
Part IV

Food Safety and Quality

Chapter 10

**Regulatory Agencies and Their
Statutory Authority**

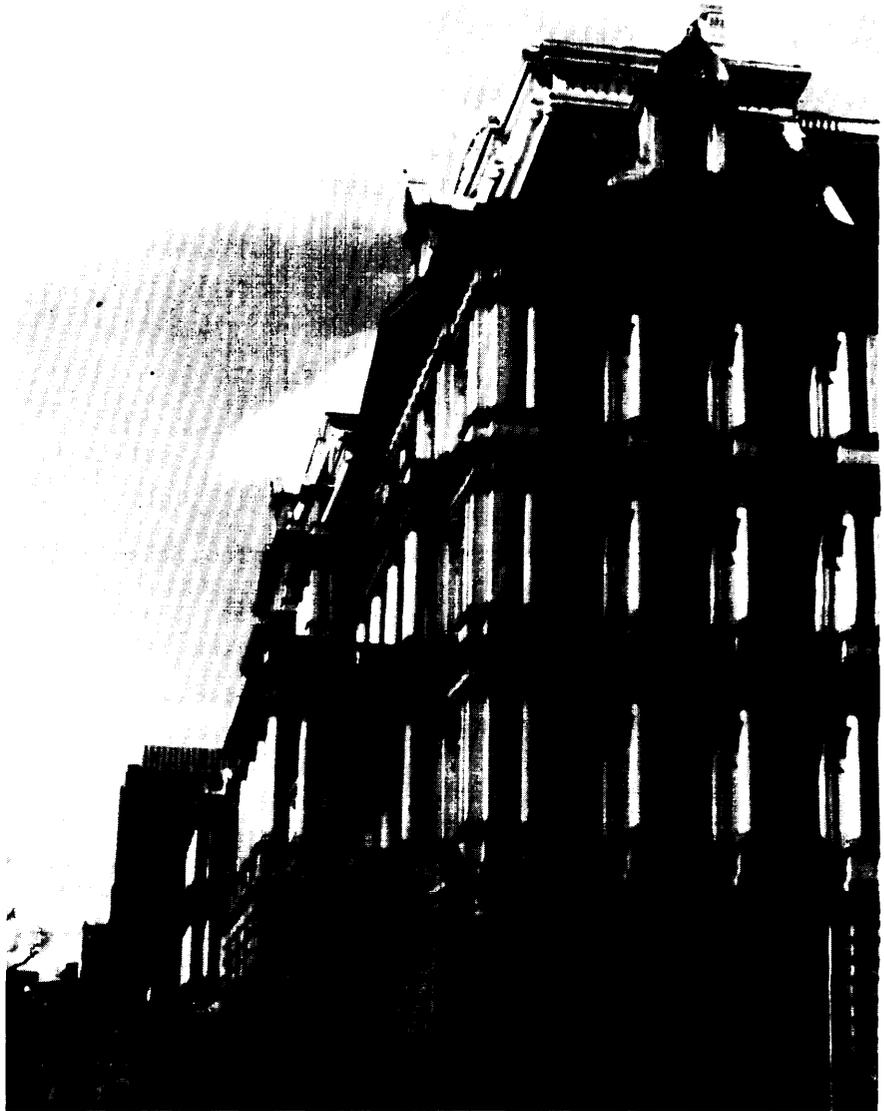


Photo credit: Jamie Notter, OTA Staff

Contents

	<i>Page</i>
THE FOOD AND DRUG ADMINISTRATION	275
Statutory Authority for FDA Regulation of Food Products	275
Statutory Authority for FDA Regulation of Animal Feeds and Drugs	277
Outside Input into the FDA Decision Process	277
FDA Inspection Activities	278
FDA Enforcement Activities	279
THE U.S. DEPARTMENT OF AGRICULTURE	279
Statutory Authority for USDA inspection of Meat and Poultry Products	280
FSIS Inspection Activities	281
AMS Inspection Activities	282
APHIS Inspection Activities	283
Outside Input into the USDA Decision Process	283
THE ENVIRONMENTAL PROTECTION AGENCY	283
Statutory Authority for EPA Food Safety Regulations	283
Outside Input into EPA Decision Process	284
EPA Enforcement Activities	285
OTHER FEDERAL AGENCIES	285
FOOD SAFETY COORDINATION AMONG FEDERAL AGENCIES	286
INTERPRETATION OF FEDERAL FOOD SAFETY LAWS WITH RESPECT TO PRODUCTS PRODUCED WITH BIOTECHNOLOGY	287
FDA Regulation of Biotechnology-Derived Food Products	287
FDA Regulation of Biotechnology-Derived Animal Drugs	290
FSIS Regulation of Biotechnology-Derived Meat and Poultry Products	290
EPA Tolerances for Biotechnology-Derived Pesticides	290
Responsibility for Transgenic Finfish and Shellfish	291
INTERNATIONAL COORDINATION	291
CHAPTER 10 REFERENCES	291

Box

	<i>Page</i>
IO-A. Federal Agencies Primarily Responsible for Food Safety	275

Tables

<i>Table</i>	<i>Page</i>
10-1. FDA Staffing Levels, Selected Years	278
10-2. FDA Domestic Inspection Activities, Selected Years	279
10-3. Food Service Establishments Covered by FDA-State Cooperative Inspection Programs, 1991	279
10-4. FDA import Inspection Activities, 1984-1991	280
10-5. FDA Enforcement Activities, 1988-1991	280
10-6. FDA Import Enforcement Activities, 1988-1991	281
10-7. USDA Residue Testing in Slaughtered Animal Tissues, 1988-1990	281
10-8. FSIS Inspection Staff, 1988-1990	282
10-9. AMS Inspection Activities, 1988-1990	282
10-10. AMS Enforcement Activities, 1989	283
10-11. Selected State Pesticide Enforcement Activities, 1988-1990	285
IO-12. National Marine Fisheries Inspection Activities, 1981-1989	286

Regulatory Agencies and Their Statutory Authority

In the United States, five Federal agencies operating under a variety of laws have primary responsibility for maintaining the safety of the food supply (box IO-A). These are the Food and Drug Administration (FDA); the U.S. Department of Agriculture (USDA Food Safety and Inspection Service; USDA Agricultural Marketing Service); the **Environmental** Protection Agency (EPA); and the National Marine Fisheries Service (NMFS).

THE FOOD AND DRUG ADMINISTRATION

The Food and Drug Administration, within the Department of Health and Human Services, is responsible for ensuring that domestic and imported food products sold in interstate commerce are safe, sanitary, nutritious, wholesome, and honestly labeled. For the purpose of oversight, food is defined as 1) articles used for food or drink for man or other animals, 2) chewing gum, and 3) articles used for components of any such article (U.S. Code, 1982a, Title 21, Food and Drugs, sec. 321(f)). By this definition, food includes that consumed by human beings as well as by livestock. Because animal drugs may leave residues in meat consumed by humans, FDA also has regulatory authority for drugs used in livestock.

FDA's Center for Food Safety and Applied Nutrition (CFSAN) is responsible for **conducting and supporting**

human food safety research; developing and overseeing the enforcement of food safety, quality, and labeling requirements of the Food, Drug, and Cosmetic Act (FDCA); coordinating and evaluating FDA and Federal/State cooperative surveillance and compliance programs relating to foods; and developing and disseminating food safety and regulatory information to consumers and industry. FDA's Center for Veterinary Medicine (CVM) regulates animal drugs and livestock feeds marketed in interstate commerce, and is responsible for the safety of these veterinary products.

Statutory Authority for FDA Regulation of Food Products

The first food safety law passed in the United States was the Food and Drugs Act of 1906. This law contained provisions for the seizure of adulterated foods, that is, foods that contained added poisonous substances or other added substances that were deleterious and that may render the food injurious to health. In 1938, this act was substantially revised to become the Federal Food, Drug, and Cosmetic Act (FDCA), which still authorizes FDA's food safety responsibilities.

Like the Food and Drug Act, the FDCA authorizes control of adulterated foods caused by added substances, and extends the adulteration clause to cover naturally occurring substances (Section 402 (a) (1)). FDA takes a

Box IO-A—Federal Agencies Primarily Responsible for Food Safety

<i>Agency</i>	<i>Principal statutory authority</i>	<i>Responsibilities</i>
Food and Drug Administration	Federal Food, Drug, and Cosmetic Act	Safety/quality/effectiveness of animal feeds and drugs, and all foods except meat and poultry.
USDA-Food Safety and inspection Service	Federal Meat Inspection Act and the Federal Poultry Products inspection Act	Safety/wholesomeness/accurate labeling of meat and poultry products
USDA-Agricultural Marketing Service	Egg Products Inspection Act	Safety/quality of egg products and shell eggs.
Environmental Protection Agency	Federal Insecticide, Fungicide, Rodenticide Act Federal Food, Drug, and Cosmetic Act	Safety of Pesticide products Pesticide residue tolerance in food feeds.
National Marine Fisheries Service (also FDA, PHS)	Agricultural Marketing Act	Voluntary Seafood Inspection

SOURCE: Office of Technology Assessment, 1992.

broad view of what is considered added, and this view has been upheld in several court cases. Any substance that is not an inherent natural component of food may be treated as an added substance, including but not limited to, those of environmental or industrial origin that become components of food (e.g., mercury in fish). Consequently, pollutants from the air, pesticide residues, and minerals from fertilizers, for example, all fall within the scope of added substances (9).

The distinction between an added substance and a natural substance is substantial because added substances are held to a higher safety standard. The FDA can request that legal action be taken against inherent natural components of food if that substance *would ordinarily* render the food injurious to health. For added substances, if the FDA can establish that a substance *may* render the **food injurious to health**, the food is adulterated under FDCA. Under this standard, FDA must show only that there is a reasonable possibility that the food will be harmful if consumed. The FDA rarely applies the standards for natural components except for obvious cases such as crops that produce cyanide when improperly processed (e.g., cassava, lima beans, etc.). Other sections of the FDCA (406 for example) authorize FDA to establish tolerances for added substances when their presence in food cannot be avoided or if their use is necessary to produce the food (9).

The FDA is responsible for demonstrating that a food is adulterated. As originally enacted, the FDCA provided no authorization for the premarket evaluation of added substances. FDA could only challenge a food ingredient after it was marketed. However, rising concern over the addition of chemical additives to foods prompted Congress to enact the Food Additives Amendment in 1958. This FDCA amendment broadens the definition of adulterated foods to include those foods that contain any food additive not specifically approved by the FDA (Section 402(a)(2)(c)). Approval is granted in the form of a regulation, which shifts the burden of proof for the safety of these additives to the food industry (7, 8, 9). This amendment defines a food additive as:

A substance, the intended use of which results or may reasonably be expected to result, directly or indirectly in its becoming a component or otherwise affecting the characteristics of any food (including any substance intended for use in producing, manufacturing, packing, processing, preparing, treating, packaging, transporting, or holding

food; and including any source of radiation intended for any such use), if such substance is not generally recognized, among experts qualified by scientific training and experience to evaluate its safety, as having been adequately shown through scientific procedures (or, in the case of a substance used in food prior to January 1, 1958, through either scientific procedures or experience based on common use in food) to be safe under the conditions of its intended use. [U.S. Code 1982c, Title 21, Food and Drugs, Sec. 321(s).]

The FDCA also covers the regulation of pesticides, color additives¹, and new animal drugs. Additionally, substances used in accordance with a sanction of approval granted prior to September 6, 1958 under FDCA, the Federal Poultry Products Inspection Act and/or the Federal Meat Inspection Act (i. e., the prior sanctioned substances) are not included in the definition.

To avoid placing unnecessary restrictions on the development of new food additives or forcing the evaluation of food additives already safely used, Congress provided for some exceptions to the food additive amendment. One clause, for example, allowed the continued use of a substance that is generally recognized as safe (GRAS) by qualified experts for its proposed use in food (U.S. Code 1982c, Title 21, Food and Drugs, Sec.321 (s)) (9).

GRAS food ingredients are those generally considered safe by qualified experts based on either 1) a safe history of use in food prior to 1958 or 2) scientific information (U.S. Code 1982c, Title 21, Food and Drugs, Sec.321(s)). A safe history of use generally involves substances of natural biological origin widely consumed for their nutrient properties prior to January 1, 1958, are subject only to conventional processing as practiced prior to 1958, and exhibit no known safety hazard (FDA 1986b, Title 21, Food and Drugs, Sec.346). To be granted GRAS status based on scientific information requires expert knowledge backed by “substantial support in the scientific literature” (Weinberger v Bentex Pharmaceuticals 1973, U.S. Reports 412,645) (9).

The same quantity and quality of scientific evidence is required to obtain regulatory approval of a food additive or a GRAS substance. The information critical to affirming a substance as GRAS must be widely available and generally published. The validity of the published literature must also be agreed to by those qualified to judge food safety issues. Disputes by qualified experts

¹ Color additives are materials that are dyes, pigments, or other substances chemically synthesized or extracted, isolated, or otherwise derived with or without change from vegetable, animal, mineral, or other sources that are capable of imparting color (including black, white, and gray) to food, drugs, cosmetics, or the human body. Color additives must receive premarket approval or be GRAS.

could prevent the granting of GRAS status. Thus, obtaining affirmation of GRAS status can be more difficult than obtaining regulatory approval as a food additive (21 CFR 170.30).

The FDCA requires premarket approval only of food and color additives. By a strict interpretation of the food additive amendment, any substance that becomes a component of food, or affects the characteristics of food, may be regulated a food additive. This implies that the development of new crop varieties could be classified as food additives. FDA has rarely enforced this strict interpretation, however. New crop varieties have generally been viewed as not being so significantly different from crops consumed prior to 1958 to warrant formal review of the GRAS status. However, FDA can review the GRAS status of substances of natural biological origin that have undergone significant changes as a result of breeding and selection or a new process introduced into commercial use after 1958 (FDA 1986c, Code of Federal Regulations, Title 21, Food and Drugs, Sec. 170.30(f)(9)). A significant increase in the use of a particular food ingredient, a change in the composition of the food ingredient, or a change in the manufacturing method could trigger a loss of the GRAS status based on the common use in food criteria. Substances altered such that they are no longer generally recognized as safe are regulated as food additives (9, 14). FDA can review food products derived from a new variety of food crop prior to marketing if that crop is known to contain toxins that have the potential to be acutely toxic if in high enough concentration.

In addition to the authority to regulate adulterated foods, FDCA also confers on FDA authority to remove misbranded foods from the market. Food products are considered misbranded if, among other things:

- . the labels are false or misleading,
- . if they are offered for sale under the name of another food,
- . if they are an imitation of another food and the label does not clearly state so,
- . if the container fill is misleading, and
- . if label information required by law is not present.

Statutory Authority for FDA Regulation of Animal Feeds and Drugs

The Center for Veterinary Medicine (CVM) carries out FDA's Animal Drugs and Feeds Program. CVM is responsible for ensuring that drugs administered to, and feeds eaten by, animals are safe and effective for the animal, are properly labeled, and produce no human health

hazards when used in food-producing animals. For the purpose of regulation, an animal drug is defined in part as "articles intended for use in the diagnosis, cure, mitigation, treatment, or prevention of disease in animals" (21 U.S.C. section 321(g)). Animal feeds are considered to be articles used as food for animals or intended to provide a substantial source of nutrients for animals (21 U.S.C. section 321(x)). CVM is responsible for monitoring animal drug sales and distribution as well as good manufacturing practices (i. e., compounding, formulation, and production and manufacturing) associated with animal drugs and medicated feed production. FDA estimates that about 80 percent of the livestock and poultry in the United States is treated with some animal drug or medicated feed. FDA's automated animal drug data system contains information on over 12,000 animal drug products (18).

The FDCA provides the statutory authority for FDA regulation of animal feeds and veterinary drugs, and its provisions are the same as those for human foods: Thus, FDA must provide premarket approval for new animal drugs and for new additives (e.g., medications) that may be included in livestock feed; pesticide tolerance levels are set by EPA for livestock feeds, as they are for human foods; pesticide and drug residue levels are established for meat products that might be consumed by humans.

GRAS status can also be granted for livestock feed additives. Similar to human food additives, livestock feed additives can attain GRAS status if they have a substantial history of safe consumption by a significant number of animals in the United States or by scientific consensus. Adulterated or misbranded products can be removed from the market using the same criteria that apply to human foods (21 CFR 570.3 (f)).

Outside Input Into the FDA Decision Process

The FDA uses notice and comment procedures for decisions concerning food additives and advisory committees for decisions concerning human drugs. Any person may petition FDA to establish a food additive regulation to approve the use of a food additive (21 U.S.C. 409(b)(1)). If a regulation is required, a notice of that decision is published in the Federal Register. Following publication of a final rule, any person who might be adversely affected by the proposed decision has 30 days to request a hearing. FDA is not required to publish receipt of a new animal drug application.

Public participation in new drug approvals comes primarily from the use of advisory committees. FDA currently has 38 standing advisory committees of which almost all are concerned with human drugs and medical devices. There is one veterinary drug advisory committee. FDA uses advisory committees to provide expert opinion, and as such the voting members of the committees are usually technical experts. Some committees have nonvoting industry and public representatives. FDA generally does not use advisory committees for food additive petitions, but does seek input from scientific organizations such as the National Academy of Science and the Federation of American Societies for Experimental Biology (2, 10, 16).

FDA Inspection Activities

All FDA inspection and enforcement activities are carried out by the Office of Regulatory Affairs (ORA). The ORA is headquartered in Rockville, MD and has field offices in 49 States and Puerto Rico. Six regional offices coordinate the activities of all of the various FDA offices and coordinate FDA activities with those of State authorities. Facilities to test products for safety, quality, and conformance with labels are provided by 21 district offices and 18 district laboratories. The Office of Regulatory Affairs also conducts research necessary to evaluate health hazards and to develop detection methodologies. Additionally, there are 136 resident posts staffed with inspection personnel (18).

FDA considers its food safety responsibilities as being primarily preventive rather than corrective. Its resources are inadequate to continuously monitor every sector of the food industry (table 10- 1). Therefore, FDA tries to ensure that safety is "built into" products rather than to continuously monitor for safety after the products are produced. However, FDA's ability to carry out its responsibilities is being strained by the lack of resources.

While the workload increased during the 1980s, FDA had nearly 8 percent fewer staff and 8 percent less funding in 1989 than in 1980 (17).

FDA's food inspection procedures focus primarily on inspecting food establishments for sanitation, ingredient labeling, nutrition labeling, good manufacturing practices. low-acid canned foods, acidified foods, and food standards, although follow-up monitoring of some marketed food products is conducted (primarily for microbial contamination and chemical residues).

The number of food establishments in the United States is enormous—at least 636,000 in 1991. About 53,000 are subject to FDA inspection in that they produce products sold in interstate commerce or products made in whole or in part from ingredients shipped in interstate commerce. The States regulate firms that produce food products that contain no ingredients shipped in interstate commerce and are to be sold only within that State. The States also have primary inspection responsibility in some food and drug areas such as milk, shellfish, retail food stores, and food service establishments (restaurants). To help carry out its regulatory responsibilities, FDA cooperates with State agencies to cover all food establishments.

FDA can contract State programs to inspect firms within its responsibility. In fiscal year 1989, FDA had 113 contracts in 45 States and Puerto Rico at a cost of approximately \$5.3 million. FDA and contracted State agencies inspected nearly 17,000 food establishments and analyzed over 20,000 laboratory samples in 1991 (table 10-2) (18).

For those food establishments under direct control by State agencies, FDA has established cooperative agreements. These agreements are valued at approximately \$175 million, involve over 400 different State agencies, and cover millions of sites where food is sold or processed (table 10-3) (18).

Table 10-1—FDA Staffing Levels, Selected Years

Staffing	1980 ^a	1985 ^a	1988 ^a	1989 ^a	1990	1991	1992
CFSAN	976	859	826	817	821 ^b	884 ^b	895 ^b
CVM	238	253	244	244	278 ^c	282 ^c	284 ^c
ORA							
Headquarters	94	106	112	114	NA	NA	NA
Field offices	1,222	1,118	1,151	1,162	NA	NA	NA

NOTE: Not all of CFSAN and CVM personnel are directly involved in food safety and quality activities.

KEY: CFSAN = Center for Food Safety and Applied Nutrition; CVM = Center for Veterinary Medicine; FDA = Food and Drug Administration; ORA = Office of Regulatory Affairs; NA = Not applicable.

SOURCES: ^aU.S. Congress, General Accounting Office, "Food Safety and Quality: Who Does What in the Federal Government," RCED-91-19B, December, 1990.

^bThe Center for Food Safety and Applied Nutrition, Food and Drug Administration

^cThe Center for Veterinary Medicine, Food and Drug Administration

Table 10-2—FDA Domestic Inspection Activities, Selected Years

Year	Number of Inspections		Samples analyzed
	FDA	State contract	
1980 ^a	16,243	NA	16,440
1985 ^a	12,463	11,943	23,010
1988 ^a	8,232	7,152	19,965
1989 ^a	7,568	7,766	20,098
1990 ^b	7,054	7,031	20,849
1991 ^b	9,195	7,633	20,780

NA - Not available

SOURCES: ^aU.S. Congress, General Accounting Office. "Food Safety and Quality: Who Does What in the Federal Government," RCED-91-19B, December 1990.

^bFood and Drug Administration, Office of Legislative Affairs

In addition to cooperative agreements and State contracts, the FDA commission program provides authority to 367 State and local officials to assist the FDA in enforcing the Federal Food, Drug, and Cosmetic Act. This program uses State and local officials to perform specifically designated functions that are subject to Federal jurisdiction, such as conducting examinations, inspections, and investigations. The purpose of this program is to provide State officials with the authority to conduct inspections, review and copy records, and collect samples in FDA regulated establishments: in some States there is no other statutory authority for such inspections (18).

FDCA contains little specific preemption language regarding Federal versus State regulatory requirements. Thus, FDA is not in a position to oversee and approve State programs and employees. FDA does provide guidance and training to State agencies, evaluates State programs using national standards, and rates State officials for their

Table 10-3—Food Service Establishments Covered by FDA-State Cooperative Inspection Programs, 1991

Food service establishments	636,000
Retail food stores	150,000
Food vending locations	1,090,000
Grade A milk farms	126,000
Milk pasteurization plants	724
Shellfish processors	770
Shellfish shippers	750
Shellfish growing areas	3,000

SOURCE. Office of Legislative Affairs, Food and Drug Administration

competency, familiarity with, and uniformity in applying national standards within individual States (18).

In addition to its domestic responsibilities, FDA is mandated to ensure that imported products meet the same safety and labeling standards as domestically produced products. Field office personnel inspect imported food products at ports of entry and warehouses. Paperwork accompanying products subject to FDA regulation are reviewed to determine whether physical inspection is warranted. A physical inspection is conducted on those products suspected of being adulterated, misbranded, or otherwise in violation of the FDCA. The physical inspection ranges from a quick, visual examination of products at a wharf to sample collection and laboratory analysis (table 10-4) (18).

FDA Enforcement Activities

The FDA can issue written warnings to violators, request voluntary recall of violative food products, initiate seizures of violative food products, seek court-ordered injunctions, and seek criminal prosecutions. Warning letters² are issued by FDA only for violations of regulatory significance. Warning letters do not commit FDA to take an enforcement action if action is not taken to promptly correct violations. However, warning letters do contain specific notice that failure to promptly correct violations may result in enforcement action. The letters usually allow the company 15 working days to respond (table 10-5).

Imported products that fail to meet requirements must be exported, destroyed, reconditioned, or relabeled to bring them into compliance with Federal laws and regulations (table 10-6).

THE U.S. DEPARTMENT OF AGRICULTURE

The U.S. Department of Agriculture (USDA) is responsible for implementing a comprehensive system of inspection that ensures that meat, poultry, meat and poultry products, and selected eggs and egg products moving in interstate and foreign commerce are safe, wholesome, and correctly labeled and packaged. The USDA Food Safety and Inspection Service (FSIS) is responsible for the safety, wholesomeness, and accurate labeling of meat

²Warning letters were implemented in 1991. Prior to that time, written warnings consisted of regulatory letters or notices of adverse findings. Regulatory letters were sent when FDA concluded that violations were serious enough to warrant seizure, injunctions, or criminal penalties against firms or individuals if corrective action was not taken. A notice of adverse findings was sent when FDA concluded that a violation was not serious enough to warrant immediate action against firms or individuals, but was serious enough to warrant some type of written notice (18).

Table 10-4—FDA Import Inspection Activities, 1984-1991

Year	Wharf examinations	Samples examined
1984 ^a	26,200	19,150
1985 ^a	28,800	20,600
1986 ^a	35,650	26,350
1987 ^a	33,040	29,890
1988 ^a	38,760	32,590
1989 ^a	63,006	37,570
1990 ^a	39,112	37,163
1991 ^a	43,769	38,042

SOURCE: ^aU.S. Congress, General Accounting Office, "Food Safety and Quality: Who Does What in the Federal Government," RCED-91-19B, December 1990.

^bFood and Drug Administration, Office of Legislative Affairs.

and poultry products, and the Agricultural Marketing Service (AMS) is responsible for the safety of egg products.

Statutory Authority for USDA Inspection of Meat and Poultry Products

Statutory authority for meat and poultry product inspection is provided by the Federal Meat Inspection Act of 1906 (PL 59-242) as amended by the Wholesome Meat Act of 1967 (21 U.S.C. 601 et seq) and the Federal Poultry Products Inspection Act of 1957 (PL 85-175) as amended by the Wholesome Poultry Products Act of 1968 (21 U.S.C. 451 et seq).

For the purpose of regulation, meat food products are defined in part as

Any product capable of use as human food which is made wholly or in part from any meat or other portion of the carcass of any cattle, sheep, swine, or goats, excepting

products which contain meat or other portions of such carcasses only in relatively small proportion or historically, have not been considered by consumers as products of the meat food industry and which are exempted from definition.

The term meat products applied to food products of horses, mules, and other equines shall have a comparable meaning to that provided for cattle, sheep, swine, and goats (Section 1(j)). Poultry is defined (Section 4(f)) as

A domesticated bird whether live or dead, and poultry product means any poultry carcass or part thereof, or any product which is made wholly or in part from any poultry carcass or part thereof, excepting products which contain poultry ingredients only in relatively small proportion or historically have not been considered by consumers as products of the poultry food industry.

FSIS is responsible for the inspection of meat and poultry products. FDA is responsible for premarket approval of any food and color additives added to meat and poultry products, and for products that contain meat but that are not traditionally considered to be meat products (e. g., sandwiches with meat in the filling).

The Federal Meat Inspection Act and the Federal Poultry Inspection Act allow USDA to remove adulterated or misbranded products from the market. Adulterated meat and poultry products are those that contain poisonous or deleterious substances that may render the product injurious to health. In cases where such substances are natural, the product is not considered adulterated if the quantity of poisonous or deleterious substances in or on the product does not ordinarily render it injurious to health. For added substances, meat and poultry products are also

Table 10-5—FDA Enforcement Activities, 1988-1991

Fiscal year	Regulatory letters		Recalls	
	Food and cosmetics	Animal drugs and feeds	Food and cosmetics	Animal drugs and feeds
1988	36	169	470	54
1989	13	93	570	89
1990	24	166	725	62
1991	122	123	566	91

Fiscal year	Seizures		Injunctions		Prosecutions	
	Food and cosmetics	Animal drugs and feeds	Food and cosmetics	Animal drugs and feeds	Food and cosmetics	Animal drugs and feeds
1988	121	17	6	2	13	5
1989	88	9	3	6	5	3
1990	78	9	4	3	5	3
1991	66	4	5	2	2	3

SOURCE: Food and Drug Administration, Office of Legislative Affairs.

Table 10-6—FDA Import Enforcement Activities, 1988-1991

Fiscal year	Import samples analyzed		Adverse findings ^a	
	Food and cosmetics	Animal drugs and feeds	Food and cosmetics	Animal drugs and feeds
1988	32,801	251	11,648	88
1989	37,936	189	14,294	73
1990	37,678	197	15,080	35
1991	38,147	148	13,487	38

^aThe number of analyzed samples that failed to meet established standards and policy guides, or would for other reasons support a regulatory action.
 SOURCE: Food and Drug Administration, Office of Regulatory Affairs.

considered adulterated if they contain substances deemed unsafe by the appropriate meanings defined in the Food, Drug and Cosmetic Act (i.e., section 408 for pesticidal chemicals, section 409 for food additives, and section 706 for color additives).

Meat and poultry products are considered misbranded if among other things, the labels are false or misleading, if they are offered for sale under the name of another food, if they are an imitation of another food and the label does not clearly state so, if the container fill is misleading, and if label information required by law is not present.

FSIS Inspection Activities

Plans for meat and poultry plant facilities, equipment, and procedures must be approved by FSIS prior to operation or use to ensure that such operations will be sanitary. The floor plan, water supply, waste disposal systems, and lighting for each plant must be approved. Facilities and equipment must be easy to clean. In 1989, FSIS reviewed 3,851 blueprints of meat and poultry plants and 2,864 drawings of equipment. Once in operation, facilities and equipment are monitored for sanitation. Inspectors monitor operations in meat processing plants, and processing procedures and product formulations are reviewed to ensure that the products will be safe. Labels are checked for truthfulness and conformance with labeling laws and regulations (18).

All cattle, sheep, swine, goats, horses, mules, and other equines slaughtered for use as food must be inspected prior to slaughter at the slaughtering plant. Their carcasses also are examined after slaughter. Slaughtering cannot take place without the presence of an inspector, Veterinarians check the live animals for symptoms of disease or other abnormal conditions. After slaughter, inspectors under the supervision of veterinarians, ex-

Table 10-7—USDA Residue Testing in Slaughtered Animal Tissues, 1988-1990

Sample type	1988	1989	1990(est)
Food chemistry	70,021	62,435	62,000
Food microbiology	37,410	36,908	37,000
Chemical residues	102,714	185,163	185,000
Antibiotic residues	223,210	255,851	256,000
Pathology	11,160	11,017	11,000
Serology	3,928	1,630	1,600
Additives in nonfoods	12,007	10,907	10,900
Radiation	3,184	139	
TOTAL	463,634	564,050	563,500

SOURCE: General Accounting Office, compiled from the Food Safety and Inspection Service,

amine each carcass and internal organs for symptoms of disease or contamination that would make all, or part, of the meat unfit for human consumption. Animal tissues may also be analyzed for drug and chemical residues to ensure that they meet tolerances as established by FDA (animal drugs) or EPA (pesticides) (table 10-7).

FSIS interprets its inspection mandate to apply to species and not breeds. The offspring of two breeds of the same species, such as Hereford and Angus beef cattle, would be classified as beef and amenable to inspection. The hybrid offspring of two different species, however, may or may not be inspected depending on which parent the offspring physically resembles. For example, the offspring that results from crossing a cow and a buffalo will be amenable if it resembles the cow, but not amenable, and therefore not subject to mandatory inspection, if its physical appearance is that of a buffalo (15). The slaughter of experimental animals at official establishments is not allowed unless certain conditions are met. These conditions include statements from FDA, EPA, or the Animal and Plant Health Inspection Service (USDA-APHIS) that experimental drugs, chemicals, or biological have been used in accordance with regulations and are below tolerances (9 CFR 309.17 and 381 .75).

FSIS is developing methods to streamline inspection activities based on hazard assessment and using statistical sampling methods, a system known as the Hazard Analysis Critical Control Point (HACCP). The agency currently is conducting a study to determine the most effective way to implement the HACCP system into meat and poultry inspection, and is working with industry to develop model HACCP plans and is soliciting volunteer plant participation to develop the pilot program. Workshops have been or will be held for application of HACCP to minimally processed foods that are refrigerated, cooked sausage, fresh ground beef, young chicken slaughter, and market hog slaughter.

Table 10-8—FSIS Inspection Staff, 1988-1990

Program area	Staff years		
	1988	1989	1990 (est)
Slaughter inspection	6,969	7,004	7,042
Processing inspection	2,847	2,791	2,805
Import-export inspection	230	231	232
Laboratory services	384	373	376
TOTAL	10,430	10,399	10,455

SOURCE: General Accounting Office, compiled from the Food Safety and Inspection Service.

FSIS also inspects imported meat and poultry products to ensure that they meet the same standards as domestic products. Countries wishing to export to the United States must impose inspection requirements at least equal to those enforced in the United States. FSIS evaluates the inspection programs of these countries to determine eligibility and reviews the way the systems are operated. As of the end of 1989, 1,431 plants in 34 countries were certified to export meat and poultry products to the United States. FSIS also reinspects imported meat and poultry products, on a sample basis, when they enter the United States.

FSIS is responsible for inspecting and monitoring about 6,720 meat and poultry plants throughout the United States, and 220 official import establishments. FSIS employs approximately 7,800 Federal inspectors of which 6,050 are food inspectors, 180 are food technologists, and 1,050 are veterinarians (table 10-8). Between 1980 and 1989 funding declined by 3 percent (in constant 1989 dollars) and staff years declined by 6 percent. However, during this same time period, inspection activities increased considerably. Pounds of processed poultry inspected increased by 134 percent, pounds of slaughtered poultry inspected increased by 52 percent, and samples analyzed increased by 182 percent. Compliance reviews also increased by 45 percent (18).

FSIS monitors State programs for inspecting meat and poultry products that will be sold only in the State in which they are produced. State programs are required to beat least equal in rigor to Federal programs. About half of the States conduct their own meat and poultry inspections and about 5,700 plants are inspected by State programs. FSIS is authorized to reimburse these programs for up to 50 percent of the inspection costs. FSIS provided about \$36.5 million in grants to 28 States in 1989. If States abolish their inspection programs, FSIS is required to assume inspection responsibility (18).

Table 10-9—AMS Inspection Activities, 1988-1990

Activity	1988	1989	1990 (est)
Egg products inspected (billion lb)	1.7	1.6	1.6
Egg product plants	86	83	86
Egg handler surveillance visits	9,723	8,769	8,200
Lab samples analyzed			
Food chemistry/ microbiology	46,481	40,969	42,000
Chemical residues	384	517	500

SOURCE: General Accounting Office, compiled from the Agricultural Marketing Service.

AMS Inspection Activities

Agricultural Marketing Service (AMS) activities are primarily related to food quality rather than food safety issues. AMS establishes standards of quality and grades for dairy, egg, fruit, poultry, and vegetable products (see ch. 14). Food safety responsibilities are in the area of egg products and shell egg surveillance programs. Statutory authority is granted by the Egg Products Inspection Act as amended (21 U.S.C. 1031 et seq).

The Egg Products Inspection Act requires continual USDA inspection of all egg products processing plants. For the purpose of regulation, egg products are defined as liquid, frozen, and dried egg products. Further processed products, such as noodles and custards, which contain egg products but have not been considered as products of the egg food industry, are not subject to inspection by USDA (but are subject to FDA authority). Facilities, equipment, and methods of processing are inspected for cleanliness and the ability to perform intended functions. Inspections include visual evaluations and laboratory tests. Egg products can be analyzed for microbial and chemical residues and other contaminants (table 10-9) (18).

The Egg Products Inspection Act also requires mandatory quarterly inspections of shell egg handlers who pack eggs for consumer sales, and restricts certain types of shell eggs from moving into consumer channels. Restricted eggs include checked eggs (those with cracked shells that are not leaking); dirty eggs (which may be sent only to official USDA inspected processing plants for proper handling and processing); incubator rejects (infertile or unmatchable eggs); leakers (cracked eggs with contents leaking); and inedible and loss eggs (unfit for human consumption). Inedible eggs and egg products

Table 10-10—AMS Enforcement Activities, 1989

Penalty	Cases closed
Letter of information	197
Letter of warning	86
Closed without penalty	21
Criminal prosecution	1

SOURCE: General Accounting Office, compiled from the Agricultural Marketing Service.

must be denatured and destroyed or otherwise handled to preclude their use as human food.

AMS has cooperative agreements with all 50 States, Puerto Rico, and the Virgin Islands. AMS uses State inspection personnel to make unannounced quarterly shell egg surveillance visits to shell egg-packing establishments. AMS provides Federal oversight for State programs, and reimburses States for performing surveillance inspection work. In 1989, approximately 1,500 shell egg-packing plants and 500 hatcheries were subject to, and received, quarterly inspections by USDA or cooperating State agencies (18).

Egg products may be imported only from countries with egg products inspection systems that meet the standards of the U.S. system. As of September, 1989 only Canada and the Netherlands met this requirement. AMS monitors incoming products and routinely tests products for *Salmonella* and various environmental contaminants. Shell eggs are imported for use in producing egg products and are processed under continual inspection. Table 10-10 summarizes AMS enforcement activities for 1989.

APHIS Inspection Activities

The Animal Plant Health Inspection Service (APHIS) has few legal responsibilities to protect or promote food safety and quality unless the organisms or chemicals of concern to public health are also of concern to animal or plant health. Programs designed to protect the animal industry against pathogens or diseases that can also pose foodborne risks to humans improves food safety. In 1990, for example, APHIS instituted an emergency program to combat *Salmonella enteritidis* in poultry. APHIS tests and monitors all egg type breeding and multiplier flocks as well as controls the interstate movement of poultry, eggs, and material from known culture positive flocks and exposed flocks. APHIS also conducts programs to prevent communicable disease of foreign origin from entering the United States, diagnoses foreign animal diseases should they enter the country, and prevents the spread of disease through interstate shipments of livestock.

APHIS also regulates animal biologics under the Virus-Serum-Toxin Act (21 U.S.C. 15 I-158) A veterinary biologic is any natural or synthetic virus, serum, toxin, or microorganism intended for use in the diagnosis, treatment, or prevention of animal diseases. USDA and FDA have a standing committee to determine whether a new animal product is a drug or a biologic. Under FDCA (21 U.S. C. 351 -360b, 1982) FDA has jurisdiction to regulate new animal drugs that are not biologics.

Outside Input Into the USDA Decision Process

Statutory authority for USDA food safety regulatory activities does not require public notification and comment, except for new food additives used in meat and poultry products that are subject to notice and comment procedures with FDA. USDA (most notably APHIS) has undertaken a voluntary notification program for the environmental release of genetically modified organisms. USDA does use advisory committees to provide outside expertise to aid their regulatory decisions (16).

THE ENVIRONMENTAL PROTECTION AGENCY

The Environmental Protection Agency (EPA) is responsible for regulating all pesticide products sold or distributed in the United States. For the purpose of regulation, EPA defines a pesticide as any substance or mixture of substances intended for preventing, destroying, repelling, or mitigating any pest, and any substance or mixture of substances intended for use as a plant regulator, defoliant, or desiccant. A pest is defined as 1) any insect, rodent, nematode, fungus, weed, or 2) any other form of terrestrial or aquatic plant or animal life or virus, bacteria, or other microorganism (except viruses, bacteria, or other microorganisms on or in living man or other living animals) that the administrator declares a pest (7 U.S. C. 136(2)(t)).

Statutory Authority for EPA Food Safety Regulations

Statutory authority for the regulation of pesticides are provided by the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) of 1947 (7 U.S.C. 136 et seq), and the Federal Food, Drug, and Cosmetic Act (21 U.S.C. 301 et seq).

Under FIFRA, EPA registers new pesticide products, reregister existing pesticides, specifies the terms and conditions of their use, and removes hazardous pesticides from the market. (See ch. 7.) Under FIFRA, EPA can register a pesticide only if it determines that the pesticide, when used according to directions, will perform its intended function without causing any unreasonable risk to humans or the environment, taking into account the economic, social, and environmental costs and benefits of the pesticide's use.

Under FDCA, EPA has responsibility for determining the safety of pesticide residues in or on food for humans, or feed for domestic food animals. Before a pesticide can be registered for use on a food or feed crop, a tolerance, or an exemption from the requirement of a tolerance, must be established. A tolerance is the maximum level of pesticide residues that can be present in or on raw agricultural commodities, food, or feed transported in interstate commerce. Tolerances, or exemptions from the requirement of a tolerance, must be established for each active and inert ingredient contained in the pesticide, and for each raw commodity, processed commodity, and livestock species that might contain residues of the pesticide.

Any person applying for a pesticide registration may file a tolerance petition. Appropriate data must be submitted so that EPA can define a safe and realistic tolerance level, or grant the exemption. These data include information on the pesticide's toxicity (potential to cause adverse health effects), the residues that may remain in or on food or feed, and an analytical method that can detect the chemical and any metabolizes of concern in the commodity (19).

In addition, EPA has discretionary authority to establish tolerances and exemptions on its own initiative or in response to a request of any interested person. EPA can set a tolerance, grant an exemption from tolerances, or amend a current tolerance if the current pesticide registration is changed. At the request of FDA or USDA, EPA also recommends enforcement levels (action levels) for residues that may occur in food and feeds resulting from other than direct application of the pesticide to the crop. For example, a pesticide may persist in the environment even after a pesticide registration has been canceled.

Section 408 of the Federal Food, Drug, and Cosmetic Act (FDCA) provides the authority to establish tolerances for raw agricultural commodities, and section 409 provides the authority for processed products. Section 408 was first passed in 1954, and section 409 was passed 4

years later. Initially, tolerances for pesticide residues were established by the Food and Drug Administration, but with the creation of the Environmental Protection Agency in 1970, these pesticide regulatory responsibilities were transferred to the EPA.

Raw agricultural commodities are considered to be fresh fruits, vegetables, grains, nuts, eggs, raw milk, and meats. The term excludes foods that have been processed, fabricated, or manufactured by cooking, freezing, dehydration, or milling among other processes (40 CFR 180.1(e)). When establishing pesticide residue tolerances on raw agricultural commodities, EPA must not only consider the safety of the product, but also the necessity of the pesticide to produce an adequate, wholesome, and economical food supply; other ways that the consumer may be affected by the pesticide; and the usefulness of the pesticide. Under FDCA, raw agricultural commodities that contain pesticide levels above established tolerance levels are considered adulterated (21 U.S.C. 346a (a)(b)).

The tolerance established for the raw commodity also applies to the processed food product if the pesticide residue level in the processed product is less than that tolerance level. If, however, the processing concentrates the pesticide residue such that levels contained in the processed food exceed the established tolerance for that pesticide in raw commodities, then a separate tolerance must be established for the pesticide in the processed food. The tolerance that then must be established for the processed food is considered a food additive under FDCA. Food additive petitions do not include an assessment of the benefits that may result from the pesticide. The Delaney Clause of the food additive amendment prohibits the use of carcinogenic food additives.

Outside Input Into EPA Decision Process

Under FIFRA, EPA is required to publish notice of the receipt of a pesticide registration application or of any Experimental Use Permit (EUP) that is of regional or national significance. EUP's are required before pesticides can undergo field trials. Trials involving less than 10 acres of land or 1 surface acre of water, and for which the crop is destroyed or used only for research (i.e., it is not used for food or feed) are generally not required to file an EUP, however. Notifications are published in the Federal Register and the public has 30 days to provide written comments. EPA also publishes the issuance of pesticide registrations and EUP's. If public comments indicate that there is sufficient interest or that it would otherwise be in the public interest, EPA can hold a public

Table 10-1 I—Selected State Pesticide Enforcement Activities, 1988-1990

Activity	1988	1989	1990 (est)
Use inspections	12,639	19,308	18,829
Producer establishment inspections	1,488	1,662	2,509
Marketplace inspections	5,662	8,032	4,035
Import inspections	273	431	475

SOURCE: General Accounting Office, compiled from the Environmental Protection Agency.

hearing concerning an application. EPA can also use advisory committees and generally tries to include public representatives on these committees. EPA tries to draw a distinction between private citizens and representatives of public interest groups (40 CFR 25.7(c)(1)(i and ii). EPA can also utilize its FIFRA Scientific Advisory Panel as a forum for scientific peer review and comment. Panel meetings are public and allow an opportunity for public comment.

EPA Enforcement Activities

EPA does not enforce tolerances; that is the responsibility of USDA and FDA, and State enforcement agencies. USDA has monitoring and enforcement responsibilities for pesticide residues in meat, poultry, and egg products. FDA is responsible for monitoring the rest of the Nation's food supply. These agencies test samples of food to determine if the food contains residues for which no tolerance has been set or residues exceeding tolerance levels, rendering the food adulterated. Food commodities with residues in excess of tolerance levels or residues for which no tolerance has been set are subject to seizure. EPA has cooperative agreements with the States to perform enforcement activities. State agencies conduct use inspections, inspect pesticide-producing establishments, maintain marketplace surveillance, inspect imports, and inspect dealers and users of restricted-use pesticides. They also complete analyses of pesticide samples collected during inspections (table 10-11) (18).

Similar to other Federal agencies, resources devoted to food safety activities at EPA declined during the 1980s. EPA had 17 percent less staff and 8 percent less funding in 1989 compared to 1980 (17).

OTHER FEDERAL AGENCIES

Other Federal agencies also carry out activities that have some effect on food safety. The National Marine Fisheries Service (National Oceanic and Atmospheric

Administration (NOAA), U.S. Department of Commerce) conducts voluntary seafood inspection programs. The Agricultural Marketing Act of 1946(7 U.S.C. 1621 et seq) authorized the Secretary of Agriculture to establish a voluntary inspection and certification program for agricultural products including fish and shellfish traded in interstate commerce. The act also required the Secretary to conduct research and development on methods of processing, packaging, handling, storing, and preserving products, and to develop and improve standards of quality, condition, quantity, grade, and packaging to encourage uniformity and consistency in commercial practices. The Fish and Wildlife Act of 1956(16 U.S.C. 742a et seq) transferred USDA functions and authorities pertaining to commercial fisheries, including the voluntary seafood inspection program, to the U.S. Department of the Interior in 1958. Reorganization Plan No. 4 of 1970 transferred the functions described in the Fish and Wildlife Act to NOAA. The National Marine Fisheries Service (NMFS) conducts the National Seafood Inspection Program and the Product Quality, Safety and Identity Research Program (18).

The seafood inspection program is voluntary and fee based. Plants and fishing vessels are inspected for sanitation and certified. Seafood products are analyzed for microbial and chemical contamination, for decomposition, and for species identification. NMFS has cooperative agreements with the States and provides training to State inspectors who are certified to perform inspection activities. NMFS also monitors State inspection activities. NMFS does not provide Federal grants to States for providing inspection services, but does reimburse States for costs incurred at an agreed on hourly rate (18).

In February, 1991 the FDA established a new Office of Seafood (within CFSAN). This office will cooperate with NMFS and will increase FDA responsibilities for seafood inspections. The office will oversee seafood inspection programs by FDA in cooperation with NMFS and State agencies, oversee the development of training programs for FDA, State, and local inspectors, and increase research and develop methods to detect and evaluate the effects of microbial and chemical contaminants in seafood that might pose public health hazards (11).

As of January 1990, there were 144 NMFS inspectors, 63 NMFS cross-licensed Federal (USDA) inspectors, and 74 NMFS cross-licensed State inspectors. It is estimated that there are approximately 1,878 fish processing plants in the United States, and about 141 of those contracted for inspection services (table 10-12) (18). FDA has about 300 people engaged in various seafood safety programs

Table 10-12—National Marine Fisheries Inspection Activities, 1981-1989

Year	Laboratory testing			Total
	Microbial	Chemical	Physical	
1981	75	35	5	115
1982	69	28	7	104
1983	70	6	2	78
1984	71	7	6	84
1985	39	9	11	59
1986	43	23	5	71
1987	51	20	14	85
1988	68	22	15	105
1989	33	25	8	66

SOURCE: General Accounting Office, compiled from the National Marine Fisheries Service.

and is expected to add another 270 scientific and inspection positions within 2 years (1).

Other Federal agencies with some food safety activities include the Agricultural Research Service (USDA-ARS), which conducts food safety research primarily to develop methods to detect and control bacterial and parasitic contamination of meat and poultry and their products. ARS develops methodologies to detect chemical residues in meat and poultry and their products, and methods to detect and prevent mycotoxins in plant commodities.

The Public Health Service Act (42 U.S.C. 201 et seq) authorizes the Center for Disease Control (Department of Health and Human Services) to conduct research on, and monitor and control foodborne diseases.

The Federal Trade Commission Act (15 U.S.C. 51 et seq) authorizes the Federal Trade Commission (FTC) to investigate advertising claims that may result in unfair competition and unfair or deceptive acts and practices in commerce. Under this Act, the FTC has investigated claims of companies that test fresh produce for pesticide residues, health claims for food products, and home test kits for food impurities.

The U.S. Customs Service assists FDA, USDA, and EPA in their import inspection duties. It makes sure that documentation is in order and, via a memorandum of understanding with FDA, delivers samples of imported food products to FDA on request.

The Bureau of Alcohol, Tobacco, and Firearms (BATF) regulates production and distribution of alcohol and tobacco products. FDA has responsibility for safety of alcoholic beverages; however, a memorandum of understanding with BATF gives most of that responsibility to BATF.

The Federal Grain Inspection Service (USDA) inspects corn, sorghum, and rice for aflatoxin contamination.

FOOD SAFETY COORDINATION AMONG FEDERAL AGENCIES

Given that so many agencies are involved in various aspects of food safety, coordination between the agencies is imperative. In general, this coordination involves notifying appropriate agencies of findings that may indicate that regulations have been violated, and trying to avoid inspection duplication when products or facilities are under the jurisdiction of more than one agency. In 1989, FDA had 27 memorandums of understanding relating to food safety and quality with other Federal agencies, primarily USDA.

EPA, FDA, FSIS, and AMS all have agreements to notify each other in the event that residues from drugs, pesticides, or environmental contaminants exceed tolerance levels. EPA is to notify FDA and USDA of any pesticide use it encounters that may have resulted in residues that adulterate human food or animal feed. FDA is to notify EPA of possible misuse of pesticides or chemical substances that may indicate a violation of EPA laws; and to notify USDA of illegal residues of drugs, pesticides, or environmental contaminants in human food or animal feed. USDA is to notify FDA of findings of illegal residues in edible meat, poultry, or egg products and to keep FDA and EPA informed of all FSIS and AMS sampling and testing programs for illegal residues (18).

FSIS, AMS, and FDA try to avoid duplicating inspections and exchange information on violative conditions concerning food manufacturers whose facilities are under the jurisdictions of more than one agency. For example, the Egg Products Inspection Act gives AMS authority over egg product plants, egg producers and packers, other firms engaged in marketing eggs including hatcheries, and imported egg products. FDA has jurisdiction over restaurants, institutions, food manufacturing plants, and other similar establishments that break and serve eggs or use them in their products. The National Marine Fisheries Service covers fishery products plants that are under NMFS voluntary inspection contracts and also subject to FDA inspection. NMFS is to apply to these plants FDA regulations concerning good manufacturing practices, labeling, food additives, tolerances, standards of identity, minimum quality, and fill of container. NMFS also cross-licenses FDA and USDA inspectors for seafood inspections. The agencies notify each other of violations (18).

INTERPRETATION OF FEDERAL FOOD SAFETY LAWS WITH RESPECT TO PRODUCTS PRODUCED WITH BIOTECHNOLOGY

None of the laws used to regulate food safety contain specific provisions for products derived using biotechnology. However, based on the Coordinated Framework (see ch. 7), all of the Federal agencies involved in food safety regulation feel that current laws are adequate to cover products created with biotechnology techniques and that no new regulation is needed for such products. The broad interpretation of the existing statutory authority allows for the agencies to extend their regulatory authority to cover genetically modified products.

FDA Regulation of Biotechnology-Derived Food Products

The application of the Federal Food, Drug, and Cosmetic Act to the regulation of food products produced with biotechnology is complex. FDA must choose a regulatory **course** that ensures public safety, however, unnecessary over-regulation could damage agricultural competitiveness and deny new products to consumers. FDA's statutory authority should be implemented in a manner consistent with past actions, with the goals of the Coordinated Framework, and with FDA's own stated policy that it will regulate the product and not the process. FDA must apply its authority to biotechnology products in such a way that they capture those foods for which there are safety concerns. but it is important that it do so in such a way that a regulatory structure that requires review of all new food crop varieties is not established. Finding an appropriate balance is a complex task.

As discussed earlier, FDA has the legal authority to take action against foods adulterated with poisonous or deleterious substances that would ordinarily (for inherent natural substances) or may (for added substances) render the food injurious to health. Action can also be taken against foods containing an additive(s) for which no regulation exists or that is not GRAS for its intended use. Because FDA does not generally conduct a premarket safety evaluation of food, only of food additives, some groups (e. g., the Environmental Defense Fund) feel that use of the adulteration clauses to remove marketed food products made from biotechnology is inadequate to ensure the safety of these foods and have proposed that essentially all food products produced with biotechnol -

ogy be classified as food additives. FDA is faced with the challenge of deciding whether new biotechnology-derived food products are GRAS or whether they are food additives that require premarket approval.

The types of food products likely to be developed using biotechnology include

- single compounds (e. g., flavors, enzymes, colors) produced by genetically modified organisms (e. g., bacteria, cell culture) and added to goods,
- genetically modified organisms (e. g., yeast and bacteria) that become part of the food itself (e. g., dairy, meat, and vegetable starter cultures),
- simple mixes of compounds added to food, and
- whole foods (transgenic crops) (8).

Biotechnology-derived food products in the first three categories generally fit the standard interpretation of a food additive and thus may be regulated in the same manner as additives produced by conventional means. Thus, genetically modified starter cultures and single and simple mixture compounds derived from genetically modified organisms may be treated as food additives if the modification alters the ingredient in such a way that it is no longer GRAS (8, 9, 12).

The primary difficulty FDA will have in applying its statutory authority to food products produced with biotechnology will be with respect to whole foods (e. g., transgenic crops). New varieties of crops have generally been regarded as safe (GRAS) by FDA, and thus have not required premarket approval as a food additive. FDA has the option of similarly allowing biotechnology-derived whole foods to be marketed, relying on its seizure procedures to remove products for which safety risks arise, or of applying the food additive definition to whole foods produced with biotechnology. In the latter case, biotechnology products either would be affirmed as GRAS or declared a food additive requiring premarket approval. The question that arises with biotechnology is does the process alter the food in such a way that it is now adulterated or is no longer GRAS'?

Use of the Seizure Procedures

It is possible to use biotechnology to create transgenic crops that contain completely novel gene products. However, it is also quite possible to use biotechnology to create transgenic crops essentially equivalent to new varieties produced by traditional means. New varieties produced by conventional methods do not undergo premarket evaluation. Rather, FDA relies on their ability to seize products should a food safety problem arise. FDA could

apply a **similar approach** to whole foods produced with biotechnology.

As is currently the case, whole foods produced with biotechnology that contain poisonous or deleterious substances could be considered adulterated if the substance is in sufficient quantities that it *would ordinarily render* the food injurious to health (inherent natural substances) or *may render* the food injurious to health (added substances). Added substances include those present as a result of human intervention (e. g., mercury in fish). Broadly interpreted, added substances could include inherent naturally occurring substances whose levels have been significantly altered as a result of human intervention. Such an interpretation could include new crop varieties produced by conventional breeding procedures, as well as whole foods produced with biotechnology methods. The use of traditional breeding methods to develop new crop varieties have generally not been found to alter the product in such a way that they would be considered adulterated. Given that many biotechnology products will be essentially equivalent to new products produced conventionally, the application of seizure standards to whole foods derived from biotechnology must be implemented in a manner that captures products for which there are safety concerns without establishing a regulatory structure that requires the review of all new food crop varieties (7, 9).

An advantage of using the seizure procedure to remove biotechnology-derived whole foods from the market is that this procedure does not a priori impose an extensive regulatory process and premarket approval for all foods for which biotechnology has been used. Action is initiated against those products that clearly pose a health risk to society. This procedure is the one currently applied to whole foods produced with conventional methods. Like biotechnology, conventional breeding can alter the levels of toxic substances or nutrients in whole foods.

A disadvantage of relying on seizure procedures to remove biotechnology-derived whole foods from the market, is that action is not initiated until a product poses a health safety risk, and/or someone is adversely affected. This is no different than what occurs now with conventionally produced whole foods, but given that biotechnology is a new procedure, and there appears to be public apprehension concerning this technology, removal of an unsafe biotechnology product from the market could be very damaging to public acceptance of biotechnology in food production.

Use of the Food Additive Definition

FDA could choose to apply the food additive definition to whole foods, including those produced by biotechnology or conventional methods. Recall that a food additive is any substance whose intended use may be reasonably expected to directly or indirectly become a component or otherwise affect the characteristics of any food, unless the substance is GRAS or subject to some other exemption of the food additive amendment (e. g., pesticides, color additives, etc.).

Application of the food additive definition to whole foods requires a specification of what food ingredient actually is the food additive. A whole food could be classified as a food additive if that food is used as an ingredient in another food product. For example, carrots used in beef stew could be considered a food additive if the carrots are not GRAS. Alternatively, some trait or constituent of the food could be designated as a food additive, if that constituent is not GRAS.

Because of a long history of safe use prior to 1958 when the food additive amendment was enacted, most whole foods have been considered GRAS. Likewise, FDA has generally not required a formal review to establish GRAS status of new varieties of crops produced after 1958 because changes resulting from traditional breeding have generally been felt not to result in traits that are sufficiently different to warrant such a review. A significant issue with respect to whole foods produced with biotechnology methods is whether these procedures alter the food in such a way that these products cannot now be viewed as GRAS.

Alternatively, constituents of whole foods could be designated as food additives if these constituents are not GRAS. Thus, for example, gene products resulting from biotechnology procedures could be classified as food additives. It is possible to transfer truly novel genes to whole foods. These genes may produce proteins that have previously not been part of the food system. Such expression products would not have been previously designated as GRAS, and would be good candidates for designation as food additives. However, many genes transferred between crops may code for proteins that are currently consumed. Under what circumstances will these proteins be deemed sufficiently different from those being consumed to warrant a formal review of GRAS status? FDA could describe the kinds of traits that might be different enough to warrant review. Minor alterations of previously consumed proteins or the addition of common kinds of nontoxic proteins could potentially be viewed as not

raising sufficient concerns to warrant a formal review of GRAS status.

An advantage of declaring whole foods or traits contained in whole foods as food additives is that this affords an opportunity to examine these products prior to marketing. A disadvantage is that in some cases it may be technically difficult to actually conduct the safety assessment (see ch. 11). Additionally, if most or all biotechnology-derived whole foods are declared food additives, and conventionally produced products are not, it would behoove FDA to explain the scientific justification for such a distinction. Otherwise it could appear that FDA is regulating by process, which it has stated it will not do.

Other analysts have suggested different interpretations of the food additive amendment with respect to whole foods derived from biotechnology. One proposal is to apply the food additive definition to gene products that would have been classified as food additives if added to foods, and to exclude from the definition gene products that result in changed agronomic traits (8). As noted above, others have suggested that all whole food produced with biotechnology be classified as food additives with the possible exception of transgenic crops that could have been developed using traditional means rather than biotechnology (i.e., the genes transferred come from species that are sexually compatible with the host plant) (3). Still others have suggested that legal difficulties may arise in developing an approach to regulating whole foods produced with biotechnology that is risk based and not process based, without simultaneously establishing regulations that require formal review of all new crop varieties produced by conventional means (7).

Current Status of FDA Regulations

Given the complexities involved, and the controversial nature of genetically engineered food products, FDA policy has been a long time in the making. A clear policy statement and guidelines have been needed. The lack of a clear policy has been confusing to industry and the public. Many biotechnology-derived food products, including whole foods, are no longer in the preliminary stages of development; products are rapidly approaching commercialization. FDA no longer has the luxury of delaying a decision on whether or how they intend to regulate food products produced with biotechnology.

In May 1992, FDA released a preliminary policy statement regarding new varieties of crops produced with biotechnology (5). The policy statement is not final; public comments are being solicited. Some public interest

groups oppose the policy and are threatening to take legal action to stop it. Thus, policy regarding the food safety regulation of transgenic crops is still evolving.

FDA policy states that it is the characteristics of the product, not the method used that will be of most concern. The FDA will not *a priori* require a food additive petition for all genetically modified whole foods. Rather, FDA will require an assessment of the expression products of the genetic modification and any unexpected or unintended effects that may result from genetic modification. Expression products that differ substantially in structure, function, or composition from substances found currently in the food supply may require a food additive regulation. New products that are not substantially different from foods currently consumed may, like new varieties conventionally produced, be considered as GRAS.

FDA policy emphasizes safety assessment guidelines that focus on determining whether the new plant varieties are as safe and as nutritious as their parental varieties. FDA is concerned that new toxicants not be introduced into the food supply, that the level of toxicants inherently present in foods is not unintentionally increased to levels exceeding those already consumed, that the composition or bioavailability of nutrients is not significantly altered, and that compounds that are known to cause allergic responses in sensitive individuals are not transferred between crop varieties. Effects of processing on the composition of the food product must also be considered.

Decision trees are provided in the policy statement to assist firms in assessing the safety of genetically modified varieties. Characteristics of the genetically modified varieties are based on the characteristics of the host and donor species, the identity and function of the newly introduced substances, and any unexpected or unintended effects that may accompany the genetic change are emphasized. The safety assessment focuses on:

- . toxicants known to be characteristic of the host and donor species,
- . potential that food allergens will be transferred from one food source to another,
- . concentration and bioavailability of important nutrients for which the food crop is ordinarily consumed,
- . **the safety and nutritional value of newly introduced proteins, and**
- . the identity, composition, and nutritional value of modified carbohydrates, fats, and oils (5).

FDA states in their preliminary policy that if genetic modification does not result in the introduction of new

toxicants to the food supply, does not alter the level of toxicants already present, does not alter the composition or bioavailability of nutrients in new varieties, and does not result in the transfer of allergenic components to new varieties, then the new variety can be considered as equivalent to traditional varieties when used in a similar manner. If that traditional variety is classified as GRAS, then the new variety would also be GRAS. Modifications that result in varieties that contain new toxicants or significantly elevated levels of inherent toxicants are unacceptable. Modifications that result in nutritional changes or potentially increase the possibility of allergic reactions must be further evaluated by FDA. Such varieties may require a food additive petition and a complete premarket safety assessment.

FDA is also not requiring generic labeling of all new crop varieties produced with biotechnology methods. Approved products that may have altered nutritional composition or that contain compounds that are potentially allergenic may need to be labeled as such. Prior to commercialization, many transgenic crops will undergo field trials. Permits for such trials are granted by USDA and EPA and require an environmental assessment. FDA intends to coordinate with these agencies to prevent duplication in FDA's efforts to comply with NEPA.

FDA has not yet formally been petitioned to review a transgenic plant, although it has been asked to give an advisory opinion on the use of the kanamycin resistance gene as a marker in transgenic tomatoes, cotton, and rapeseed (6). FDA has also been asked to give an advisory opinion on the use of the antisense technology to delay softening in tomatoes. The agency has recently provided for public comment its response to this request.

FDA has ruled on an enzyme (chymosin) produced by a genetically modified bacteria, and used to clot milk in cheese production. Chymosin will be used to replace rennet, a GRAS enzyme extracted from the forestomachs of cattle. The manufacturers of chymosin sought a formal affirmation of the GRAS status of this enzyme. After reviewing the structure, function, and purity of the enzyme, and published information, FDA affirmed GRAS status for chymosin (4).

FDA Regulation of Biotechnology-Derived Animal Drugs

All new animal drugs, whether administered directly to livestock or added to their feed, are required to receive premarket approval. Thus, biotechnology-derived drugs

will undergo a premarket evaluation similar to that required for their traditionally developed counterparts. There is no difficulty in interpreting FDCA with respect to these products.

Transgenic crops used to feed livestock will face many of the same ambiguities as transgenic crops used as human food as discussed above. Transgenic animals that produce human or animal drugs may also raise questions concerning the safety of food products produced from these animals.

FSIS Regulation of Biotechnology-Derived Meat and Poultry Products

FSIS will regulate biotechnology in meat and poultry products. Food additives produced by fermentation using genetically engineered organisms and added to the meat, and genetically engineered meat starter cultures are classified as GRAS or food additives and are regulated as such. FDA is the agency responsible for approving the safety of these products and all food additives; FSIS will then consider approval of their use in meat and poultry products. These classes of biotechnology products will be handled in the same way that their conventional counterparts are (i.e., as food additives unless granted GRAS status). FSIS will also enforce the tolerances of biotechnology-produced pesticide and animal drugs in meat and poultry products as established by EPA and FDA.

Application of the Federal Meat Inspection Act and the Federal Poultry Inspection Act to transgenic animals is a little more ambiguous. FSIS is in the process of developing guidelines regarding transgenic animals. They are expected to issue guidelines concerning the slaughter of experimental livestock in which the attempts to insert foreign genes failed. Development of guidelines for transgenic livestock are in the preliminary stages and are not likely to be available any time soon. FSIS has indicated that it regards transgenic animals as new breeds, rather than new species, and thus they are amenable to inspection (1, 13, 15).

EPA Tolerances for Biotechnology-Derived Pesticides

EPA is responsible for establishing pesticide tolerance levels for, or exempting from the requirement of tolerances, any pesticides used in food and feed products. When an application is made under FIFRA to register a pesticide that will be used on agricultural commodities

marketed as food or feed, the applicant must also submit to EPA a petition proposing either the issuance of a regulation establishing a tolerance or an exemption of the pesticide from the requirement of a tolerance as required by FDCA (21 U.S. C. 346a). The trigger for establishing a pesticide tolerance for biotechnology products will be whether or not the biotechnology product is classified as a pesticide under FIFRA and has food or feed uses. Thus, EPA's role in food safety issues involving biotechnology products hinges on its interpretation of FIFRA with respect to these products (see ch. 7).

Responsibility for Transgenic Finfish and Shellfish

Finfish and shellfish have been identified that produce toxins highly poisonous to humans. Additionally, several species of seafood consumed by humans are known to concentrate environmental toxins and microbial toxins that may pose food safety risks to humans. At present it is not known how genetic engineering might affect these characteristics. Fish and seafood consumption in the United States has increased significantly, and transgenic finfish and shellfish are in varying stages of development. The FDA Office of Seafood has claimed food safety responsibility for transgenic fish and seafood products.

INTERNATIONAL COORDINATION

Because food is internationally traded and several nations are developing the capability of producing biotechnology-derived foods, there is a need to develop acceptable international standards for these food products. Several European countries as well as Canada and Japan are developing regulatory guidelines for the safety assessment of foods produced with biotechnology. Additionally, international organizations such as the Food and Agricultural Organization (FAO), the World Health Organization (WHO), and the Organization for Economic Cooperation (OECD) among others, are exploring the issues involved. The FAO and the WHO jointly consulted on the issue of food safety. They stated that any food safety assessment of biotechnology-derived foods should be based on sound scientific principles, that the extent of the evaluation should be based on potential risks, and that the evaluation should be multidisciplinary and include all steps in the production process.

Building on the FAO-WHO approach, the OECD, a group of industrial nations including Europe, the United States, Canada, Japan, Australia, and New Zealand, has

established various working groups to discuss issues surrounding the development of products produced with biotechnology. With respect to food safety, OECD has established a group of international experts in the area of biotechnology safety to address issues related to food safety. Issues to be addressed include:

1. the scientific principles that underlie the definition of a new food or food component,
2. identification of methods to distinguish between new foods or food components and their conventional counterparts,
3. establishing whether conventional food and food components and their associated safety judgments are good benchmarks for assessing the safety of new foods or food components,
4. determining methods for establishing the substantial equivalence of the new foods or food components as compared to their conventional counterparts, and
5. identifying methods to establish the safety of new foods or food components when there are no conventional counterparts.

It is hoped that these and other international groups can both develop principals that are acceptable for new biotechnology products and help harmonize international regulations to facilitate international trade of biotechnology products. Preliminary FDA policy is consistent with the concept of substantial equivalence of new foods discussed in the OECD working papers and with the safety assessment procedures discussed in the FAO-WHO reports.

CHAPTER 10 REFERENCES

1. Crawford, Lester M. and Clark, Denise L., "Biotechnology and Food Safety," Agricultural Biotechnology, Food Safety and Nutritional Quality for the Consumer, National Agricultural Biotechnology Council Report 2, 1990, pp. 161-166.
2. Degnan, Frederick H., "An Introduction to FDA Advisory Committees," *Food Drug Cosmetic Law Journal*, vol. 45 (1990), pp. 709-716.
3. Environmental Defense Fund, "Mutable Harvest," 1991.
4. Flamm, Eric L., "How FDA Approved Chymosin: A Case History," *Biotechnology* vol. 9, April 1991, pp. 349-351.
5. Food and Drug Administration, "Statement of Policy: Foods Derived From New Plant Varieties; Notice," *Federal Register*. 57,22984-23005, 1992.
6. Food Chemical News, Dec. 24, 1990, p. 10.

7. Frank, Steven W., "Food Additive Models for the Regulation of Recombinant DNA Technology Under the Federal Food, Drug, and Cosmetic Act," *Food Drug Cosmetic Law Journal*, vol. 45, 1990, pp. 169–202.
8. International Food Biotechnology Council, **Biotechnologies and Food: Assuring the Safety of Foods Produced by Genetic Modification**, 1990.
9. Jones, Daniel D. and Maryanski, James H., "Safety Considerations in the Evaluation of **Transgenic** Plants for Human Food," *Risk Assessment in Genetic Engineering*, Morris A. Levin and Harlee S. Strauss (eds.) (New York, NY: McGraw-Hill, Inc., 1991, pp. 64-82.
10. Lakshmanan, Joseph L., "Nontechnical Representation on the FDA's Advisory Committees: Can There Be More," *Food Drug Cosmetic Law Journal*, vol. 44, 1989, pp. 181–194.
11. Miller, Roger W., "Get Hooked on Seafood Safety," *FDA Consumer*, June 1991.
12. Munro, Ian, **Pariza**, Michael, and Stewart, Kent, 'Scientific Information and Methodologies for Assessing the Safety of Genetically Modified Foods and Feeds, commissioned background paper prepared for the Office of Technology Assessment, 1991.
13. Norcross, M. et al., USDA, **FSIS**, "Food Safety of Animals Produced by Biotechnology," 1990.
14. Office of Science and Technology Policy, Coordinated Framework for Regulation of Biotechnology, Federal Register, 51, 23302, 1986.
15. Regulatory Information for Food Safety, **FSIS** Handout, 1989.
16. Shapiro, Sidney A., "Administrative Conference of the United States: Biotechnology and the Design of Regulation," Administrative Conference of the United States, 1989.
17. U.S. Congress, General Accounting Office, "Food Safety and Quality: Who Does What in the Federal Government, **RCED-91-19B**, December 1990.
18. U.S. Environmental Protection Agency, "General Information on Applying for Registration of Pesticides in the United States," USEPA, Office of Pesticide Programs, June 1989.