently, however, the potential for internal SE contamination of eggs has been established and egg-handling practices have been reevaluated. Common egg-handling practices now considered to be unsafe include: temperature abuse (i.e. holding eggs and egg-containing foods at room temperature instead of under refrigeration); inadequate cooking; and pooling eggs to prepare a large volume of an egg-containing food that is subsequently temperature abused or inadequately cooked. The presence of SE bacteria in a raw egg, alone, does not guarantee illness upon consumption. However, the likelihood of developing an SE infection increases when the egg is not handled safely by permitting the bacteria to multiply and a greater number of bacteria to

¹³ U.S. General Accounting Office. *Food Safety: U.S. Lacks a Consistent Farm-to-Table Approach to Egg Safety*. GAO/RCED-99-184. July 1999.

¹⁴ Centers for Disease Control and Prevention. *Outbreaks of Salmonella Serotype Enteritidis Infection Associated with Consumption of Raw Shell Eggs—United States, 1994-1995*. Morbidity and Mortality Weekly Report 45(34). Aug. 30, 1996.

¹⁵ Food Safety and Inspection Service, USDA. *Salmonella Enteritidis Risk Assessment: Shell Eggs and Egg Products*. Final Report. June 12, 1998.

be ingested with the food. Investigations of SE outbreaks show that the consumption of foods prepared with SE-contaminated eggs that are not cooked or are undercooked or that are held at room temperature is a common scenario. In fact, many of the SE outbreaks that occurred between 1985 and 1998 were attributed to commercial establishments, such as restaurants, hospitals, nursing homes, schools, and prisons, and greater than 75 percent of those SE outbreaks with an identified source were associated with foods containing undercooked eggs. In addition, the 1996-97 Food Consumption and Preparation Diary Survey showed that 27 percent of all egg dishes consumed were undercooked, described as being runny or having a runny yolk or runny white.¹⁶ On average, each person in the survey consumed undercooked eggs 20 times a year. Within those subgroups at risk, women over 65 and children under 6 consumed undercooked eggs 21 times a year and 8 times a year, respectively.

U.S. Egg Industry. On a per capita basis, Americans consume about 234 eggs per year. In 1998, the U.S. table egg industry produced 67.3 billion eggs, up 3 percent from 1997.¹⁷ U.S production is relatively stable and has increased only slightly from about 60 billion eggs in 1984. The total value of the table eggs (eggs produced for human consumption, not hatching) produced in the U.S. in 1995 was estimated at \$3.96 billion.¹⁸ Generally, about 70 percent of the table eggs produced are sold as shell eggs while the remainder are processed into liquid, frozen or dried pasteurized egg products. The majority of egg products are destined for institutional use or further processing into foods such as cake mixes, pasta, ice cream, mayonnaise, and bakery goods.

Flocks associated with egg production fall into three categories: breeders (grandparents), multipliers (parents), and laying flocks (including both immature hens, or pullets, and laying hens, or layers). There were roughly 300,000 breeding hens, 3 million multipliers, and 300 million layers. The value of laying flocks alone is estimated

¹⁶ Lin, C-T., R.A. Morales, and K. Ralston. *Raw and Undercooked Eggs: A Danger of Salmonellosis.* Food Review 20:27-32, 1997.

¹⁷ National Agricultural Statistics Service, USDA. *Layers and Egg Production 1998 Summary.* January 1999.

¹⁸ Food Safety and Inspection Service, USDA and Food and Drug Administration, HHS. *Salmonella Enteritidis in Eggs.* Federal Register, Vol. 63, No. 96. Proposed Rules. May 19, 1998.

to be nearly \$1 billion.¹⁹ Geographically, commercial egg production in the western U.S. is concentrated in California and in the eastern U.S. is centered in Ohio, Indiana, and Pennsylvania. Other states in which major producers are located include Iowa, Texas, Minnesota, and Georgia. About 5,000 producers have 3,000 or more layers, representing 99 percent of all domestic egg-laying hens and accounting for 99 percent of total egg production.²⁰ An additional 65,000 farms have less than 3,000 egg-laying hens accounting for the balance of eggs produced.²¹

Current Regulation of Shell Eggs. Federal authority to regulate egg safety is shared by the Department of Health and Human Services' (HHS') Food and Drug Administration (FDA) and the United States Department of Agriculture's (USDA's) Food Safety Inspection Service (FSIS). In addition, USDA's Animal and Plant Health Inspection Service (APHIS) conducts a control program that certifies poultry breeding stock and hatcheries as SE-free and USDA's Agricultural Marketing Service (AMS) conducts a surveillance program to ensure proper disposition of restricted shell eggs. (See Figure 2, page 16; see glossary.)

FDA has jurisdiction over the safety of foods generally, including shell eggs, under the Federal Food, Drug, and Cosmetic Act (FFDCA; 21 U.S.C. 301 *et seq.*). Under the Public Health Service Act (PHSA; 42 U.S.C. 201 *et seq.*), FDA also has the authority to prevent the spread of communicable diseases, including the authority to regulate foods when the foods may act as a vector of disease, as in the case of SE in eggs. FDA is responsible for: (1) investigating SE outbreaks, reported by CDC and State/local health departments, due to foods in interstate commerce, (2) performing trace backs to identify the source of the implicated eggs, (3) testing flocks, (4) diverting eggs from SE-positive flocks, (5) collecting flock data to help track the spread of SE among layer flocks, and (6) promoting better quality control.

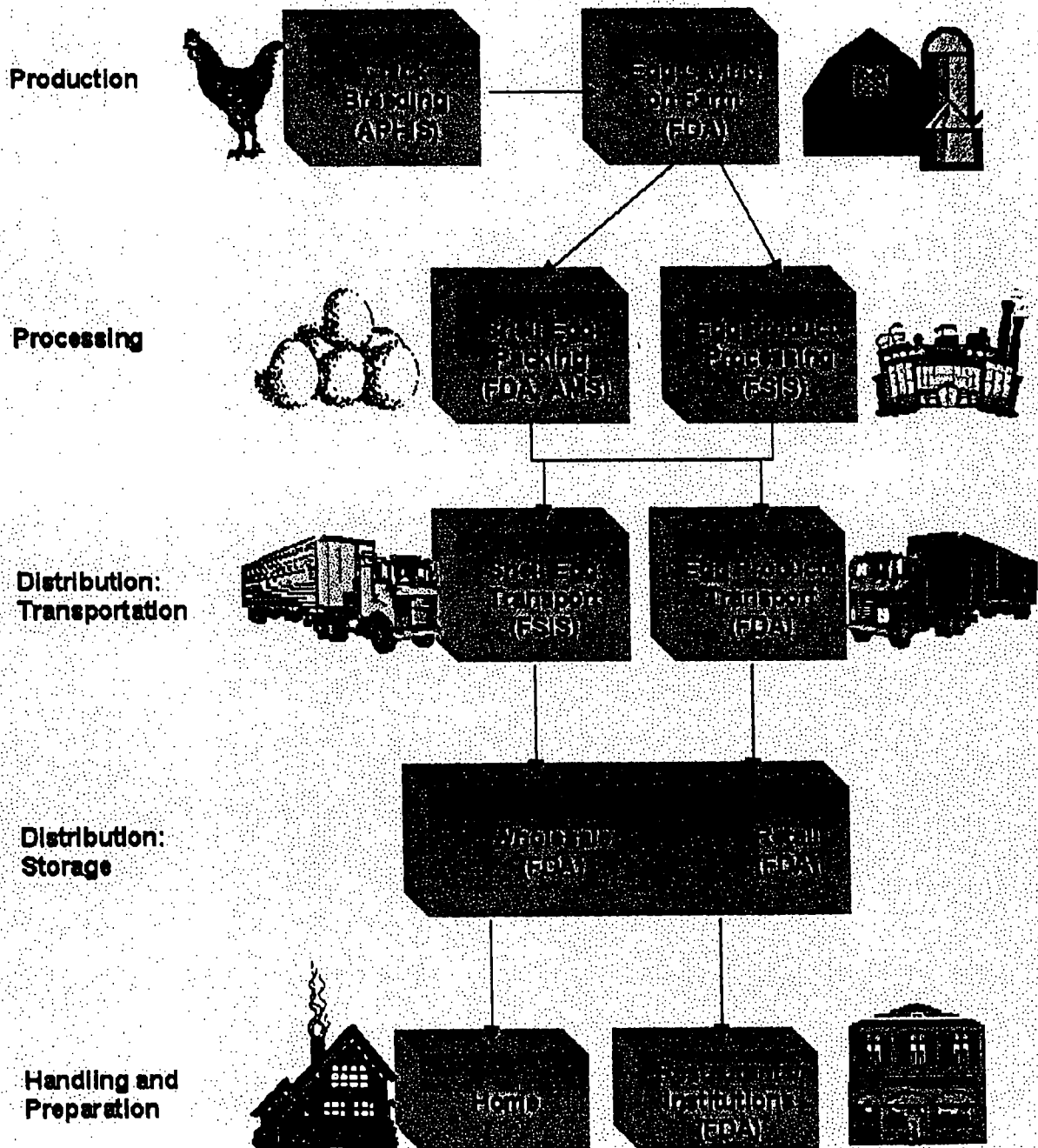
USDA has primary responsibility for implementing the Egg Products Inspection Act (EPIA; 21 U.S.C. 1031 *et seq.*). Under EPIA, FSIS has primary responsibility for the

¹⁹ Ibid.

²⁰ AMS correspondence with FDA. 10/1/99.

²¹ National Agricultural Statistics Service, USDA. 1997 *Census of Agriculture*. Poultry Inventory and Sales.

Figure 2. Egg Safety from Production to Consumption



inspection of processed egg products to prevent the distribution of adulterated or misbranded egg products. Also under EPIA, AMS conducts a surveillance program to ensure proper disposition of restricted shell eggs and visits producer/packers periodically to ensure: (1) that eggs packed for commercial sale contain no more restricted eggs than permitted for US Consumer Grade B, (2) that restricted and inedible product is properly labeled, and (3) that restricted and inedible eggs are denatured and properly disposed of. Under current federal regulations, all major commercial egg producers are required to register with AMS and are subject to periodic onsite inspections by AMS. In FY1998, 698 producer/packers were registered with AMS, with a balance of about 4,300 producers that do not process (pack).²²

Quantitative Risk Assessment of SE in Eggs. In December 1996, FSIS and FDA jointly began a comprehensive risk assessment in response to an increasing number of human illnesses associated with the consumption of eggs.²³ A team of scientists developed a quantitative model to characterize the risks associated with the consumption of eggs contaminated internally with SE, using information obtained from academic, government, and industry sources and scientific literature. The risk assessment model consists of discrete modules that may be used independently to evaluate the effect of variable changes during a particular stage of the farm-to-table continuum. However, the overall model encompasses the entire continuum, from the chicken through egg production, to egg consumption and human illness. The model continues to serve as a quantitative tool for FSIS and FDA decision-makers to use in the design of a comprehensive, integrated risk reduction strategy.

The risk assessment of SE in eggs: (1) established the unmitigated risk of foodborne illness from SE; (2) evaluated potential risk reduction strategies; and (3) identified knowledge gaps where future research is needed. First, the model predicted the risk of a hen laying an SE-contaminated egg to be 1 in 20,000. Second, two interventions showed great promise in reducing the number of SE illnesses associated with contaminated egg consumption: (1) lowering the temperature at which shell eggs

²² AMS correspondence with FDA. 9/20/99.

are maintained and (2) diverting eggs produced by SE-positive flocks from the shell egg market to the pasteurized, egg products market. In addition, the model predicts that the probability of any cases of SE illness resulting from the consumption of pasteurized egg products is low. However, the risk of illness may be further reduced by basing the egg product pasteurization time-temperature standards on: (1) the amount of bacteria in the raw product, (2) the specific process used to treat the raw product, and (3) the intended use of the finished egg product. Third, several research needs were identified and have been incorporated into the research objective of this Action Plan. Overall, the model predicted that while using any one intervention could achieve a modest reduction in human SE illnesses, using multiple interventions could achieve a more substantial reduction for those interventions tested. This finding suggests that a broadly based policy is likely to be more effective in eliminating egg-associated SE illnesses than a policy directed solely at one stage of the egg production to consumption continuum.

FDA and FSIS Egg Safety Regulations. As a result of the risk assessment findings, FDA has proposed a rule to require: (1) safe handling statements on labels of shell eggs that have not been treated to destroy *Salmonella* bacteria and (2) that shell eggs be stored and displayed under refrigeration at a temperature of 7.2°C (45°F) or less when held at retail establishments.²⁴ These proposed actions complement FSIS' final rule that requires: (1) shell eggs be stored and transported at an ambient air temperature of 7.2°C (45°F) or less and (2) consumer containers of shell eggs be labeled to indicate that refrigeration is required.²⁵ The label statements are intended to ensure that consumers have the information necessary to protect themselves from eggs contaminated with SE. The refrigeration requirements are intended to ensure that eggs be held at temperatures that restrict pathogen growth. Careful coordination of these efforts in the overall strategy presented in the SE Action Plan will amplify their individual

²³ Food Safety and Inspection Service, USDA. *Salmonella Enteritidis Risk Assessment for Shell Eggs and Egg Products*. Final Report. June 12, 1998.

²⁴ Food and Drug Administration, HHS. *Safe Handling Label Statement and Refrigeration at Retail Requirements for Shell Eggs*. Federal Register, Vol. 64, No. 128. Proposed Rules. July 6, 1999.

²⁵ Food Safety and Inspection Service, USDA. *Refrigeration and Labeling Requirements for Shell Eggs*. Federal Register, Vol. 63, No. 166. Final Rule. Aug. 27, 1998.

impact and will provide early progress toward meeting the public health goals of the Action Plan.

AN ACTION PLAN FOR EGG SAFETY

On August 26, 1999, the President's Council held a public meeting to obtain input during the development of the action plan to address egg safety. A single theme resounded from representatives of the consumer groups and the egg industry. The federal government needs a set of national, mandatory standards. These standards should: (1) provide consumers an assurance that all eggs are subject to the same safety standards across the U.S. and (2) provide egg producers and processors a "level playing field" industry-wide.

With this in mind, the Council concluded that the further development and implementation of the Action Plan presented in this section of the report is the most effective way to achieve its public health goals. This comprehensive Action Plan identifies the sum of activities necessary to reach the overarching goal of the elimination of SE illnesses associated with the consumption of eggs. While the Plan focuses on SE and eggs, major components of the Plan offer food safety benefits well beyond the specific goal of eliminating egg-associated human SE illnesses. For example, upgrading the information systems at public health departments will contribute to reductions in all foodborne illnesses.

The Action Plan consists of 8 objectives, each with at least one performance measure, covering all stages of the farm-to-table continuum as well as support functions. The farm-to-table continuum encompasses: egg production, shell egg processing (or packing), egg products processing, egg distribution, and egg handling and preparation. The support functions are surveillance of human and poultry SE infections (including outbreak and traceback investigations) and eggs, research, and education.

Regulatory approach. The Action Plan presented in this report clearly lays out the components for an effective program to prevent human SE infections resulting from consumption of contaminated eggs. At each stage of the egg production-to-consumption continuum, the Plan identifies the systems and activities necessary to achieve our food safety public health goals. The Plan offers industry the flexibility to choose from two equivalent SE reduction strategies, each delivering eggs into distribution at an equivalent level of safety. The strategy selection by egg producers and packer/processors determines the point at which the pathogen reduction steps are taken:

- Strategy I: SE testing-egg diversion on farm
- Strategy II: Lethal treatment, or "kill step" at packer/processor

For the distribution and retail stages, the Plan specifies the safe handling practices necessary to ensure consumers receive a safe food product. Furthermore, the Plan clearly describes the surveillance, research, and education activities that must also be conducted to achieve the elimination of egg-associated SE illnesses.

Both Strategies I and II require an on-farm regulatory presence and a packer/processor regulatory presence; therefore, an industry shift over time from one strategy to the other should not change the overall human resource needs. Because reaching our public health goals requires that each stage of the farm-to-table continuum achieve its objectives, oversight and enforcement at every stage will be key to the Plan's success.

As the federal agencies develop consistent nationwide standards through the public process, they encourage States and the egg industry to adopt, in the interim, measures such as the Pennsylvania Quality Assurance program (PEQAP), United States Animal Health Association (USAHA) SE Reduction Program or equivalent.

Organizational structure. To consolidate egg safety oversight responsibilities and provide clarity, the Council identified one responsible agency for each stage of the farm-to-table continuum, based on the strengths of each agency, as follows:

- FDA develops standards for the producer and the States provide oversight and enforcement on the farm.
- FSIS develops standards for both shell egg packers and egg products processors and provides inspection and enforcement for both.
- FDA and CDC conduct surveillance and monitoring activities. CDC focuses on human health and FDA on the food supply.

Therefore, the plan can be implemented quickly without legislation.

The performance measures that will be used to assess the progress of the Plan toward its goal are the numbers of SE cases, isolates, and outbreaks annually. The data will be collected using the following existing systems: (1) Foodborne Diseases Active Surveillance Network (FoodNet), (2) National Salmonella Surveillance System (via PHLIS), and (3) National SE Outbreak Surveillance System and Foodborne Diseases Outbreak Surveillance System. The new data will be compared to the 1998 baseline values of: (1) 1.9 cases per 100,000 persons; (2) 5,900 SE isolates; and (3) 45 SE outbreaks, respectively.

EGG SAFETY ACTION PLAN

OVERARCHING GOAL:

To eliminate SE illnesses associated with the consumption of eggs by 2010. The Egg Safety Action Plan has set an interim goal of a 50% reduction in egg-associated SE illnesses by 2005.

Performance measures: Numbers of SE cases and outbreaks decrease annually. Data from: (1) Foodborne Diseases Active Surveillance Network (FoodNet), (2) National Salmonella Surveillance System (via PHLIS), and (3) National SE Outbreak Surveillance System and Foodborne Diseases Outbreak Surveillance System.

1998 Baseline data: (1) 1.9 cases per 100,000 persons; (2) 5,900 SE isolates; and (3) 45 SE outbreaks, respectively.²⁶

Objective 1:

Reduce the number of SE-containing eggs marketed to the consumer.

Performance measure: Number of production sites testing positive for SE reduces annually, according to agency and producer data. (Proxy measure for eggs marketed baseline to be determined.).

- 1.1 Establish a consistent, nationwide SE reduction program for egg production that includes components such as:
 - 1.1.1 SE environmental testing
(For example, chick papers; pullets at 12-14 weeks and layers at 25-30 weeks of age; post-molt, if molted; 2-4 weeks prior to de-population.)
 - 1.1.2 Restricting access and movement of personnel and equipment
 - 1.1.3 Using SE-negative feed
 - 1.1.4 Using chicks from SE-negative breeders
 - 1.1.5 Cleaning and disinfection of poultry houses and equipment
 - 1.1.6 Improving rodent and pest control in houses
 - 1.1.7 Diverting of eggs to pasteurization if SE testing yields a positive.
(With option to test eggs and sell SE-negative eggs as shell eggs.)
 - 1.1.8 Training agency inspection force

²⁶ CDC correspondence with FDA. 10/27/99.

Timeline: Proposed rule - FY2000; final rule - FY2001; implementation following.

- 1.2 Establish a HACCP-based system for shell egg processing and prerequisite programs that includes components such as:

- 1.2.1 Basic sanitation of premises and facilities
- 1.2.2 Rodent and pest control
- 1.2.3 Employee hygiene and health
- 1.2.4 Safety of water and food packing materials
- 1.2.5 Washing, sanitizing, grading, packaging, cooling, and repackaging

Timeline: Proposed rule - FY2002; final rule - FY2003; implementation following.

- 1.3 Establish a HACCP-based system for egg products processing and prerequisite programs that includes components such as:

- 1.3.1 Basic sanitation of premises and facilities
- 1.3.2 Rodent and pest control
- 1.3.3 Employee hygiene and health
- 1.3.4 Safety of water and food packing materials
- 1.3.5 Washing, sanitizing, packaging

Timeline: Proposed rule - FY2000; final rule - FY2001; implementation following.

- 1.4 Finalize and implement refrigeration and labeling regulations for eggs from processor to consumer.

Timeline: Final rule - FY2000; implementation following.

Objective 2:

Reduce exposure of consumers to SE-containing foods.

Performance measure: Number of egg-associated SE illnesses due to unsafe handling practices at the retail stage decreases annually.

- 2.1 Establish safe egg handling and preparation practices using egg-relevant sections of FDA's 1999 Food Code, specifically practices such as:

- 2.1.1 Acquisition

- 2.1.2 Storage
- 2.1.3 Preparation
- 2.1.4 Service

Timeline: Proposed rule - FY2000; final rule - FY2001; implementation following.

- 2.2 Identify and address barriers to implementing Food Code provisions in facilities serving high-risk populations, through the collaborative efforts of interagency Federal Food Safety Coalition. These facilities include:

- 2.2.1 Child and adult day care centers
- 2.2.2 Senior centers and home-delivered meals
- 2.2.3 Preschools and elementary schools
- 2.2.4 Nursing homes
- 2.2.5 Hospitals
- 2.2.6 Detention and penal facilities

Timeline: Ongoing

Objective 3:

Expand and upgrade surveillance systems for human SE infection

Performance measures: Number of public health laboratories that rapidly report SE isolates and SE outbreak surveillance data electronically increases; number of SE isolates phage-typed increases

- 3.1 Conduct active surveillance in a location where SE is prevalent. (Requires an additional FoodNet site.)

Timeline: By FY2005

- 3.2 Upgrade information systems, at State and local public health departments, for electronic reporting of laboratory-confirmed SE isolations (via Public Health Laboratory Information System) and SE outbreak surveillance data.

Timeline: By FY2005

- 3.3 Maintain CDC's role as the national SE phage typing reference and support center for human isolates. Continue phage-typing SE isolates submitted through

the National Antimicrobial Resistance Monitoring system-Enteric Bacteria (NARMS-EB).

Timeline: Ongoing

- 3.4 Begin phage typing human SE isolates from FoodNet sites.

Timeline: By 2001

- 3.5 Conduct SE case-control studies at FoodNet sites to monitor changes in risk factors for human SE infection and association with egg consumption.

Timeline: By FY2005

Objective 4:

Expand surveillance and upgrade surveillance systems for poultry SE infection

Performance measures: Availability of data on prevalence of SE infections in poultry increases; number of SE-isolates phage-typed increases.

- 4.1 Monitor SE prevalence in layer breeding flocks.

Timeline: Ongoing

- 4.2 Complete USDA NAHMS Layers '99 Study.

Timeline: By FY2000. (Repeat survey in FY2005.)

- 4.3 Phage-type SE isolates submitted through Layers '99 Study.

Timeline: By 2001

- 4.4 Define, assess and enhance surveillance capacities and data at industry and animal health agencies.

Timeline: By 2005

- 4.5 Maintain USDA's National Veterinary Services Laboratories (NVSL) role as the national SE phage typing reference and support center for feed and animal isolates.

Timeline: Ongoing

Objective 5:

Accelerate SE outbreak detection and initiation of outbreak investigations and improve completeness of outbreak investigations.

Performance measures: Number of SE outbreaks investigated completely increases; number of egg-associated outbreaks in which source of eggs is identified increases.

- 5.1 Develop and implement new outbreak detection algorithms. Use Salmonella Outbreak Detection Algorithm (SODA) to analyze SE surveillance data.

Timeline: Ongoing

- 5.2 Identify and address reasons for delayed investigation and reporting of SE outbreaks from state agencies.

Timeline: By FY2005

- 5.3 Assess practices and environmental circumstances during outbreak investigations to identify common contributing factors.

Timeline: By FY2005

- 5.4 Establish product identification and tracking system requirements to facilitate identification of egg sources during outbreaks.
(Note: May require new statutory authority to access product records.)

Timeline: By FY2005

- 5.5 Establish national egg traceback procedures.

Timeline: By FY2005

Objective 6:

Improve communication among Federal, State, and local agencies involved in SE outbreak and traceback investigations and by agencies with industry and the public about outbreaks.

Performance measure: Number of days to notify other relevant government agencies of outbreaks decreases.

- 6.1 Establish a listserve to communicate SE outbreak information among public health authorities and other partners.

Timeline: By FY2001

- 6.2 Conduct an SE outbreak information needs assessment with industry and the public.

Timeline: By FY2001

- 6.3 Develop and maintain an internet site for posting SE surveillance and outbreak data for industry and public access.

Timeline: By FY2001

Objective 7:

Ensure adequate, current information is available to make decisions about SE preventive controls, surveillance, and education based on sound science.

Performance measure: Number of research questions answered increases.

- 7.1 Conduct research to develop and evaluate on-farm intervention strategies or technologies including:

- 7.1.1 Forced molting and other stress factors
- 7.1.2 Vaccines and immunomodulators
- 7.1.3 Competitive exclusion
- 7.1.4 Ion air scrubbers in hatcheries

Timeline: By FY2005

7.2 Conduct research to provide additional information about commercial processing technologies and practices including:

- 7.2.1 In-shell pasteurization of eggs
- 7.2.2 Rapid cooling before and after processing
- 7.2.3 Continuous rewashing
- 7.2.4 Repackaging
- 7.2.5 Pasteurization of egg products with additives

Timeline: By FY2003

7.3 Conduct research to improve testing methodologies for SE on the farm and in eggs, including the identification of virulence factors and development of rapid tests, screening tests, sampling protocols, and molecular methods for subtyping SE isolates.

Timeline: By FY2005

7.4 Conduct research to understand the ecology and epidemiology of SE in the hen and farm environment, including:

- 7.4.1 Sources of SE in the environment
- 7.4.2 Mechanism of colonizing the layer house
- 7.4.3 Factors affecting infection of the hen and contamination of the egg
- 7.4.4 Characteristics of SE that promote infection in hens and humans
- 7.4.5 Biochemical characteristics of SE strains causing variations in virulence
- 7.4.6 Immunological and other factors in humans that affect infectivity
- 7.4.7 Risk factors associated with the on-farm presence of SE isolates.

Timeline: By FY 2008

Objective 8:

Educate individuals throughout the production to consumption continuum using science-based materials.

Performance measures: Number of partnerships increases; number of education materials available increases; percentage of consumers using unsafe egg-handling practices decreases.

8.1 Develop and distribute materials for the egg, retail, and foodservice industries, using partnerships:

- 8.1.1 For egg producers and processors/packers about their role in egg safety, using egg industry organizations.
- 8.1.2 For retailers and food service workers about regulations and adoption of the Food Code, using retail and institutional organizations.
- 8.1.3 For food packages including safe food handling tips, using food industry representatives.

Timeline: FY 2000-2005

8.2 Develop and distribute materials for target audiences of:

- 8.2.1 Healthcare practitioners, including physicians, about diagnosing and treating foodborne illness, through professional organizations, such as the AMA.
- 8.2.2 Patients and at-risk populations, about safe handling and preparations of foods, including eggs, through professional organizations, such as the AMA.
- 8.2.3 Food preparers at facilities serving highly susceptible populations, including nursing homes, daycare centers, and hospitals, about proper egg handling and preparation practices.
- 8.2.4 Under-served populations, including Hispanics and African-Americans, about proper egg handling and preparation practices, through magazines and newspapers.
- 8.2.5 Senior citizens, about proper egg handling and preparation practices, using the Food Safety Information for Seniors, the Senior food safety website, the Senior food safety video, and the Senior food safety publication.
- 8.2.6 Women and men, about proper egg handling and preparation practices, through women's, men's, and health magazines.
- 8.2.7 Students and parents, advice on not eating foods containing uncooked eggs, such as homemade raw cookie dough.

Timeline: FY 1999-2000

8.3 Conduct a nationwide telephone survey to assess consumer knowledge about and proper practices of egg handling and consumption, including:

- 8.3.1 Consume raw or undercooked (runny) eggs, by age group
- 8.3.2 View eggs as a high-risk food
- 8.3.3 Awareness of safe handling and warning label statements

8.3.4 Cooking time-temperatures

8.3.5 Pooling

Timeline: FY 1999-2000

- 8.4 Conduct a survey at retail establishments (e.g. restaurants, institutions) to assess food preparer knowledge and proper practices of egg handling, as in 8.3.

Timeline: FY 2001-2002

[End of Action Plan]

Appendix 1. Action Plan Timeline

Task Name	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
1.1 Establish a consistent, nationwide SE reduction program for egg production.											
1.2 Establish a HACCP-based system for shell egg processing and prerequisite programs.											
1.3 Establish a HACCP-based system for egg products processing and prerequisite programs.											
1.4 Finalize and implement refrigeration and labeling regulations for eggs from processor to consumer.											
2.1 Establish safe egg handling and preparation practices using egg relevant sections of FDA's 1999 Food Code.											
2.2 Identify and address barriers to implementing Food Code provisions in facilities serving high-risk populations through the collaborative efforts of the interagency Federal Food Safety Coalition.											
3.1 Conduct active surveillance in a location where SE is prevalent.											
3.2 Upgrade information systems, at State and local public health departments, for electronic reporting of laboratory-confirmed SE isolations and SE outbreak surveillance data.											
3.3 Continue phage-typing SE isolates submitted through National Antimicrobial Resistance Monitoring system-Enteric Bacteria (NARMS-EB) and isolates from SE outbreaks.											
3.4 Begin phage typing human SE isolates from Food Net sites.											
3.5 Conduct SE case-control studies to monitor changes in risk factors for human SE infection and association with egg consumption.											
4.1 Monitor SE prevalence in layer breeding flocks.											
4.2 Complete USDA NAHMS Layers '99 Study.											
Repeat USDA NAHMS Layers '99 Study.											
4.3 Phage-type SE isolates submitted through Layers '99 Study.											
4.4 Define, assess and enhance surveillance capacities and data at industry and animal health agencies.											
4.5 Maintain USDA's National Veterinary Services Laboratories (NVSL) role as the national SE phage typing reference and support center for feed and animal isolates.											
5.1 Develop and implement new outbreak detection algorithm. Use SODA to analyze SE surveillance data.											
5.2 Identify and address reasons for delayed investigation and reporting of SE outbreaks from state agencies.											
5.3 Assess practices and environment circumstances during outbreak investigations to identify common contributing factors.											
5.4 Establish product identification and tracking system requirements to facilitate identification of egg sources during outbreaks.											
5.5 Establish national egg traceback procedures.											
6.1 Establish a listserve to communicate SE outbreaks among public health authorities and other partners.											
6.2 Conduct an SE outbreak information needs assessment with industry and the public.											
6.3 Develop and maintain an internet site for posting SE surveillance and outbreak data for public access.											
7.1 Conduct research to develop on-farm intervention strategies or technologies.											
7.2 Conduct research to provide additional information about commercial processing technologies and practices.											
7.3 Conduct research to improve testing methodologies for detection of SE on the farm and in eggs.											
7.4 Conduct research to understand the ecology and epidemiology of SE in the hen and in the farm environment.											
8.1 Develop and distribute materials for the eggs, retail, and foodservice industries, using partnerships.											
8.2 Develop and distribute materials for target audiences.											
8.3 Conduct a nationwide telephone survey to assess consumer knowledge about and proper practices of egg handling and consumption.											
8.4 Conduct a survey at retail establishments (e.g. restaurants, institutions) to assess food preparer knowledge and proper practices of egg handling.											

APPENDIX 2. GLOSSARY

Biosecurity. The term refers to procedures designed to prevent SE from being carried into poultry houses from outside sources and may include all or some of the following: use of chicks from SE-negative breeder flocks, use of SE-negative feed ingredients; proper use of medications and pesticides; and restricted access and movement of personnel and equipment in/out of hen houses.

Eggs. The term is used in this document to include both shell eggs and egg products.

Egg products processing. The processing of shell eggs into egg products involving breaking, filtering, mixing, stabilizing, blending, pasteurizing, cooling, freezing or drying, and packaging.

Egg production. The on-farm activities of egg-laying and collection.

Egg products. The term refers to eggs that have been removed from their shells and processed. The term applies to whole eggs, whites, yolks, and various blends with or without non-egg ingredients, regulated by FSIS. The term does not apply to freeze-dried products, imitation egg products, and egg substitutes which are the responsibility of FDA.

Federal Food Safety Coalition. The interagency working group consists of members from: Department of Veterans Affairs, Veterans Health Administration; USDA, Food and Nutrition Service's School Lunch Program, WIC Program, and Infant Formula Program; Department of Justice, Bureau of Prisons; HHS, Head Start Program, Administration on Aging, Indian Health Service, Health Care Financing Administration, and CFSAN.

Food Code. A reference document for regulatory agencies responsible for overseeing food safety in retail outlets, such as restaurants, grocery stores, and institutions (including nursing homes and daycare centers), consisting of recommendations for adoption by local, state, and federal governmental jurisdictions, offered by FDA.

FoodNet (Foodborne Diseases Active Surveillance Network). A network consisting of 8 sites that conduct active surveillance, investigations, and epidemiologic studies. The information is used to: (1) determine the frequency and severity of foodborne diseases; (2) determine the proportion of common foodborne diseases that result from eating specific foods; (3) describe the epidemiology of new and emerging foodborne pathogens; and (4) assess the effectiveness of new food safety control measures. It is a collaborative project among CDC, the 8 sites, FSIS and FDA.

HACCP (Hazard Analysis-Critical Control Points). The process of identifying the hazards (hazard analysis) present in a process and determining critical points

throughout the process (critical control points) at which loss of control would result in the presence of a hazard posing a serious risk to human health.

Layers. Hens (including those being molted) or pullets producing table or commercial type shell eggs, usually at least 20 weeks of age.

“Layers 99” NAHMS Survey. A study to: (1) describe baseline health and management practices used by the U.S. layer industry; (2) estimate the national prevalence of SE in layer flocks by testing the environment and at layer operations; (3) identify potential risk factors associated with the presence of SE; and (4) describe biosecurity practices.

Molt. A process during which hens stop laying and shed their feathers, occurring naturally every 12 months. May be artificially induced by withholding feed or water for a period of time. Forced molting is done to improve egg production.

National Animal Health Monitoring System (NAHMS). An animal health monitoring system, established by APHIS in 1990, (1) to help government officials and industry organizations define public risks and identify research needs and (2) to identify opportunities for producers and veterinarians to improve management and product quality.

National Antibiotic Resistance Monitoring System (NARMS). A system for monitoring emerging resistance to antibiotics in foodborne pathogens, established in 1996 as an interagency cooperative activity.

National Poultry Improvement Plan (NPIP). A program that certifies that poultry breeding stock and hatcheries are free from egg-transmitted and hatchery-disseminated diseases, including SE.

National Veterinary Services Laboratories (NVSL). A national laboratory providing veterinary diagnostic, laboratory support, and reference services related to domestic and foreign livestock and poultry diseases for programs, including NAHMS and NPIP, and administered by APHIS.

Outbreak. Two or more people having a similar illness that has been traced to eating a common food.

Public Health Laboratory Information System (PHLIS). An electronic reporting system used by State public health laboratories to report isolates of *Salmonella* from human sources to CDC's National Salmonella Surveillance System.

Pullet. A female chicken that has not yet started to lay eggs.

Restricted eggs. Eggs with cracks or checks in the shell, dirty eggs, incubator rejects, and inedible, leaker, or loss eggs.

Salmonella Enteritidis (SE). A bacterium of the genus *Salmonella*, species *enterica*, and serotype Enteritidis.

SE Isolation Rate. The rate of isolation of *Salmonella* Enteritidis from infected humans.

“Sell by” period. The time within which retailers must sell shell eggs.

Shell eggs. The term refers to eggs still in their shells.

Shell egg handlers. Firms that grade and pack shell eggs for commercial distribution (packing plants) and hatcheries.

Shell egg processing. The phase of processing involving the washing, segregation and packaging of shell eggs for distribution to retail, institutional, and other commercial users.

Shell Egg Surveillance program. A quarterly inspection program, mandatory for shell egg handlers, to verify that: (1) restricted eggs are properly disposed of and (2) no more restricted shell eggs than permitted in U.S. Consumer Grade B are sold to the consumer

Salmonella Outbreak Detection Algorithm (SODA). A statistical algorithm designed to detect unusual clusters of isolates of *Salmonella* infection and to compare current *Salmonella* isolates reported through PHLIS by serotype to an historical baseline for that serotype, implemented in 1996.

Spent Hen. A breeder or commercial type egg hen that no longer performs at desired production levels.

Undergrade. Any edible shell eggs that does not meet the requirements (standards) for the indicated grade, Grade AA, Grade A, or Grade B.

Whole Eggs. Consist of yolk (yellow portion) and albumen (white or clear portion). For the various types of egg products - liquid, frozen, and dried - the yolks and albumen are separated during the breaking. Customers may request whole eggs (entire contents of egg) or a combination of yolks and albumen to produce egg product for specific uses.

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