**Summary**

Food animals and poultry are exposed to drugs and other chemical compounds from a number of sources. Many of the compounds are important to modern meat and poultry production, but illegal residue levels of drugs or chemicals can constitute a public health hazard or adulteration and result in financial loss for producers. Since 1967, the U.S. Department of Agriculture (USDA) has operated the National Residue Program to control residue incidence. Administered by the Food Safety and Inspection Service (FSIS), the Program is evolving from a retrospective mode of operation to a prospective one, stressing research and technical refinement, education, improved management practices and cooperation between producers and regulatory agencies. By educating producers and regulatory personnel and by developing techniques for improved detection and control of chemical substances in meat and poultry, the new Residue Avoidance Program (RAP) aims at the total prevention of residue problems. At present, the violations from pesticides are beginning to decrease; sulfa drugs are being controlled properly by users; and environmental accidents are being confined to small areas. The ultimate objective of the Program is to eliminate chronic ignorant misuse and thus to reduce surveillance to incidents or incidents of willful misuse.

**Introduction**

The Food Safety and Inspection Service (FSIS) of the U.S. Department of Agriculture is responsible for the safety and wholesomeness of meat and poultry. As part of that responsibility, FSIS has, since 1967, conducted the National Residue Program to help prevent the marketing of animals containing illegal drug and chemical residues.

FSIS monitors the incidence and amount of chemical and drug residues in meat and poultry slaughtered for human consumption. Many animals receive drugs or are exposed to pesticides and environmental contaminants during their lifetime. Residues from these substances can remain in animal tissue, posing a potential public health danger.

FSIS distinguishes three general periods in the development of the National Residue Program: the past (1969-1978); the current, or transitional, period (1979-1984); and the foreseeable future (1985-1990).

At present, the Program is evolving from a retrospective mode of operation to a prospective one, stressing research and technical refinement, education, improved management practices and cooperation between producers and regulatory agencies. By educating producers and regulatory personnel and by developing techniques for improved detection and control of chemical substances in meat and poultry, the new Residue Avoidance Program (RAP) aims at the total prevention of residue problems. This paper traces the evolution that has resulted in RAP and indicates the direction of the future for the National Residue Program.

**The Early Residue Program**

The Residue Program developed in the late 1960’s as a response to the enormous growth in the use of drugs and chemicals in agricultural practices that has characterized the post-war era in the United States. Many of these compounds are important to modern meat and poultry production; furthermore, modern industrialization has contributed a number of environmental contaminants that may enter the food supply. Given this situation, FSIS developed the basic regulatory procedures of monitoring and surveillance.

In the monitoring phase, statistically random samples of tissue are taken and submitted for a series of analyses. From these data, residue incidence and trends are identified. Information gathered in the monitoring program is referred to the Food and Drug Administration (FDA) or the Environmental Protection Agency (EPA) for their use in making on-the-farm inspections to determine if chemicals were misused. The random sampling plan is designed to provide 95 percent assurance that FSIS will detect adulteration by a specific residue if the problem exists nationwide in 1 percent or more of a major food animal species. From the approximately 20,000 samples analyzed annually, the Agency determines residue incidence and trends and identifies specific problems.

In the surveillance phase, statistically random samples of tissue are taken and submitted for a series of analyses. From these data, residue incidence and trends are identified. Information gathered in the monitoring program is referred to the Food and Drug Administration (FDA) or the Environmental Protection Agency (EPA) for their use in making on-the-farm inspections to determine if chemicals were misused. The random sampling plan is designed to provide 95 percent assurance that FSIS will detect adulteration by a specific residue if the problem exists nationwide in 1 percent or more of a major food animal species. From the approximately 20,000 samples analyzed annually, the Agency determines residue incidence and trends and identifies specific problems.

In the surveillance phase, FSIS tests tissues from specified suspect animals. For example, testing in this phase is initiated after a producer markets animals containing residues above tolerance. Testing in this phase may be initiated in response to data from the monitoring phase, from exploratory surveillance, or from inplant inspectors or others indicating that adulterating levels of a residue may be present. Suspect products are retained pending test results, and producers may not market additional animals until tissue samples show no illegal residues.

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The key advantages of these agreements are several: 1) regulatory action is restricted to contaminated product; 2) control programs can be continually upgraded to reflect the latest scientific knowledge and/or technology; 3) FSIS receives early warning of problems and can identify the issue quickly and respond immediately; 4) laboratory results are expedited; and 5) food products are predetermined free of hazardous residues when offered into commerce.

FSIS further benefits in that it is able to reduce sampling rates at plants with good quality control systems and adequate data bases and concentrate on other plants. Cooperative agreements make it possible for decisions to be made based upon a more complete data base than that constructed from FSIS monitoring alone. Most problems, furthermore, are detected and corrected before slaughter, thereby allowing the greatest possible range of options if a problem arises.

RAP includes a cooperative effort with USDA's Extension Service. FSIS transferred $1.5 million to Extension for 35 projects which are being carried out by land grant colleges in 31 states. Projects include studies of farm management controls that prevent contamination. Many of the projects include educational components to pass findings onto producers.

Several states are carrying out programs that focus on ways to reduce pesticide contamination. In West Virginia, for example, project officials are developing a regional information model for analysis, reporting and avoidance of pesticides in livestock and poultry. Beef, poultry and deer samples will be analyzed for chlorinated hydrocarbons and other residues, using gas chromatography techniques. Feed and environmental samples also will be analyzed for contamination, with the data used to demonstrate methods of avoiding residues.

FSIS and the Extension Service are collaborating on many of the educational efforts. Slide shows are being distributed to Extension Service agents to introduce residue avoidance concepts to poultry, swine and dairy farmers. The show for dairy farmers introduces the Live Animal Swab Test, which they can perform to check dairy cows, calves and heifers for antibiotic residues prior to marketing. A new FSIS guidebook provides step-by-step instructions for the test, which gives results overnight. When the test indicates no antibiotics, the animal can be sent to slaughter. When it indicates antibiotics, the animal can be retained in a few days. The slide show for dairy farmers also explains the problem of antibiotics and sulfa residues in young bull calves — born on the dairy farm and marketed shortly afterwards — and provides suggestions for marketing drug-free calves.

FSIS has also worked to improve its testing capabilities to strengthen the monitoring program. Efforts have been directed toward simple rapid on-site screening methods and single laboratory tests that can detect several residues at one time. The use of one of our previously-developed rapid analytical tests was expanded that year. USDA inspectors can now use this quick test to screen carcasses from all animal species for traces of antibiotics. Inspectors had been using this STOP test — for Swab Test on Premises — on cull dairy cows since 1979. The test not only speeds inspection but also enhances USDA's ability to assure that meat and poultry products are not adulterated.

The concrete results offered by such approaches are clearly visible. For example, in 1978, a high percentage of swine were coming to market with violative sulfa residues. As
we focused attention on this problem, the feed system was identified as the source of contamination. A cooperative educational effort by industry, the Extension Service and other government agencies succeeded in achieving a significant reduction in violations. The official cooperative campaign has ended, but local efforts are continuing. A similar experience with antibiotics in cull dairy cows demonstrated that a focus of attention on residues, combined with producer education, can result in a marked decline in residue problems.

Six major contamination incidents have occurred in the past several years. In four of these, FSIS first learned of the problem from the industry. One example is a sulfa residue problem that developed in turkeys in North Carolina. It was corrected by the company, which began testing every flock before slaughter to make sure the birds would be free of illegal residues after slaughter. FSIS participated in that program.

The new cooperative approach to residue control is being tested with a current problem — drug residues in calves. In 1982, FSIS recorded almost 1,000 violations from drug residues in one-week-old calves, as compared to just over 500 violations in 1981.

In response to the worsening situation, FSIS and other Government agencies, along with affected marketing and drug groups, formed a task force to identify the causes of the problem. The task force’s preliminary efforts to discover contributing factors point to marginal management practices on some dairy farms. For example, some farmers have been feeding new-born calves antibiotic or sulfa medication to ward off disease, rather than permitting the calves to drink the colostrum (first milk) from their mothers, which provides natural protection from disease and infection.

As part of its transfer of funds to the Extension Service, FSIS has awarded $122,000 to three land-grant universities for projects on ways to avoid drug residues in veal calves. These projects, as recommended by the task force, will focus on acceptable drug treatment, management practices and producer education programs. The projects will be completed in 1984.

The residue avoidance concept has significantly changed the monitoring and surveillance phases of the National Residue Program. With more information gained from closer contact with industry, and from the exploratory surveillance programs and new and multi-residue screening methods, FSIS has been able to work with a larger data base than was available before. This has been particularly noticeable in the expanding knowledge of compounds not normally identifiable during routine analysis. One consequence is that problems can be anticipated before they occur.

FSIS recognizes the need for better evaluation of the ability of compounds to be in foods under probable use conditions. High priority has been given to multiple and rapid-screening methods and procedures for indirect measurement of animal exposure to drugs and pesticides.

One result of the residue avoidance concept has been the perceived need for a flexible, rotational compound-inclusion system for the residue program. The process of compound prioritization begins with the consideration of all possible compounds of interest, from which are eliminated those unlikely to be problems in meat and poultry production. The remaining compounds are evaluated on the basis of five determining factors: the likelihood of universal use; the manner of use on a crop; the percentage of treated crop in an animal’s diet, and where and when it is included in the ration; the known metabolic patterns of the chemical; and the direct use on animals or in animal production practices. Those compounds selected for the program are ranked according to the amount of actual or probable use; the conditions of use; any potential misuse of a substance; and the toxicity of the residue. The laboratory capability for these compounds is reviewed, and the annual monitoring and method development plans are then formulated. With the added understanding of actual use practices gained through the cooperative agreements, FSIS will be able to identify crucial areas of interest and direct its resources according to what compounds are actually being used during given periods.

Part of the general refinement of approach made possible by the residue avoidance concept is the Contamination Response System, which can react quickly and efficiently to contamination incidents and, with industry cooperation, ensure that any episode is restricted to a limited area.

**Future**

FSIS sees the near future (1985-1990) as a period in which sampling will be divided equally between monitoring and exploratory surveillance. Monitoring will be designed to verify risk assessment evaluations in the area of public health. Few, if any, compounds will need to be included over an entire year, and residue avoidance programs will make possible a much more refined coverage of plants over given time cycles. The exploratory surveillance phase will be employed to test the accuracy of risk assessment evaluations, to investigate the potential problems of old or new compounds and to verify the efficacy of special management systems.

The period will be characterized generally by the maximum use of residue avoidance and cooperative programs, closer coordination with industry to evaluate new compounds against existing practices and cooperation with other nations to evaluate the residue potential of compounds used worldwide.

It is anticipated that the beneficial results of residue avoidance will continue to appear; that violations from pesticides will continually decrease; that sulfa drugs will continue to be controlled properly by users; and that environmental accidents will be more closely confined than before. The ultimate objective of the Program is to totally eliminate chronic ignorant misuse and thus to reduce surveillance to accidents or incidents of willful misuse. Through cooperative effort, the next few years should see a complete avoidance of the potential health hazards and financial losses associated with residue problems in agriculture.

**Discussion**

**Question:**

I understand there is some research being done on dioxin residues on meat products. My question is, what is the current status of this and do you foresee any problems in the future?
Answer:
Not in red meat right now. We are working with FDA and EPA very closely, especially in Missouri. We did go ahead and sample all animals coming from that area and found no dioxin. And we did a survey in 1980 on dioxin and found that all red meat was below the tolerance level for dioxin. If they get into it, it is usually a very isolated case, and that very complex thing I showed you will go into action right away. But I think you can eat red meat without much problem with residues anymore. I am getting more confident as the days go on.

Question:
How concerned are you at the sulfa plateauing at around 5%, or is it 5%?
Answer:
That's a statistical sampling. It's about 4.8% right now. We are concerned, but we are beginning to see a drop. As we get out to the extension people, we get these simple tests out at about a drop of 1% or below 1% where we feel that we can't do any better.