Food and Drug Administration
Pesticide Program
Residue Monitoring 2003

Table of Contents

Figures

Tables

This document is the seventeenth annual report summarizing the results of the Food and Drug Administration's (FDA) pesticide residue monitoring program. Eight of the sixteen previous reports were published in the *Journal of the Association of Official Analytical Chemists/Journal of AOAC International*; these presented results from Fiscal Years (FY) 1987 through 1994. Results from FY 1995 through FY 2002 were published on FDA's World Wide Web site. This report includes findings obtained during FY 2003 (October 1, 2002 through September 30, 2003) under regulatory and incidence/level monitoring. Selected Total Diet Study findings for 2003 are also presented. Results in this and earlier reports continue to demonstrate that levels of pesticide residues in the U.S. food supply are well below established safety standards.

FDA Monitoring Program

Three federal government agencies share responsibility for the regulation of pesticides. The Environmental Protection Agency (EPA) registers (*i.e.*, approves) the use of pesticides and sets tolerances (the maximum amounts of residues that are permitted in or on a food) if use of a particular pesticide may result in residues in or on food (1). Except for meat, poultry, and certain egg products, for which the Food Safety and Inspection Service (FSIS) of the U.S. Department of Agriculture (USDA) is responsible, FDA is charged with enforcing tolerances in imported foods and in domestic foods shipped in interstate commerce. FDA also acquires incidence/level data on particular commodity/pesticide combinations and carries out its market basket survey, the Total Diet Study. Since 1991, USDA's Agricultural Marketing Service (AMS), through contracts with participating states, has carried out a residue testing program directed at raw agricultural products and various processed foods. FSIS and AMS report their pesticide residue data independently.

Regulatory Monitoring

FDA samples individual lots of domestically produced and imported foods and analyzes them for pesticide residues to enforce the tolerances set by EPA. Domestic samples are collected as close as possible to the point of production in the distribution system; import samples are collected at the point of entry into U.S. commerce. Emphasis is on the raw agricultural product, which is analyzed as the unwashed, whole (unpeeled), raw commodity. Processed foods are also included. If illegal residues (above EPA tolerance or no tolerance for a given food/pesticide combination) are found in domestic samples, FDA can invoke various sanctions, such as a seizure or injunction. For imports, shipments may be stopped at the port of entry when illegal residues are found. "Detention without physical examination" (previously called automatic detention) may be invoked for imports based on the finding of one violative shipment if there is reason to believe that the same situation will exist in future lots during the same shipping season for a specific shipper, grower, geographic area, or country.

Factors considered by FDA in planning the types and numbers of samples to collect include review of recently generated state and FDA residue data, regional intelligence on pesticide use, dietary importance of the food, information on the amount of domestic food that enters interstate commerce and of imported food, chemical characteristics and toxicity of the pesticide, and production volume/pesticide usage patterns.

Analytical Methods

To analyze the large numbers of samples whose pesticide treatment history is usually unknown, FDA uses analytical methods capable of simultaneously determining a number of pesticide residues. These multiresidue methods (MRMs) can determine about half of the approximately 400 pesticides with EPA tolerances, and many others that have no tolerances. The most commonly used MRMs can also detect many metabolites, impurities, and alteration products of pesticides (2).

Single residue methods (SRMs) or selective MRMs are used to determine some pesticide residues in foods (2). An SRM usually determines one pesticide; a selective MRM measures a relatively small number of chemically related pesticides. This type of methods is usually more resource-intensive per residue. Therefore, SRMs are much less cost effective than MRMs.

The lower limit of residue measurement in FDA's determination of a specific pesticide is usually well below tolerance levels, which generally range from 0.1 to 50 parts per million (ppm). Residues present at 0.01 ppm and above are usually measurable; however, for individual pesticides, this limit may range from 0.005 to 1 ppm. In this report, the term "trace" is used to indicate residues detected, but at levels below the limit of quantitation (LOQ).

FDA/State Cooperation

FDA field offices interact with their counterparts in many states to increase FDA's effectiveness in pesticide residue monitoring. Memoranda of Understanding or more formal Partnership Agreements have been established between FDA and various state agencies. These agreements provide for more efficient monitoring by broadening coverage and eliminating duplication of effort, thereby maximizing federal and state resources allocated for pesticide activities. These arrangements vary from data sharing, joint planning, and state collection of samples for FDA examination, to FDA/State division of collection, analytical, and enforcement follow-up responsibilities for individual commodities or products of particular origin (*i.e.*, imported *vs.* domestic products).

Animal Feeds

In addition to monitoring foods for human consumption, FDA also samples and analyzes domestic and imported feeds for pesticide residues. FDA's Center for Veterinary Medicine (CVM) directs this portion of the Agency's monitoring via its Feed Contaminants Compliance Program. Although animal feeds containing violative pesticide residues may present a potential hazard to a number of different categories of animals (*e.g.*, laboratory animals, pets, wildlife, etc.), CVM's monitoring focuses on feeds for livestock and poultry, animals that ultimately become or produce foods for human consumption.

International Activities

FDA participates in several international agreements in an effort to minimize incidents of violative residues and to remove trade barriers. A standing request for information from foreign governments on pesticides used on their food exported to the U.S. exists, a provision of the Pesticide Monitoring Improvements Act.

FDA continues to collaborate with the New Zealand Food Safety Authority to implement the Residue Compliance Assurance Program. New Zealand, historically having excellent compliance with U.S. pesticide tolerances, is implementing the Program, whereby its government would provide assurances that selected commodities exported to the U.S. by the exporters covered under the Program would be in full compliance with U.S. tolerances.

FDA collaborates with the government of Spain to assure the prevention of exports to the U.S. of Spanish clementines and other mandarins containing illegal pesticide residues.

FDA and the Canadian Food Inspection Agency (CFIA) implemented the Action Plan on Food Safety in 2000. The Action Plan expanded to the area of pesticide residues in food in 2002. The intent of the Action Plan on pesticide residues is to facilitate entry of the selected fresh produce from growers/shippers/responsible parties identified by CFIA as being in compliance with U.S. tolerances.

Under the auspices of the North American Free Trade Agreement (NAFTA), the U.S., Mexico, and Canada have established a NAFTA Technical Working Group on Pesticides (TWG). The TWG reports directly to the NAFTA Sanitary and Phytosanitary Committee. One of the major goals of the TWG is to ensure that pesticide registrations and tolerances/maximum residue limits in the three countries are harmonized to the extent practical, while strengthening protection of public health and the environment. A number of projects has been undertaken by the TWG to identify differing residue limits in the NAFTA countries and to determine what steps might be taken to harmonize the limits. While this process is difficult, the TWG envisions eventual movement toward a "North America" pesticide registration and tolerance system so that citizens of all three countries can be assured of the safety and legality of foods produced in any one of the NAFTA countries.





Incidence/Level Monitoring

FDA's pesticide program includes incidence/level monitoring to complement regulatory monitoring. This approach increases FDA's knowledge about particular pesticide/commodity combinations. This information is acquired by analyses of randomly selected samples to determine the presence and levels of selected pesticides. In 2003, FDA issued a special assignment, to determine incidences and levels of certain pesticides in ginseng dietary supplements.

Total Diet Study

The Total Diet Study is the other major element of FDA's pesticide residue monitoring program (3). In its previous annual pesticide reports, FDA provided Total Diet Study findings for 1987-2002 (4a, 4b). More detailed information, including estimated dietary intakes of pesticide residues covering June 1984-April 1986 (5) and July 1986-April 1991 (6), has been published. In September 1991, FDA implemented revisions to the Total Diet Study that were formulated in 1990 (7). These revisions primarily consisted of collection and analysis of an updated and expanded number of food items, addition of six age/sex groups (for a total of 14), and revised analytical coverage. Details of that revision are published (8, 9).

In conducting the Total Diet Study, FDA personnel purchase foods from supermarkets or grocery stores four times per year, once from each of four geographic regions of the country. The 285 foods that comprise each of the 4 market baskets represent over 3,500 different foods reported in USDA food consumption surveys; for example, apple pie represents all fruit pies and fruit pastries. Each market basket is a composite of like foods purchased in three cities in a given region. The foods are prepared table-ready and then analyzed for pesticide residues (as well as radionuclides, industrial chemicals, toxic elements, trace and macro elements, and folic acid). The levels of pesticides found are used in conjunction with USDA food consumption data to estimate the dietary intakes of the pesticide residues.

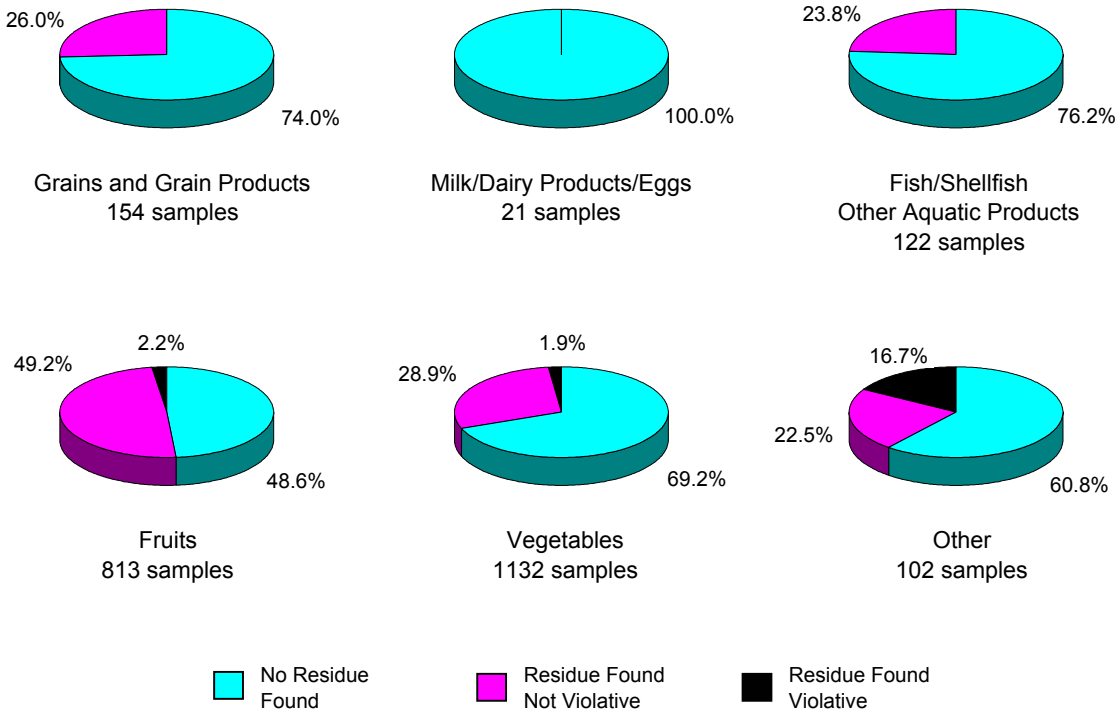
Results and Discussion

Regulatory Monitoring

Under regulatory monitoring, 7,234 samples were analyzed. Of these 2,344 were domestic and 4,890 were imports.

Figure 1 shows the percentage of the 2,344 domestic samples by commodity group with no residues found, nonviolative residues found, and violative residues found. (A violative residue is defined in this report as a residue which exceeds a tolerance or a residue at a level of regulatory significance for which no tolerance has been established in the sampled food.)

Figure 1. Summary of Results of Domestic Samples by Commodity



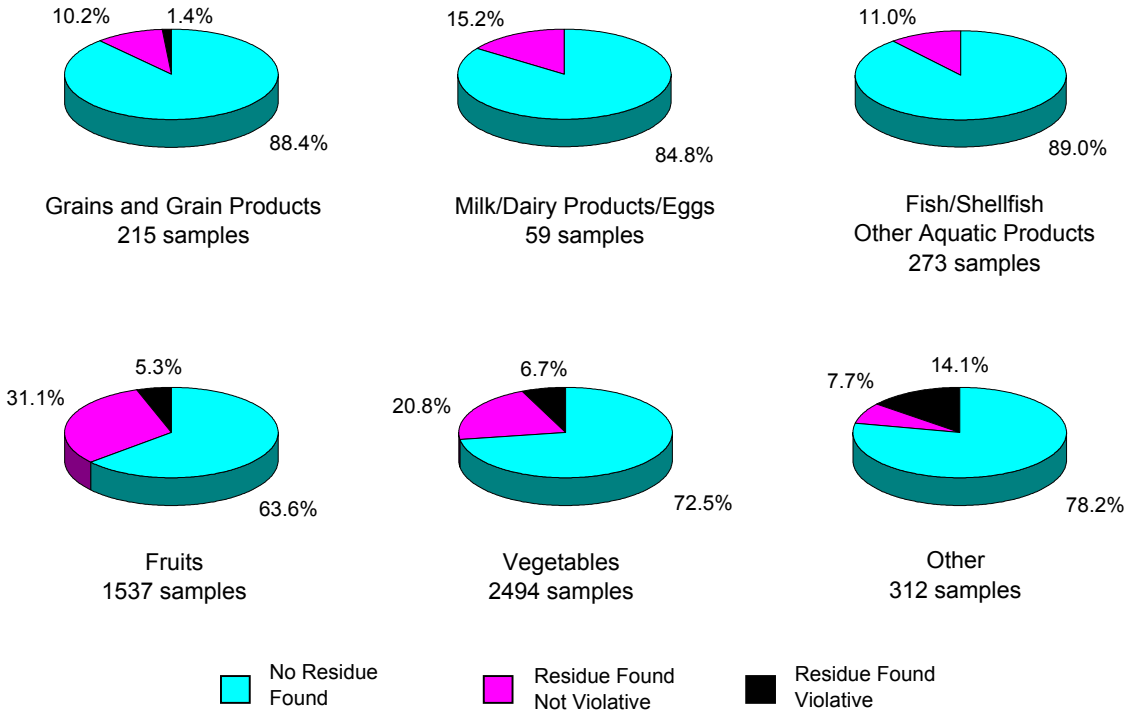
As in earlier years, fruits and vegetables accounted for the largest proportion of the commodities analyzed in 2003; those two commodity groups comprised 83.0% of the total number of domestic samples. In 2003, no violative residues were found in 97.6% of all domestic samples (99.1% in 1996, 98.8% in 1997, 99.2 % in 1998, 99.2% in 1999, 99.3% in 2000, 98.9% in 2001, 99.2% in 2002).

Appendix A contains more detailed data on domestic monitoring findings by commodity, including the total number of samples analyzed, the percent samples with no residues found, and the percent violative samples. Of the 2,344 domestic samples, 62.6% had no detectable residues and 2.4% had violative residues. In the largest commodity groups, fruits and vegetables, 48.6% and 69.2% of the samples, respectively, had no residues detected; 2.2% of the fruit samples and 1.9% of the vegetable samples contained violative residues (Figure 1). In the grains and grain products group, 74.0% of the samples had no residues detected, and none had violative residues. In the fish/shellfish/other aquatic products group, 76.2% had no detectable residues, and no violative residues were found. In the milk/dairy products/eggs group, all of the samples had no residues detected, violative or not violative. Six samples of baby foods or formula were analyzed (see category Other). None of the samples had violative residues.

Findings by commodity group for the 4,890 import samples are shown in Figure 2. Fruits and vegetables accounted for 82.4% of these samples. Overall, no violative residues were found in 94.0% of the import samples (97.4% in 1996, 98.4% in 1997, 97.0% in 1998, 96.9% in 1999, 96.2% in 2000, 95.2% in 2001, 95.7% in 2002).

Appendix B contains detailed data on the import samples. Of the 4,890 samples analyzed, 71.8% had no residues detected, and 6.0% had violative residues. Fruits and vegetables had 63.6% and 72.5%, respectively, with no residues detected. The fruit group and the vegetable group had 5.3% and 6.7%, respectively, with violative residues. No residues were found in 84.8% of the milk/dairy products/eggs group and in 89.0% of the fish/shellfish group, and no violative residues were found in either of those groups. In the grains and grain products group, 88.4% had no detectable residues, and 1.4% had violative residues.

Figure 2. Summary of Results of Import Samples by Commodity



Pesticide monitoring data collected under FDA's regulatory monitoring approach in 2003 are available to the public as a computer database. This database summarizes FDA 2003 regulatory monitoring coverage and findings by country/commodity/pesticide combination. The database also includes the monitoring data by individual sample from which the summary information was compiled. Information on how to obtain this database as well as those for 1992–2002 is provided at the end of this report.

Geographic Coverage

Domestic. A total of 2,344 domestic samples was collected in 2003 from 45 states (no samples were collected from Alabama, Hawaii, Nevada, Mississippi, or South Dakota) and from Puerto Rico. The largest numbers of samples were collected from those states that are the largest producers of fruits and vegetables. Table 1 lists numbers of domestic samples from each location, in descending order of numbers of samples.

Import. A total of 4,890 samples representing food shipments from 99 countries was collected. (The origin of some additional samples was unspecified.) Table 2 lists numbers of samples collected from each country. Mexico, as usual, was the source of the largest number of samples, reflecting the volume and diversity of commodities imported from that country, especially during the winter months.

Table 1. Domestic Samples Collected and Analyzed, by State, in 2003*

California	361	Wisconsin	58	Wyoming	30	Maine	14
New York	205	Utah	51	Kansas	29	Vermont	13
Louisiana	204	Texas	50	Rhode Island	27	Nebraska	11
Florida	148	Minnesota	48	Montana	26	New Hampshire	11
Oregon	107	Massachusetts	43	Connecticut	25	North Dakota	10
New Jersey	89	Illinois	41	South Carolina	25	Oklahoma	10
Washington	88	Colorado	39	Iowa	22	Indiana	8
Virginia	80	Maryland	38	New Mexico	18	West Virginia	8
Ohio	66	Idaho	34	Michigan	17	Arkansas	4
Missouri	64	Pennsylvania	34	Delaware	16	Alaska	4
Arizona	62	North Carolina	32	Kentucky	16	Georgia	2
						Tennessee	1

*Other domestic samples: Puerto Rico, 30 samples; no state identified, 25 samples.

Domestic/Import Violation Rate Comparison

In 2003, 2,344 domestic and 4,890 import samples were collected and analyzed. Pesticide residues were detected in 37.3% of the domestic samples and in 28.2% of the import samples. Only 2.4% of the domestic samples and only 6.1% of the import samples were violative. Among grains and grain products, the violation rate was 0.0% domestic *vs.* 1.4% import. No violations were found in the milk/dairy products/eggs group or the fish/shellfish/other aquatic products group among either domestic or import samples. Of domestic fruits, 2.2% were violative; of import fruits, the violation rate was 5.3%. Of vegetables, 1.9% of domestic samples and 6.7% of import samples were violative. In the category "Other" the rates for domestic and import samples were, respectively, 16.7% and 14.1%. Except for this last category, the overall rate of violations is approximately one domestic violation for three import violations. Of the violative samples, nine of the domestic ones and 26 of the import ones contained pesticide residues at levels which exceeded the tolerance for the given chemical in the given commodity. The remainder of the violative samples contained pesticide residues which were not registered in the U.S. for use in the commodities in which they were found; 48 domestic samples and 270 import samples fell in this category.

Table 2. Foreign Countries and Number of Samples Collected and Analyzed in 2003

Mexico	966	Honduras	39
China, Peoples Rep.	377	Jamaica	38
Netherlands	335	Korea, Rep. of (South)	38
Chile	313	France	37
Canada	288	Unspecified	37
Dominican Republic	181	Colombia	36
Spain (inc. Canary Is.)	176	Greece	34
Israel	141	Pakistan	34
Guatemala	126	Iran	33
India	117	Egypt	32
Ecuador	113	South Africa	32
Thailand	111	Taiwan, Republic of	32
Poland	106	El Salvador	22
Costa Rica	103	Australia	21
Peru	102	Japan	20
Italy	92	Trinidad & Tobago	18
Viet-Nam, Rep. of	73	Haiti	16
Philippines	69	Lebanon	16
New Zealand	66	Panama	16
Turkey	66	Indonesia	15
Belgium	55	Myanmar (Burma)	13
Brazil	55	Hungary	12
Argentina	47	Germany, Fed. Rep. of	11

Ten or fewer samples collected from the following:

Algeria
Antigua and Barbuda
Armenia
Austria
Bangladesh
Belize
Bolivia
Bosnia-Hercegovina
Bulgaria
Croatia
Cyprus
Czech Republic
Denmark
Dominica
Estonia
Ethiopia
Faroe Islands
Fiji
Ghana
Hong Kong
Iceland
Ireland
Ivory Coast
Jordan
Kenya
Kuwait
Lithuania
Macedonia
Malaysia
Morrocco
Mozambique
Nicaragua
Nigeria
Norway
Portugal (inc. Azores)
Romania
Russia
Saint Lucia
Saudi Arabia
Singapore
Somalia
Sweden
Switzerland
Syrian Arab Republic
Tonga
Tunisia
Uganda
Ukraine
United Arab Emirates
United Kingdom
Uruguay
Uzbekistan
Venezuela
Yugoslavia

Pesticide Coverage

Table 3 lists the 360 pesticides that were detectable by the methods used; each of the 144 pesticides that were actually found is indicated by an asterisk.

FDA conducts ongoing research to expand the pesticide coverage of its monitoring program. This research includes testing the behavior of new or previously untested pesticides through existing analytical methods, and development of new methods to cover pesticides that cannot be determined by methods currently used by FDA. The research encompasses both U.S.-registered pesticides and foreign-use pesticides that are not registered in the U.S. The list of pesticides detectable for 2003 (Table 3) reflects the addition of a number of pesticides whose recovery through the analytical methods used was demonstrated as a result of ongoing research. Pesticides that were not detectable in previous years are indicated by a dagger.

Animal Feeds

In 2003, 438 domestic and 60 import feed samples were collected and analyzed for residues. Of the 438 domestic feed samples, 303 (69.2%) contained no detectable pesticide residues, and 8 (1.8%) contained residues which exceeded regulatory guidance. Of the 60 import feed samples, 50 (83.3%) contained no detectable pesticide residues, and 3 (5.0%) contained residues which exceeded regulatory guidance (Table 4).

Eight domestic surveillance samples contained 11 residues that exceeded regulatory guidance. Two corn samples from Ohio, collected by the Cincinnati District, contained 0.010 ppm of chlorpyrifos-methyl. One corn sample from Missouri, collected by the Kansas City District, contained 0.086 ppm of chlorpyrifos-methyl. A soybean sample from Kansas, collected by the Kansas City District, contained 0.094 ppm of chlorpyrifos-methyl. One sample of alfalfa hay from Colorado, collected by the Denver District, contained 0.514 ppm of o-phenylphenol. The EPA has not established a tolerance for chlorpyrifos-methyl on corn or soybeans in 40 CFR 180.419 or for o-phenylphenol on alfalfa in 40 CFR 180.129.

One sample of soybean deodorizer distillate from Iowa, collected by the Kansas City District, contained 0.062 ppm of endosulfan (I + sulfate) and 0.185 ppm of heptachlor epoxide. The EPA has not established a tolerance for endosulfan on soybeans in 40 CFR 180.182. The level of heptachlor epoxide found exceeds an FDA action level [FDA Compliance Policy Guide Sec. 575.100 Pesticide Residues in Food and Feed – Enforcement Criteria (CPG 7141.01)]. The applicable FDA action level for heptachlor epoxide in this sample is likely either 0.03 ppm in processed animal feed or 0.05 ppm in beans (except snap beans).

On January 27, 2003, two corn samples were collected by the Kansas City District from different bins at the same establishment in Kansas. These corn samples contained 26.7 ppm and 11.3 ppm of malathion and 0.642 ppm and 0.249 ppm of methoxychlor, respectively. The malathion levels in the corn samples exceeded the 8 ppm tolerance established by the EPA in 40 CFR 180.111. All pesticide tolerances for methoxychlor in 40 CFR 180.120 were revoked effective October 15, 2002 (Federal Register, July 17, 2002, vol. 67, number 137, pages 46906-46909). Prior to October 15, 2002, the tolerance for methoxychlor on corn was 2 ppm from storage bin treatment.

Three import samples contained 3 residues that exceeded regulatory guidance. A corn sample from Argentina, collected by the San Juan District, contained 1.66 ppm of fenitrothion. A sample of wheat pellets from Sierra Leone, collected by the San Juan District, contained 0.187 ppm of pirimiphos-methyl. A sample of canola fines from Canada, collected by the Seattle District, contained 0.052 ppm of malathion. The EPA has not established a tolerance for fenitrothion on corn in 40 CFR 180.540, for pirimiphos-methyl on wheat in 40 CFR 180.409, or for malathion on canola in 40 CFR 180.111.

In the 135 domestic surveillance and 10 import samples of feed in which one or more pesticides were detected, there were 206 residues (136 quantifiable and 70 trace). Malathion, methoxychlor, diazinon, chlorpyrifos-methyl, and chlorpyrifos were the most frequently found and accounted for 76.7% of all residues detected (Table 5).

Table 3. Pesticides and Industrial Chemicals Detectable and Found (*) by Methods Used in 2003 Regulatory Monitoring[a,b,c]

1,2,3,5-tetrachlorobenzene*†
1,2,4,5-tetrachlorobenzene*†
1-naphthol*
2,3,5,6-tetraachloroaniline*
3,4-dichloroaniline*†
3-chloro-5-methyl-4-nitro-1H-pyrazole
4-(dichloroacetyl)-1-oxa-4-azaspiro[4.5]decane
4(phenylamino)phenol
acephate*
acetochlor
acibenzolar-S-methyl
acrinathrin*
alachlor
aldicarb*
aldrin
allethrin
alpha-cypermethrin
ametryn*
amitraz*
anilazine
Aramite
atrazine
azinphos-ethyl
azinphos-methyl*
azoxystrobin*, (E)- and (Z)-†
benfluralin
benodanil†
benoxacor
bensulide
benzoylprop-ethyl
BHC*
bifenox
bifenthrin*
binapacryl
biphenyl*
bitertanol*†
bromacil
bromophos
bromophos-ethyl
bromopropylate*
bromuconazole†
Bulan
bupirimate*
buprofezin*
butachlor
butralin
butylate
cadusafos*
captafol
captan*
carbaryl*
carbofuran*
carbophenothion
carboxin
carfentrazone ethyl ester
chlorbenside
chlorbromuron
chlorbufam
chlordane*
chlordecone
chlordimeform
chlorethoxyfos
chlorfenapyr†
chlorfenvinphos*
chlorflurecol methyl ester
chlornitrofen
chlorobenzilate
chloroneb*
chloropropylate
chlorothalonil*
chloroxuron
chlorpropham*
chlorpyrifos*
chlorpyrifos-methyl*
chlortetracycline*†
chlorthiophos
clodinafop-propargyl
clomazone*
clopyralid*
cloquintocet-mexyl
coumaphos*
crotoxyphos
crufomate
cyanazine
cyanofenphos†
cyanophos
cycloate
cyfluthrin*
cyhalofop butyl ester
cymoxanil
cypermethrin*
cyprazine
cyproconazole
cyprodinil*
DCPA*
DDT*
deltamethrin*
deltamethrin, trans
demeton
desmetryn†
dialifor
di-allate
diazinon*
diazinon oxygen analog*
dichlobenil*
dichlofenthion
dichlofluanid*
dichlone
dichlormid
dichlorobenzophenone, p,p′-†
dichlorvos*
diclobutrazol
diclofop-methyl
dicloran*
dicofol*
dicrotophos
dieldrin*
diethatyl-ethyl†
diethofencarb*†
difenoconazole*
Dilan
dimethachlor
dimethipin
dimethoate*
dinitramine
dinobuton†
dinocap
dioxabenzofos
dioxathion
diphenylamine*
disulfoton
diuron†
DPX-MP062
edifenphos
endosulfan*
endrin*
EPN
epoxiconazole
EPTC
esfenvalerate*
etaconazole
ethalfluralin
ethephon†
ethiofencarb†
ethion*
ethion oxygen analog*
ethofumesate†
ethoprop*
ethoxyquin*
etofenprox*†
etridiazole
etrimfos
famphur
fenamidone
fenamiphos
fenarimol*
fenbuconazole*
fenhexamid*
fenitrothion*
fenoxaprop ethyl ester
fenpropathrin*
fensulfothion
fenthion
fenvalerate*
fipronil*
flamprop-M-isopropyl†
flamprop-methyl
fluazifop butyl ester
fluazinam
fluchloralin
flucythrinate
fludioxinil*

[a] The list of pesticides detectable is expressed in terms of the parent pesticide. However, monitoring coverage and findings may have included metabolites, impurities, and alteration products.
[b] Some of these pesticides are no longer manufactured or registered for use in the United States.
[c] Chemicals indicated by a dagger (†) were not looked for by methods used in previous years.

Table 3 (continued)

flufenacet
fluridone*†
flusilazole*
flutolanil*†
fluvalinate*
folpet*
fonofos
formothion†
fosthiazate†
fuberidazole†
furilazole†
Gardona
heptachlor*
hexachlorobenzene*
hexaconazole
hexazinone†
hexythiazox
imazalil*
imazamethabenz methyl ester
iprobenfos
iprodione*
isazofos
isocarbamid†
isofenphos
isopropalin
isoprothiolane*
isoxaflutole
kresoxim-methyl*
lactofen
lambda-cyhalothrin*
leptophos
lindane*
linuron*
malathion*
malathion oxygen analog*
mecarbam
mephosfolan
merphos
metalaxyl*
metaldehyde*
metasystox thiol
metazachlor
methabenzthiazuron†
methamidophos*
methidathion*
methiocarb*
methomyl*
methoprotryne
methoxychlor*
metobromuron
metolachlor
metribuzin
mevinphos*
MGK 264
mirex*
molinate
monocrotophos*
monolinuron
myclobutanil*
naled
N-desmethyl flucarbazone
neburon†
nitralin
nitrapyrin
nitrofen
nitrofluorfen
nitrothal-isopropyl†
norflurazon
nuarimol
octhilinone
ofurace†
omethoate*
ovex
oxadiazon
oxadixyl*
oxamyl*
oxydemeton-methyl
oxyfluorfen
oxythioquinox
paclobutrazol†
parathion*
parathion-methyl*
pebulate
penconazole*
pendimethalin
pentachlorobenzene*
pentachlorobenzonitrile*
pentachlorophenyl methyl ether*
permethrin*
Perthane
phenmedipham†
phenothrin†
phenthoate*
phenylphenol, ortho-*
phorate
phosalone*
phosmet*
phosphamidon*
phoxim
piperonyl butoxide*
piperophos
pirimicarb*
pirimiphos-ethyl
pirimiphos-methyl*
pretilachlor
prochloraz*
procymidone*
profenofos*
profluralin
Prolan
prometryn*
pronamide*
propachlor
propanil
propargite*
propazine
propetamphos
propham
propiconazole*
prothiofos*
prothoate
pyracarbolid*†
pyraclostrobin
pyrazon
pyrazophos
pyrethrins*
pyridaben*
pyridaphenthion†
pyrimethanil*
pyriproxyfen*
quinalphos*
quinoxyfen
quintozene*
ronnel
S-bioallethrin
schradan†
simazine*
simetryn
Strobane
sulfallate
sulfotep*
Sulphenone
sulprofos
TCMTB
tebuconazole*
tebupirimfos
tebuthiuron†
tecnazene*
tefluthrin
TEPP†
terbacil
terbufos
terbuthylazine
terbutryn
tetradifon*
tetraiodoethylene
tetramethrin*†
tetrasul
thiabendazole*
thiamethoxam
thiazopyr
thiobencarb
thiometon†
thionazin
THPI*
tolylfluanid*
toxaphene
tralomethrin
traloxydim†
triadimefon*
triadimenol*
tri-allate
triazamate†
triazophos*
tribufos
trichlorfon
tricyclazole
tridiphane
trietazine
triflumizole
trifluralin*
triflusulfuron methyl ester†
tris(2-butoxyethyl) phosphate*
tris(β-chloroethyl) phosphate*†
vamidothion sulfone†
vernolate
vinclozolin*
zoxamide

Table 4. Summary of 2003 Domestic and Import Feed Samples

Type of Feed	Total # Samples	Without residues #	Without residues %	Exceeding Guidance #	Exceeding Guidance %
Whole/Ground Grains	224	165	73.7	8	3.6
Plant By-products	121	83	68.6	2	1.7
Mixed Feed Rations	55	35	63.6	0	0.0
Animal By-products	36	26	72.2	0	0.0
Hay & Hay Products	34	25	73.5	1	2.9
Supplements	28	19	67.9	0	0.0
Total	**498**	**353**	**70.9**	**11**	**2.2**

Table 5. Residues Found in Domestic and Import Feeds in 2003

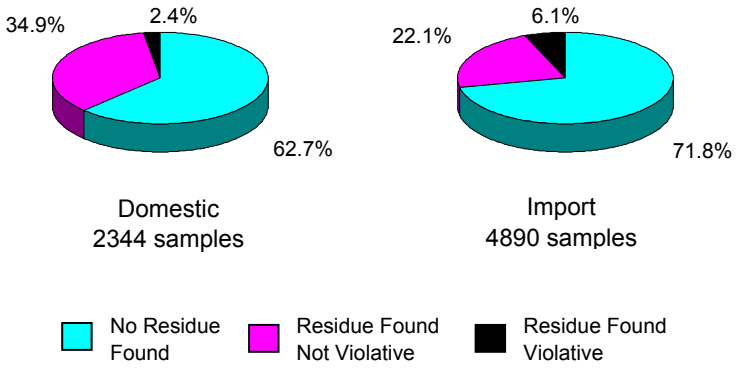
Pesticide	# of Samples with Trace Amount[a]	# of Samples with Quantifiable Levels	Range[b] (ppm)	Median[b] (ppm)
malathion	29	62	0.009 - 26.7	0.103
chlorpyrifos-methyl	8	13	0.009 - 0.560	0.039
methoxychlor (p,p' + o,p')	10	7	0.010 - 0.642	0.062
chlorpyrifos	4	11	0.008 - 0.400	0.018
diazinon	3	11	0.010 - 0.307	0.029
ethoxyquin	0	9	0.103 - 50.0	1.200
pirimiphos-methyl	3	3	0.009 - 0.187	0.031
azoxystrobin	0	3	0.016 - 0.043	0.020
tribufos (DEF)	2	1	0.025	N/A
dieldrin	2	1	0.277	N/A
endosulfan (I + sulfate)	1	2	0.062-0.067	N/A
ethion	1	1	0.008	N/A
heptachlor epoxide	1	1	0.185	N/A
lambda-cyhalothrin	0	2	0.023-0.059	N/A
all others[c]	6	9	0.012 - 1.660	0.041

[a] Residue found is below that normally quantifiable, but its presence and identity are known.
[b] In samples containing quantifiable levels.
[c] n=1 for the following: β-BHC (0.036 ppm), bifenthrin (trace), carbaryl (0.058 ppm), chlorpropham (0.025 ppm), cyprodinil (0.012 ppm), diphenylamine (trace), fenitrothion (1.66 ppm), iprodione (0.370 ppm), lindane (trace), octrachlor epoxide (trace), parathioin-methyl (0.013 ppm), PCB (trace), permethrin (0.041 ppm), o-phenylphenol (0.514 ppm), and TDE (p,p′-) (trace).

Summary: Regulatory Monitoring

No residues were found in 62.7% of domestic and in 71.8% of import samples (Figure 3) analyzed under FDA's regulatory monitoring approach in 2003. Only 2.4% of domestic and 6.1% of import samples had residue levels that were violative. The findings for 2003 demonstrate that pesticide residue levels in foods are generally well below EPA tolerances, corroborating results presented in earlier reports (4a, 4b). Animal feed samples (438 domestic, 60 import) were analyzed. No residues were found in 69.2% of the domestic samples and in 83.3% of the import samples.

Figure 3. Summary of Results of Domestic vs. Import Samples



Incidence / Level Monitoring

Special Surveys

Ginseng Dietary Supplements. Ginseng is one of the most widely consumed herbal products. Information available to FDA suggested that ginseng-containing dietary supplements may contain unlawful pesticide residues. In FY 2003, FDA issued a special assignment to determine incidences and levels of pesticide residues and to take appropriate regulatory action against ginseng products that contain unlawful pesticide residues. The survey focuses on Panax species of ginseng, Asian ginseng (*Panax ginseng*) and American ginseng (*Panax quinquifolius L).*

The goal was to collect 60 samples of imported bulk ginseng from the major export countries and 83 samples of ginseng dietary supplements sold in the U.S.

Summary: Incidence / Level Monitoring

The study is expected to be completed in FY 2004.

Total Diet Study

The Total Diet Study (TDS) is distinct from regulatory monitoring in that it determines pesticide residues in foods prepared for consumption (3). To measure the low levels of residues found in the TDS foods, the analytical methods used are modified to permit measurement at levels 5-10 times lower than those normally used in regulatory monitoring. In general, residues present at or above 1 part per billion can be measured. Of the over 300 chemicals that can be determined for the analytical methods used, 118 individual residues were found in the foods analyzed in the four market baskets reported here (Market Baskets 02-4, 03-1, 03-2, and 03-3). Among these were 73 pesticides, including 15 which represent more than one related compound counted as a "total", 20 volatile organic compounds for which 285 TDS foods per basket are now being examined, and 13 other organic compounds.

Table 6 lists the 35 most frequently found residues (those found in >2% of the samples), the total number of findings, and the percent occurrence in the four market baskets analyzed in 2003 (285 food items). The five most frequently observed chemicals, DDT, malathion, endosulfan, dieldrin, and chlorpyrifos-methyl, are the same as those observed for the past several years. The levels of these and residues, as well as the others listed in Table 6, are well below regulatory limits.

Information obtained through the TDS is used to estimate dietary intakes of pesticides which are then compared with established standards. Dietary intakes based on TDS samples collected through mid-1991 have been published previously. (5, 6)

For several years, FDA has collected and analyzed a number of baby foods in addition to those covered under TDS. Table 7 lists the 21 pesticide residues found in four collections of these foods (93 samples total) in 2003, the percentage occurrence, and ranges of levels found.

Summary: Total Diet Study

In 2003, the types of pesticide residues found and their frequency of occurrence in TDS were generally consistent with those given in previous FDA reports (4a, 4b). The pesticide residue levels found were well below regulatory standards. An adjunct survey of baby foods in 1991-2003 also provided evidence of only small amounts of pesticide residues in those foods.

Table 6. Frequency of Occurrence of Pesticide Residues Found in Total Diet Study Foods in 2003[a]

Pesticide[b]	Total No. of Findings	Occurrence, %	Range, ppm
DDT	123	12	0.0001-0.171
malathion	71	7	0.0006-0.121
endosulfan	70	7	0.0001-0.116
dieldrin	64	6	0.0001-0.0141
chlorpyrifos-methyl	63	6	0.0005-0.092
chlorpyrifos	50	5	0.0002-0.110
chlorpropham	33	3	0.0007-2.627
permethrin	31	3	0.0008-4.713
thiabendazole[c]	27	3	0.001-2.105
o-phenylphenol	21	2	0.006-1.266
carbaryl[d]	20	2	0.003-0.190
dicloran	20	2	0.0002-4.4179
methamidophos	19	2	0.0002-0.123
quintozene	19	2	0.00002-0.0095
diazinon	19	2	0.0002-0.043
pirimiphos-methyl	18	2	0.0004-0.1347
acephate	16	2	0.0007-0.459
lindane	16	2	0.0001-0.007

[a] Based on 4 market baskets analyzed in 2003 consisting of 1039 total items. Only those found in >2% of the samples are shown.

[b] Isomers, metabolites, and related compounds are included with the "parent" pesticide from which they arise.

[c] Reflects overall incidence; however, only 67-79 selected foods per market basket (*i.e.*, 304 items total) were analyzed for the benzimidazole fungicides.

[d] Reflects overall incidence; however, only 93-97 selected foods per market basket (*i.e.*, 384 items total) were analyzed for N- methylcarbamates.

Table 7. Frequency of Occurrence of Pesticide Residues Found in Selected Baby Foods in 2003[a]

Pesticide[b]	Total No. of Findings	Occurrence, %	Range, ppm
thiabendazole[c]	9	10	0.001-0.102
captan + THPI	8	9	0.009-0.149
endosullfan	8	9	0.0001-0.0054
diphenylamine	8	9	0.002-0.050
carbaryl[d]	6	6	0.001-0.030
DDT	6	6	0.0001-0.0007
ethylenethiourea[e]	5	5	0.003-0.008
dimethoate	4	4	0.0005-0.019
permethrin	4	4	0.0013-0.075
dieldrin	3	3	0.0001
malathion	3	3	0.001-0.033
chlorpropham	2	2	0.005-0.013
biphenyl	2	2	0.002
phosmet	2	2	0.003-0.004
benomyl[c]	2	2	0.032-0.052
acephate	2	2	0.003-0.006
chlorpyrifos-methyl	2	2	0.0187-0.024
fenvalerate	2	2	0.003-0.005
chlorpyrifos	2	2	0.0002-0.0011
fenpropathrin	1	1	0.035
hexachlorobenzene	1	1	0.0009

[a] Based on 4 market baskets consisting of 93 total items.

[b] Isomers, metabolites, and related compounds are included with the "parent" pesticide from which they arise.

[c] Reflects overall incidence; however, only 13-16 selected foods per collection (*i.e.*, 60 items total) were analyzed for benzimidazole fungicides (thiabendazole and benomyl).

[d] Reflects overall incidence; however, only 13-17 selected foods per collection (*i.e.*, 63 items total) were analyzed for N- methylcarbamates.

[e] Reflects overall incidence; however, only 12-17 selected foods per collection (*i.e.*, 62 items total) were analyzed for ethylenethiourea.

Summary

A total of 7,234 samples of domestically produced food and imported food from 99 countries was analyzed for pesticide residues in 2003. No residues were found in 62.7% of domestic and in 71.8% of import samples. FDA collected and analyzed animal feed samples (438 domestic, 60 import) for pesticides. No residues were found in 69.2% of the domestic feed samples and in 83.3% of the import feed samples. Total Diet Study findings for 2003 were generally similar to those found in earlier periods; details of findings will be published separately.

This report was compiled through the efforts of the following FDA personnel: Center for Food Safety and Applied Nutrition, Washington, DC: Office of Plant and Dairy Foods: Carolyn M. Makovi, Mark S. Wirtz, Young H. Lee, Alexander J. Krynitsky, and Stephen G. Capar, Division of Pesticides and Industrial Chemicals; Office of Management Systems: Sharon A. Macuci, Division of Information Resources Management; Center for Veterinary Medicine, Rockville, MD: Randall Lovell; Kansas City District, Lenexa, KS: Chris A. Sack.

The database containing the data from which this report was derived is also available from FDA's World Wide Web site, at http://www.cfsan.fda.gov. The 1996 through 2002 reports and databases are available at the same site. FDA pesticide monitoring data collected under the regulatory monitoring approach in 1992, 1993, 1994, and 1995 are available for purchase on personal computer diskettes from the National Technical Information Service (NTIS), 5285 Port Royal Road, Springfield, VA 22161 (telephone 1-800-553-6847); or from NTIS's website at http://www.ntis.gov. Order numbers are: 1992, PB94-500899; 1993, PB94-501681; 1994, PB95-503132; and 1995, PB96-503156.

References

(1) Code of Federal Regulations (2003) Title 40, U.S. Government Printing Office, Washington, DC, Parts 180, 185, and 186.

(2) Pesticide Analytical Manual Volume I (3rd Ed., 1994 and subsequent revisions), available from FDA's World Wide Web site at http://www.cfsan.fda.gov, and Volume II (1971 and subsequent revisions), available from National Technical Information Service, Springfield, VA 22161. Food and Drug Administration, Washington, DC.

(3) Pennington, J.A.T., Capar, S.G., Parfitt, C.H., & Edwards, C.W. (1996) History of the Food and Drug Administration's Total Diet Study (Part II), 1987-1993. *J. AOAC Int.* **79**, 163-170.

(4a) Food and Drug Administration (1995) Food and Drug Administration pesticide program - residue monitoring - 1994. *J. AOAC Int.* **78**, 117A-143A (and earlier reports in the series).

(4b) Food and Drug Administration (1996) Food and Drug Administration pesticide program - residue monitoring - 1995, 2002 (and earlier reports in the series). Available from FDA's World Wide Web site at http://www.cfsan.fda.gov.

(5) Gunderson, E.L. (1995) Dietary intakes of pesticides, selected elements, and other chemicals: FDA Total Diet Study, June 1984-April 1986. *J. AOAC Int.* **78**, 910-921.

(6) Gunderson, E.L. (1995) FDA Total Diet Study, July 1986-April 1991, dietary intakes of pesticides, selected elements, and other chemicals. *J. AOAC Int.* **78**, 1353-1363.

(7) Pennington, J.A.T. (1992) Total Diet Studies: the identification of core foods in the United States food supply. *Food Addit. Contam.* **9**, 253-264.

(8) Pennington, J.A.T. (1992) The 1990 revision of the FDA Total Diet Study. *J. Nutr. Educ.* **24**, 173-178.

(9) Pennington, J.A.T. (1992) Appendices for the 1990 revision of the Food and Drug Administration's Total Diet Study. PB92-176239/AS, National Technical Information Service, Springfield, VA 22161.

Appendix A. Analysis of Domestic Samples by Commodity Group in 2003

Commodity Group	Total Samples	Samples without Residues, %	Samples Violative[a], %	# over tolerance	# no tolerance
A. Grains and Grain Products					
Barley & barley products	11	72.7	0.0		
Corn & corn products	24	83.3	0.0		
Oats & oat products	6	50.0	0.0		
Rice & rice products	22	81.8	0.0		
Soybeans & soybean products	1	0.0	0.0		
Wheat & wheat products	69	68.1	0.0		
Other grains & grain products	1	100.0	0.0		
Breakfast cereals	19	89.5	0.0		
Bakery products, crackers, etc.	1	0.0	0.0		
Total	**154**	**74.0**	**0.0**	**0**	**0**
B. Milk/Dairy Products/Eggs					
Butter	1	100.0	0.0		
Cheese & cheese products	5	100.0	0.0		
Eggs	6	100.0	0.0		
Milk/cream & milk products	9	100.0	0.0		
Total	**21**	**100.0**	**0.0**	**0**	**0**
C. Fish/Shellfish/Other Aquatic Products					
Fish and Fish Products	100	72.0	0.0		
Shellfish & Crustaceans	22	95.5	0.0		
Total	**122**	**76.2**	**0.0**	**0**	**0**
D. Fruits					
Blackberries	8	75.0	0.0		
Blueberries	40	85.0	0.0		
Cranberries	10	50.0	0.0		
Grapes, raisins	28	67.9	0.0		
Raspberries	14	92.9	0.0		
Strawberries	79	44.3	3.8	0	3
Other berries	1	100.0	0.0		
Grapefruit	12	25.0	0.0		
Lemons	13	38.5	0.0		
Oranges	120	30.8	2.5	0	3
Other citrus fruit	6	50.0	0.0		
Apples	183	48.6	1.1	0	2
Pears	43	46.5	0.0		
Apricots	7	14.3	28.6	0	2
Avocadoes	10	100.0	0.0		

[a] Includes samples with residues over tolerance or action level and samples with residues with no tolerance.
[b] Residue in one or more samples exceeded an action level rather than a tolerance.

Appendix A. (continued)

Commodity Group	Total Samples	Samples without Residues, %	Samples Violative[a], %	# over tolerance	# no tolerance
Cherries	18	27.8	16.7	0	3
Nectarines	4	50.0	0.0		
Peaches	95	32.6	2.1	0	2
Plums	10	60.0	20.0	0	2
Bananas, plantains	12	100.0	0.0		
Papaya	5	80.0	0.0		
Pineapple	1	0.0	0.0		
Cantaloupe	22	45.5	0.0		
Watermelon	20	70.0	5.0	0	1
Other melons	6	0.0	0.0		
Other fruits	4	50.0	0.0		
Apple juice	11	90.9	0.0		
Other fruit juices	5	100.0	0.0		
Fruit jams/jellies/pastes/toppings	26	50.0	0.0		
Total	**813**	**48.6**	**2.2**	**0**	**18**
E. Vegetables					
Corn	46	95.7	0.0		
Peas (green/snow/sugar/sweet)	13	100.0	0.0		
String beans (green/snap/pole/long)	61	67.2	3.3	0	2
Other beans & peas & products	60	90.0	0.0		
Cucumbers	44	70.5	6.8	0	3
Eggplant	17	70.6	5.9	0	1
Okra	7	71.4	14.3	0	1
Peppers, hot	5	100.0	0.0		
Peppers, sweet	35	74.3	0.0		
Squash/pumpkins	79	63.3	1.3	1[b]	0
Tomatoes	89	76.4	0.0		
Other fruiting vegetables	2	100.0	0.0		
Artichokes	3	33.3	0.0		
Asparagus	17	82.3	0.0		
Bok choy & Chinese cabbage	3	66.7	0.0		
Broccoli	27	81.5	0.0		
Cabbage	73	80.8	0.0		
Cauliflower	8	87.5	0.0		
Celery	23	8.7	0.0		
Collards	8	62.5	0.0		
Endive	8	50.0	0.0		
Kale	10	40.0	10.0	0	1

[a] Includes samples with residues over tolerance or action level and samples with residues with no tolerance.

[b] Residue in one or more samples exceeded an action level rather than a tolerance.

Appendix A. (continued)

Commodity Group	Total Samples	Samples without Residues, %	Samples Violative[a], %	# over tolerance	# no tolerance
Lettuce, head	18	61.1	0.0		
Lettuce, leaf	49	40.8	6.1	0	3
Mustard greens	6	66.7	0.0		
Radicchio	3	66.7	0.0		
Spinach	22	36.4	4.5	0	1
Other leaf & stem vegetables	38	71.0	13.2	0	5
Mushrooms and Truffles	3	66.7	0.0		
Carrots	56	69.6	0.0		
Onions/leeks/scallions/shallots	64	92.2	0.0		
Potatoes	105	64.8	0.0		
Radishes	6	50.0	0.0		
Red beets	11	63.6	0.0		
Sweet potatoes	35	68.6	0.0		
Turnips	13	30.8	0.0	0	3
Other root & tuber vegetables	29	24.1	10.3		
Vegetables with sauce	3	100.0	0.0		
Vegetables, dried or paste	1	100.0	0.0		
Other vegetables/vegetable products	32	71.9	3.1	0	1
Total	**1132**	**69.2**	**1.9**	**1[b]**	**21**
F. Other					
Cashews	2	100.0	0.0		
Peanuts & peanut products	10	80.0	0.0		
Other nuts & nut products	7	71.4	0.0		
Edible seeds & seed products	2	50.0	0.0		
Vegetable oil, crude	1	100.0	0.0		
Spices & condiments & flavors	4	50.0	0.0		
Beverages & water	1	100.0	0.0		
Coffee/tea/wine	23	30.4	34.8	5[b]	3
Honey & other sweeteners	23	91.3	0.0		
Baby foods/formula	6	66.7	0.0		
Other food products, incl. prepared foods	1	0.0	0.0		
Nonfood items	22	45.5	40.9	3[b]	6
Total	**102**	**60.8**	**16.7**	**8[b]**	**9**
Total A-F	**2,344**	**62.6**	**2.4**	**9[b]**	**48**

[a] Includes samples with residues over tolerance or action level and samples with residues with no tolerance.
[b] Residue in one or more samples exceeded an action level rather than a tolerance.

Appendix B. Analysis of Import Samples by Commodity Group in 2003

Commodity Group	Total Samples	Samples without Residues, %	Samples Violative[a], %	# over tolerance	# no tolerance
A. Grains and Grain Products					
Barley & barley products	9	77.8	0.0		
Corn & corn products	13	69.2	0.0		
Oats & oat products	7	100.0	0.0		
Rice & rice products	44	84.1	2.3	0	1
Wheat & wheat products	15	93.3	6.7	0	1
Other grains & grain products	19	89.5	5.3	0	1
Breakfast cereals	12	91.7	0.0		
Bakery products, crackers, etc.	49	95.9	0.0		
Pasta and noodles	47	87.2	0.0		
Total	**215**	**88.4**	**1.4**	**0**	**3**
B. Milk/Dairy Products/Eggs					
Cheese & cheese products	40	97.5	0.0		
Eggs	14	42.9	0.0		
Milk/cream & milk products	5	100.0	0.0		
Total	**59**	**84.8**	**0.0**	**0**	**0**
C. Fish/Shellfish/Other Aquatic Products					
Fish and Fish Products	225	89.3	0.0		
Shellfish & Crustaceans	44	88.6	0.0		
Other Aquatic Animals & Products	4	75.0	0.0		
Total	**273**	**89.0**	**0.0**	**0**	**0**
D. Fruits					
Blackberries	30	50.0	13.3	0	4
Blueberries	56	78.6	0.0		
Cranberries	6	100.0	0.0		
Grapes, raisins	60	38.3	0.0		
Raspberries	64	54.7	0.0		
Strawberries	80	40.0	15.0	1	11
Other berries	6	83.3	16.7	0	1
Clementines	9	0.0	0.0		
Grapefruit	5	60.0	0.0		
Lemons	9	88.9	0.0		
Limes	3	100.0	0.0		
Oranges	30	86.7	6.7	0	2
Other citrus fruit	3	100.0	0.0		
Apples	62	45.2	0.0		
Pears	51	41.2	7.8	0	4
Other pome fruit	2	50.0	0.0		

[a] Includes samples with residues over tolerance or action level and samples with residues with no tolerance.
[b] Residue in one or more samples exceeded an action level rather than a tolerance.

Appendix B. (continued)

Commodity Group	Total Samples	Samples without Residues, %	Samples Violative[a], %	# over tolerance	# no tolerance
Apricots	22	13.6	63.6	0	14
Avocadoes	34	97.1	0.0		
Cherries	32	46.9	15.6	0	5
Dates	11	90.9	9.1	0	1
Nectarines	11	9.1	0.0		
Olives	41	95.1	0.0		
Peaches	36	44.4	2.8	1	0
Plums	15	33.3	0.0		
Other pit fruit	8	100.0	0.0		
Ackees, lychees, longans	12	66.7	33.3	0	4
Bananas, plantains	146	39.7	0.7	0	1
Breadfruit, jackfruit	11	100.0	0.0		
Figs	3	66.7	33.3	0	1
Guavas	4	50.0	25.0	0	1
Kiwi fruit	7	71.4	14.3	0	1
Mangoes	64	92.2	0.0		
Papaya	70	67.1	10.0	0	7
Pineapple	50	72.0	0.0		
Other sub-tropical fruit	31	93.5	3.2	0	1
Bitter melon	11	54.5	27.3	0	3
Cantaloupe	18	44.4	0.0		
Honeydew	37	46.0	0.0		
Watermelon	15	66.7	0.0		
Other melons	14	78.6	7.1	0	1
Other fruits	13	84.6	7.7	0	1
Apple juice	32	96.9	0.0		
Citrus juice	9	100.0	0.0		
Other fruit juices	67	82.1	3.0	0	2
Fruit jams/jellies/pastes/toppings	237	75.5	6.3	1	14
Total	**1537**	**63.6**	**5.3**	**3**	**79**

E. Vegetables

Corn	25	96.0	0.0		
Mung beans and bean sprouts	21	81.0	0.0		
Peas (green/snow/sugar/sweet)	82	54.9	24.4	0	20
String beans (green/snap/pole/long)	74	52.7	23.0	1	16
Other beans & peas & products	157	71.3	7.0	4[b]	7

[a] Includes samples with residues over tolerance or action level and samples with residues with no tolerance.
[b] Residue in one or more samples exceeded an action level rather than a tolerance.

Appendix B. (continued)

Commodity Group	Total Samples	Samples without Residues, %	Samples Violative[a], %	# over tolerance	# no tolerance
Cucumbers	105	52.4	0.0		
Eggplant	58	93.1	0.0		
Okra	17	88.2	11.8	0	2
Peppers, hot	185	43.8	9.2	0	17
Peppers, sweet	425	78.6	7.1	3	27
Squash/pumpkins	155	50.3	3.2	0	5
Tomatoes	199	76.4	4.5	1	8
Other fruiting vegetables	77	76.6	7.8	2[b]	4
Artichokes	11	90.9	0.0		
Asparagus	72	90.3	1.4	0	1
Bamboo shoots	2	100.0	0.0		
Bok choy & Chinese cabbage	9	66.7	0.0		
Broccoli	45	53.3	0.0		
Cabbage	8	75.0	0.0		
Cauliflower	15	93.3	0.0		
Celery	9	11.1	11.1	0	1
Collards	1	100.0	0.0		
Endive	12	100.0	0.0		
Kale	4	0.0	0.0		
Lettuce, head	9	55.6	11.1	0	1
Lettuce, leaf	6	33.3	16.7	0	1
Mustard greens	5	60.0	20.0	1	0
Radicchio	6	100.0	0.0		
Spinach	17	52.9	5.9	0	1
Other leaf & stem vegetables	125	69.6	19.2	0	24
Mushrooms and Truffles	69	94.2	1.4	0	1
Carrots	24	75.0	4.2	0	1
Cassava	32	100.0	0.0		
Onions/leeks/scallions/shallots	87	86.2	0.0		
Potatoes	58	89.7	0.0		
Radishes	20	75.0	0.0		
Red beets	1	100.0	0.0		
Sweet potatoes	31	83.9	12.9	2	2
Turnips	3	66.7	33.3	0	1
Water chestnuts	9	100.0	0.0		
Other root & tuber vegetables	43	97.7	2.3	1[b]	0
Vegetables with sauce	12	100.0	0.0		
Vegetables, dried or paste	112	80.4	8.9	0	10
Other vegetables/vegetable products	57	87.7	3.5	0	2
Total	**2494**	**72.5**	**6.7**	**15[b]**	**152**

[a] Includes samples with residues over tolerance or action level and samples with residues with no tolerance.
[b] Residue in one or more samples exceeded an action level rather than a tolerance.

Appendix B. (continued)

Commodity Group	Total Samples	Samples without Residues, %	Samples Violative[a], %	# over tolerance	# no tolerance
F. Other					
Cashews	39	97.4	2.6	0	1
Coconut & coconut products	6	83.3	0.0		
Peanuts & peanut products	11	81.8	9.1	0	1
Other nuts & nut products	26	96.2	0.0		
Edible seeds & seed products	35	94.3	5.7	0	2
Vegetable oil, crude	3	100.0	0.0		
Vegetable oil, refined	10	100.0	0.0		
Spices & condiments & flavors	34	70.6	17.6	0	6
Beverages & water	13	92.3	0.0		
Beverage bases	9	88.9	0.0		
Coffee/tea/wine	20	30.0	50.0	4[b]	6
Honey & other sweeteners	39	97.4	2.6	0	1
Baby foods/formula	5	100.0	0.0		
Other food products, incl. prepared foods	15	86.7	13.3	1[b]	1
Nonfood items	47	31.9	44.7	3[b]	18
Total	**312**	**78.2**	**14.1**	**8[b]**	**36**
Total A-F	**4,890**	**71.8**	**6.0**	**26[b]**	**270**

[a] Includes samples with residues over tolerance or action level and samples with residues with no tolerance.
[b] Residue in one or more samples exceeded an action level rather than a tolerance.