Animal and Egg Production Food Safety

OBJECTIVES

To demonstrate mastery of Animal and Egg Production Food Safety the trainee will:

1. Describe and explain why certain classes of livestock presented for slaughter are historically the highest risk for violative residues.

2. Be familiar with the dairy, pork, egg and beef producer HACCP-compatible, Quality Assurance or Good Production Practices Programs. Be able to describe the newest trends in verifiable, third party audited programs and the advantages to industry these programs bring.

3. Be able to describe the role of the in-plant Public Health Veterinarian when interacting with animal and egg production food safety partners.

4. Be familiar with promising research in pre-harvest food safety and why multiple interventions are believed to be more likely to succeed from farm to slaughter in reducing, controlling and/or eliminating public health hazards reasonably likely to occur in and on animals, poultry and eggs presented to processing.

REFERENCES

1. Animal Production Food Safety, An Overview for FSIS Employees
http://www.fsis.usda.gov/OPPDE/animalprod/Publications/overview/anmprdv1.htm
2. Animal Production Food Safety Presentations
http://www.fsis.usda.gov/OPPDE/animalprod/Presentations/presentations.htm
3. E. coli O157 Solutions: The Pre-harvest Commitment
http://www.bifsco.org/uDocs/e_colisolutions_preharvest.pdf
4. Federal Register, Nov. 28, 2000, Residue Control in a HACCP Environment. 5 (229): 70809-70815 http://frwebgate1.access.gpo.gov/cgi-bin/waisgate.cgi?WAISdocID=54385985008+2+0+0&WAISaction=retrieve

INTRODUCTION

FSIS has a firm commitment to a farm-to-table public health strategy in pursuit of its broad public health mission. The Agency has committed to developing the role of its veterinarians to include a number of non-regulatory responsibilities. These responsibilities and roles include delivering food safety and public health messages by interacting with colleagues in animal and public health agencies and organizations outside the establishment environment.

Since FSIS has no regulatory authority on farm or during the transportation of food animals and poultry to slaughter, it is apparent that the regulatory model used in the slaughter and processing establishments does not apply for enhancing food safety

during the animal production link of the food chain. A different approach must be taken to identify and promote programs that encourage food animal producers, veterinarians and information multipliers who communicate with them to adopt production practices that support HACCP and reduce food safety hazards in animals presented for slaughter. There is a need for all of FSIS to help carry the food safety message to those who can help implement practices that will result in a safer animal being presented for slaughter. In short, the knowledge and experience of FSIS veterinarians is necessary to put the "farm" in "farm to table food safety" but you must be knowledgeable about production practices.

The animal production segment of the food chain in includes breeding, raising and transporting to the next stage of production or to markets, feedlots or slaughter establishments.
Because there are so many different production practices for poultry and livestock, as well as exotic species, it is important to be familiar with them. Resources will be provided to you in this module to get you started.

Here are the subject areas we will review in this module.

- Foodborne hazards carried in and on food animals and poultry to processing, and high risk classes of livestock for hazards
- Producer Quality Assurance and Certification Programs
- Your role in collaboration, information sharing and scientific assessments
- Promising areas of research

Food animal producers are impacted by public media events. For example, the U. S. News story "Outbreak," was about a farmer's family that contracted multi-drug resistant *Salmonella* from their dairy cattle and calves. An investigation included the state animal and public health authorities, USDA APHIS, FSIS and the CDC. The family was devastated emotionally and economically by the event that they felt they had no control over. So, it is important that when dealing with the animal production stakeholders that you speak from a frame of reference of science and not emotion.

The 2003 finding of one "mad cow" in Canada resulted in a significant negative economic impact on the cattle industry there. You are probably also familiar with the impact of the finding of BSE in the U.S. in December 2003.

Foodborne hazards

Foodborne hazards can be carried internally and externally on the hide, hair, saliva and feathers. Some examples of chemical hazards include animal drugs, pesticides, and antimicrobials. Examples of physical hazards include injection needles and lead shot. Some microbial hazards that are found in food animals include *Salmonella* and *E. coli* O157:H7. Chemical and physical hazards may be introduced via improper injection of drugs into muscle tissue. A study by the National Cattleman's Beef Association (NCBA) found that almost 14% of dairy cattle in feedlot pens going to slaughter had visible abscesses. From a public health standpoint, these injection site abscesses are a clinical sign of potential violative drug residues. There are sufficient historical data that show the following classes of animals are more likely to have violative residues and may be

prone to animal and public health pathogens: Bob veal (3 weeks, 150 pounds), culled cows and bulls, culled boars and sows, roaster pigs (approximately 35 pounds), hospital pen "clean-outs." These are the primary classes of animals which need a greater focus for residue testing efforts to protect the public's health.

Good management practices

One helpful way to communicate the message about food safety to the production community is to explain how good management practices will result in more value, better food safety results, and improved animal health.

Examples of good management practices are:

- Quality assurance programs (see below).
- Animal identification to permit trace back for critical foreign animal diseases, such as BSE, and residue violations. Good animal ID practices will help producers to contain an animal or public health problem from spreading, such as Food and Mouth Disease, and therefore will aid biosecurity efforts.
- Proper treatment records of drugs, pesticides and antimicrobials.
- Proper drug use; use only as directed by the label.
- Practicing feed quality and safety to prevent chemical and microbial contamination that can spread throughout the herd.
- Good culling practices which means removing animals from the herd before they become so ill that they end up in the 4-D category of down, diseased, disabled or dead on arrival to slaughter establishments (thus less valuable and resulting in more food safety and quality problems).
- Good sanitation and waste management practices.
- Good external and internal biosecurity.

Good management practices can improve the health of the animals. Food animal veterinarians recognize that very thin or sick animals will often be condemned and that livestock with better body condition scores bring higher prices. Cattle not too fat or too thin have a higher percentage of good carcass quality. These findings indicate that good production practices also result in an economic benefit at slaughter. Other research shows more profitability on farms where producers cull (remove) animals from production before they become emaciated and diseased, disabled and/or non-ambulatory.

Livestock in general with poor condition have a higher incidence of disability and have poor red meat yield. If the animal is emaciated, it has a greater susceptibility to bruising and injury at slaughter. Approximately 3% of slaughtered dairy cattle are too fat. Increased carcass quality means increased profit.

Since FSIS implemented the HACCP rule in slaughter and processing establishments, beginning in 1996, there has been a ripple effect on the animal production or "pre-harvest" section of the food chain. FSIS recommends that there are basic production practices that are HACCP compatible - meaning that when practiced they reduce the relative public health risks of incoming animals for their HACCP plan. These HACCP compatible animal production practices include:

- Animal or premises identification.
- Management and health records.
- Proper and documented use of antibiotics, biologics, and pesticides.
- Feed and water quality/safety.
- Good sanitation practices.
- Animal waste management.
- Biosecurity
- Quality assurance programs.
- Third party certification.

One of the best starting places for food safety in the pre-harvest (pre-slaughter) segment of the food chain, and the best option for progress in this area lies in the industry-developed, voluntary quality assurance programs that are driven by processors, food businesses, and consumers. Third party certification will be described in more detail later. It is the "wave of the future," as more and more purchasers of food products and live animals require specific reasonable guarantees that certain practices have or have not been in place.

Here are some questions to consider for reducing, controlling or eliminating hazards reasonably likely to occur in the animal production process that are likely to result in better protecting animal and public health and be HACCP-compatible.

- What are the possible problems?
- Where's the best place to prevent the problems?
- At what point in the process do we recognize the problem?
- How do we detect the problem?
- What to do if we go over the critical limit?
- How can we keep track of the results of testing programs?
- What kind of reports and records are needed of our processes?

You may recognize these as representing producer language for the seven HACCP principles. For example, McDonalds Corporation requires a phase-out of growth promoting antibiotic use on farms and uses a third party certification to verify that the growers are complying. They also have their own third party audit of humane slaughter and handling practices at slaughter establishments, and have their own buyers evaluate records and information about production practices of animals purchased for slaughter.

More and more retailers and wholesalers are setting up purchasing criteria based on the practices and records of livestock and poultry producers, feedlots and marketers.

The livestock production industry has long-established Quality Assurance Programs (QAP). For example, the Milk and Dairy Beef Quality Assurance Program requires that a practicing veterinarian have a valid working relationship with the producer for dispensing veterinary drugs. There are strict guidelines for storing and administering veterinary drugs and antibiotics and for conducting milk drug screening tests. State milk inspectors conduct on-farm certification of drug use. Working with the Food and Drug Administration, the State will enforce violative levels of drugs in milk- resulting in dumping of entire tanks if violations are found. The details of the program can be found at Milk and Dairy Beef Quality Assurance Center, 801 Shakesphere, Box 497, Statford,

IA 50249; Phone (515) 838-2793; FAX (515) 838-2788; website: www.dqacenter.org; email: dqa@netins.net.

Another well known QAP is the Pork QAP. The first two levels of the Pork QAP involve education and self-test for the producer. For Level 3, required by many packing establishments before they purchase swine, a veterinarian must go over each good production practice to verify that the producer is performing it. Every two years the veterinarian recertifies the producer at Level 3. The PQAP also includes environmental and humane handling recommendations as the program evolves.

The Beef Quality Assurance Program has yielded major improvements in beef quality and value by raising the awareness of the need for proper injection of vaccines and medications and for proper handling of cattle to reduce the level of injuries and bruises. It has a number of elements that encourage food safety at the live animal level.

One successful pre-harvest program in this country has significantly reduced on-farm human pathogens and was linked to a decrease in human foodborne infections. The USDA began the pre-harvest program to control *Salmonella* serotype Enteritidis (SE) in the early 1990s. The flock-based intervention program became the Pennsylvania Egg Quality Assurance Program. The Center for Disease Control stated that, "the decrease in SE infections in the Northeast may reflect the collaborative prevention efforts in that region." As part of its farm-to-table strategy, in FY 1996 FSIS worked with constituent groups to encourage and coordinate voluntary efforts to address public health issues associated with food animal production. It is the first egg quality assurance program to demonstrate effectiveness in reducing SE infections in poultry houses. The percentage of flocks testing positive for the presence of SE decreased from about 40 percent to less than 15 percent. The program continues as a successful example of industry, academia, and government cooperation in a voluntary, on-farm intervention program to reduce foodborne pathogens. Currently egg safety programs are overseen by the Food and Drug Administration, which has regulatory authority for shell eggs in interstate commerce. Prevention programs use on-farm microbiologic testing and control procedures developed to reduce SE contamination of eggs. Further control of SE will require limiting the spread of SE on farms.

Let's take a closer look at this successful program that is a model for others in encouraging good animal production practices that benefit the producer and result in increased food safety. The Pennsylvania Egg Quality Assurance Program (PEQAP) is a voluntary industry program intended to minimize SE contamination of chicken eggs. Although the program does not guarantee shell eggs to be free of SE contamination, the program does assure consumers of the commitment producers and processors are making to prevent SE contamination. The Pennsylvania Department of Health provides technical advice regarding public health implications. PEQAP participants are assuring the public that they are taking every reasonable precaution to assure the safety of their eggs.

The details of the program can be found at the web site
http://poultryextension.psu.edu/PEQAP.html#PEQAP

Following is a summary of the program.

Wholesale Pennsylvania Egg Quality Assurance Program Program Requirements

Pullets

- Purchase chicks from U.S. Sanitation Monitored SE *negative* breeder flocks.
- Obtain samples of chick dropping papers at time of delivery. Sample every 10th chick paper and submit to laboratory for SE.
- Sample and culture the manure at 10 to 15 weeks of age. A culture will consist of two samples taken from the manure beneath each row of cages.
- Maintain a defined rodent control and monitoring program.
- Houses with positive manure or chick samples must be cleaned and disinfected before new chicks can be placed

Layers

- Purchase and place pullets from an SE monitored flock.
- Houses with positive manure samples must be thoroughly cleaned and disinfected between flocks.

Eggs

- Houses with negative manure samples will not be required to test eggs.
- Houses with positive manure samples must test 480 nest run eggs or a combination of all available blood spot eggs plus additional nest run eggs to total 480 eggs every 2 weeks for 4 lots of samples. If any egg pools are positive, then all eggs must be diverted for pasteurization or hard cooking. Egg testing will eliminate the need for further environmental testing.

Force Molted Flocks

- Test manure at five to seven weeks following return to feed and follow egg testing procedures if positive.

Rodent Control

- A defined rodent control and record monitoring program must be maintained at all times.

Biosecurity

- All participants must maintain an acceptable biosecurity program.

Refrigeration

- Eggs must be kept under refrigeration as specified in the Pennsylvania law.

Processing Plant·

Processing plants packing eggs bearing the PEQAP "Tested Quality" seal must meet all applicable USDA, Pennsylvania Department of Agriculture, and PEQAP program requirements. These address plant and employee sanitation, refrigeration, egg washing and sanitation, water testing, packing materials, carton coding and records.

Participating producers and processors are:·

- Demonstrating their concern about food safety.

- Producing a quality egg which helps to assure consumer confidence in eggs.
- Addressing the demands of buyers for eggs produced in a food safety program.
- Reducing potential foodborne illness liability claims.
- May have insurance premiums reduced.

The importance of quality assurance certification is that it:

- Promotes animal health and food safety.
- Ensures proper drug and antibiotic use.
- Provides records to assure purchasers of good production practices.

In summary, the basic requirements of a verifiable animal production certification program that could improve animal and public health include:

- Knowledge of risk factors for transmission of pathogens among food animals.
- Management interventions which reduce or eliminate risk for hazard exposure.
- An objective audit and other records sufficient to document risk-reduction management practices.
- Tools for monitoring absence of infection or residues in a certified population.
- Administrative, record-keeping and reporting systems to support certification.

To successfully implement a verified food safety system, producers on farm, in livestock markets and at feedlots will need to:

- Know food-safe production practices.
- Carry out those practices.
- Document practices.

The rule of thumb is, “If it is not documented, then it did not happen.”

As more and more of these systems are established, processing establishments will need to evaluate the records. Suppliers and FSIS veterinarians will play a role in making sure they are based on science if they are included in the establishment’s HACCP plans.

<u>The Trichinae Certification model</u>

Let’s review a “food safe” verified certification program that currently exists. It is a pathogen reduction model established by the USDA, the National Pork Board, practicing veterinarians, and producers. This is truly a collaborative effort. It is the Trichinae Certification model and it’s based on the use of management practices which minimize the risk of exposure of pigs to *Trichinella*. It relies on written records and third party auditing to document that good production practices are being followed. It is supported by regular testing of animals from certified premises to verify the absence of infection. Although trichinosis in market pigs is at a very low level (0.01%), it is still a significant concern of both domestic and foreign consumers (customers). Millions of dollars a year are spent on testing and holding meat for *Trichinella spiralis* cysts. USDA’s Agriculture Research Service developed an on-farm ELISA blood test that is used in the U.S program. USDA, APHIS developed a certification program with the pork producers, and USDA FSIS veterinarians collaborated with sampling in establishments to verify the new certification model.

The components of the certification process are:

- USDA accredited veterinarians, trained in trichinae Good Production Practices (GPP), work with producers to assure that trichinae infection risks are minimized on their farms.
- Periodic audits, performed by trained herd veterinarians, document the absence of trichinae infection risks.
- USDA-APHIS makes the certification decision and notifies the producer.
- Routinely, statistical samples are tested (ELISA) at slaughter and to verify absence of infection and verify program integrity
- USDA-APHIS-VS: Veterinarians conduct random spot-audits of certifications to ensure completeness and to build credibility among trade partners regarding the certification process.
- Verification of Certification: It is the responsibility of the slaughter facility receiving swine originating from certified production sites to verify that certification is current. This is done by:
    - verifying the producer's certification status by accessing the APHIS trichinae certification web site, or
    - maintaining certification documentation on file

Your role

FSIS veterinarians need to use all of their knowledge, skills and abilities when addressing public health issues at production/ pre-harvest areas. Here are some things to consider.

Credibility: YOU represent FSIS and your expertise is valued by others.

Voluntary: There is no regulatory authority in out-of-establishment initiatives. Our key role is to encourage others to adopt practices that will reduce chemical (antibiotic and drug residues, pesticides, etc.), physical (broken needles, buckshot), and microbial pathogens in animals presented for slaughter and to encourage HACCP-compatible production practices

FSIS State Partnerships

In order to promote food safety at the animal production level, FSIS has funded state partnerships. The intent of such cooperative agreements has been to promote collaboration among all food safety stakeholders. There have been as many as 10-20 partnerships funded each year, each one receiving from $10,000 to $50,000 to support activities that bring people together. Should one ever be funded in your State, you can provide expertise to these groups regarding food safety hazards at slaughter and processing. Be sure to coordinate all such activities with your supervisor and the FSIS Strategic Initiatives, Partnerships, and Outreach (SIPO) staff. Information on previously funded cooperative agreements can be found on the FSIS website at About FSIS / Cooperative Agreements.

FSIS funding of state partnerships began in 1998. Funded projects have focused on preventive measures and include producer education, biosecurity, quality assurance programs, *Salmonella* serotype Enteritidis, residue prevention and identifying practices associated with *Salmonella* and *E. coli* O157:H7 at dairies.

Some examples of the results from partnership activities include the following:

- Promoting quality assurance programs and Good production practices that may help reduce pathogens.
- Creating producer handbooks on residues, quality assurance programs, biosecurity, and animal production food safety.
- Conducting educational meetings and seminars on food safety for producers.

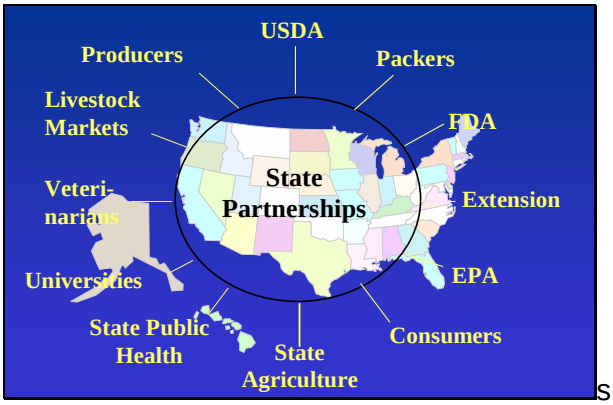
Quality assurance programs and state partnerships help build infrastructure for communicating with producers about animal production food safety. They also increase awareness of the need for production practices which reduce food safety risks.

Your roles in working with the animal production stakeholders include:

- Collaboration: look for opportunities to advance state-of-art food safety practices from farm to table.
- Education: help others change behaviors that may negatively impact public health.
- Information: keep everyone informed about preventive practices to reduce, eliminate and control hazards before, during and after processing.

Use your skills to build relationships among all food safety, public health, and animal health partners. Recruit others in food animal production to seek a career in FSIS. It is important to build bridges whenever possible among animal and human health experts regarding food safety. We all need to look for the best and brightest veterinarians to join our agency and to encourage students to pursue a rewarding career in public health practice in FSIS.

Educators are critical contacts because they can effectively spread your message to their audiences. Providing new information about FSIS is always welcome. Your role is to serve as the FSIS spokesperson to raise awareness that food safety is a shared responsibility among all parties from farm to table. In order to do this you must stay current on the latest interventions and preventive practices that offer the most promise for reducing chemical, physical, and microbiological hazards. Be sure to clear these activities with your supervisor and to use materials that have been cleared by the Agency for this purpose.



This graphic illustrates the partnerships among the important stakeholders in public health. FSIS encourages local partnerships to bring these key partners “to the table” to

play collaborative roles in protecting public health and food security. Make a list of animal and public health educators and communicators in your area such as:

- local colleges and universities, veterinary, veterinary technician, and medical schools;
- Minority institutions (Native American, historically Black, etc.);
- extension service agents;
- Future Farmers of America, 4-H Clubs; and
- Consumer organizations

As a FSIS Public Health Veterinarian, you are the local Agency spoke person for farm-to-table food safety. Collaboration activities include:

- stay informed of current animal and public health issues;
- make presentations (always clear presentations with supervisor): use Agency materials available on the web and AEPFSS;
- articulate concurrent benefits of GPP to animal, health, food safety, and productivity;

Good Production Practices or Quality Assurance Programs are specific guidelines developed by industry to address food safety as well as animal health, welfare, and productivity.

Scientific Information on Best Practices for Animal Production

The public health model for improving human health dramatically in the past century includes a multiple hurdle approach: water treatment, attention to food safety and proper sewage disposal. Human enteric illnesses continue to be a major problem in developing countries due to poor water sanitation, food protection practices and sewage disposal. FSIS works with the animal and egg production researchers and partners to develop the scientific evidence that good public health practices can be successfully applied from farm to slaughter.

There is a complex interaction including animals, birds, the environment, retail, restaurant and consumer practices, fruits and vegetables and human outbreaks of foodborne disease Current research considers multiple interventions to reduce foodborne hazards at many different steps. Since *E. coli* O157:H7 is the agency's priority foodborne pathogen and it's reservoir is in animals, we will focus on research on that organism but research on others will be mentioned.

The current research on sodium chlorate shows that trials indicate a reduction in *Salmonella* spp. and *E. coli* O157:H7. It targets enteric pathogens. This compound is added to feed prior to slaughter and it works in multiple species. FDA has indicated that it will evaluate sodium chlorate as a feed additive. Tissue residue studies are required by the FDA's Center for Veterinary Medicine. The USDA Agriculture Research Service is feeding radio-labeled sodium chlorate to cattle in Fargo, ND, to provide the required information.

Some researchers have stated that if they fed only hay or other forages prior to slaughter they could reduce *E. coli* O157:H7. However there are conflicting results in the literature. Some findings showed that altered rations or schedules resulted in increased shedding of pathogens. Others have shown that it decreases the shedding. There are economic and meat quality concerns. Further research is needed in this area.

Recently a promising *E. coli* O157:H7 vaccine has had good results when combined with concurrent interventions at feedlots, such as antimicrobials and *Lactobacillus* cultures added to feeds. In March, 2009, a one-year conditional license for an *E. coli* O157:H7 vaccine was granted by the USDA. The vaccine will be used in feedlot cattle to decrease pathogen shedding. It works by preventing uptake of iron, thus decreasing bacterial enumeration in the intestines. Other vaccines are being evaluated that may prevent attachment and colonization. Some are designed to target intimin which is necessary for pathogen attachment in the intestine. Other bacterial species are under investigation.

Research is also being conducted using bacteriophages to reduce bacterial pathogens. These are viruses which attack bacteria. There has been some success in killing *Salmonella* spp. on poultry carcasses with bacteriophages. There may be pathogen reduction potential when the bacteriophages are used internally. Collaborative work with Russian scientists is under way. However, no product is currently approved.

Research with antibiotic treatment has shown that some antibiotics (tilmicosin) increase shedding while others decrease shedding (ceftiofur, bicozamycin, and neomycin). Repeat successful trials are needed. These treatments are currently not approved for pathogen reduction.

Tasco® is an extract from the seaweed *Ascophyllum nodosum* and is a source of cytokinins with increased antioxidant activity believed to reduce *E. coli* O157:H7 Currently it can be fed in commercial feedlots. Trials on reduced pathogen shedding are pending and have not been published in refereed journals.

CONCLUSIONS

Carriage of food borne pathogenic bacteria is a complex and sensitive issue. There is no “magic bullet.” Integrated multiple hurdle schemes using several complementary intervention strategies is most likely to be successful. Further pre-harvest intervention strategies need to be researched and developed. With continued progress, animal producers will lead the way to significant positive changes in animal and public health.

WORKSHOP

1. The pork, beef and dairy Quality Assurance Programs primarily address production practices that:

    a. Help prevent violative residues in high risk livestock (cull sows, boars, cows, bulls, calves and roaster pigs)
    b. Help prevent *E. coli* O157:H7 from contaminating livestock
    c. Uses veterinary practitioners to certify and guarantee livestock are safe for food
    d. Are required by all slaughter establishments before a producer can sell to them

2. Verifiable producer certification programs:

    a. Guarantee that the animals and eggs are safe
    b. Are the wave of the future as purchasers require objective audits and other records sufficient to document risk-reduction management practices
    c. Require a third party audit of records and/or practices
    d. Promote public health by ensuring chain of custody

3. Multiple hurdle hazard reduction interventions are a key public health tool:

    a. Because Typhoid Mary had to wash her hands to prevent spread of typhoid to others
    b. Because human outbreaks from food are caused by direct contact
    c. Because water treatment, food handling practices and proper disposal of feces reduced human illness and current animal production research is also looking into how similar approaches can apply to reducing *E. coli* O157:H7
    d. Because a magic bullet will probably be found that will be able to reduce fecal contamination, improve water sanitation and reduce pathogens on meat products