# Food and Drug Administration
# Pesticide Program
# Residue Monitoring 2002

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This document is the sixteenth annual report summarizing the results of the Food and Drug Administration's (FDA) pesticide residue monitoring program. Eight of the fifteen 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 2001 were published on FDA's World Wide Web site. This report includes findings obtained during FY 2002 (October 1, 2001 through September 30, 2002) under regulatory and incidence/level monitoring. Selected Total Diet Study findings for 2002 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 has a history of excellent compliance with U.S. pesticide tolerances, and the Program is the means whereby its government assures that selected commodities exported to the U.S. by the exporters covered under the Program are 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 has 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. In 2002, FDA completed one special assignment, to measure the levels, at the lowest possible detectable limits, of organophosphate pesticides in fruits and vegetables for dietary risk assessment.

## 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 1987-1998 (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 257 or 258 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.

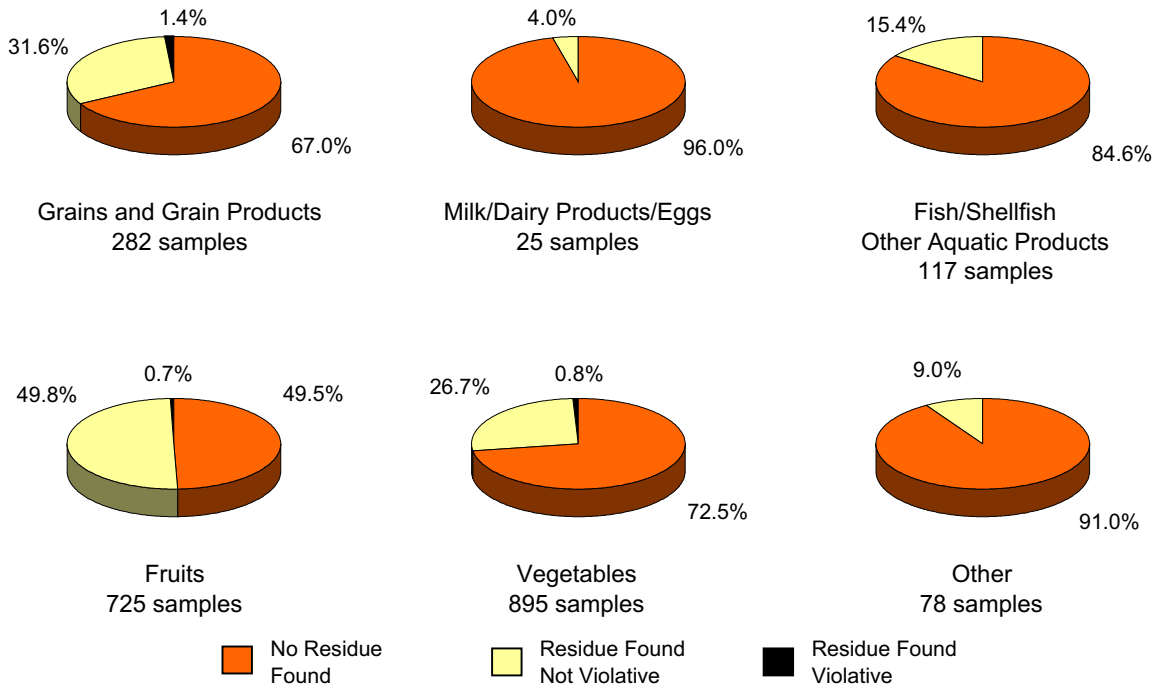
# Results and Discussion

## Regulatory Monitoring

Under regulatory monitoring, 6,766 samples were analyzed. Of these 2,122 were domestic and 4,644 were imports.

Figure 1 shows the percentage of the 2,122 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*

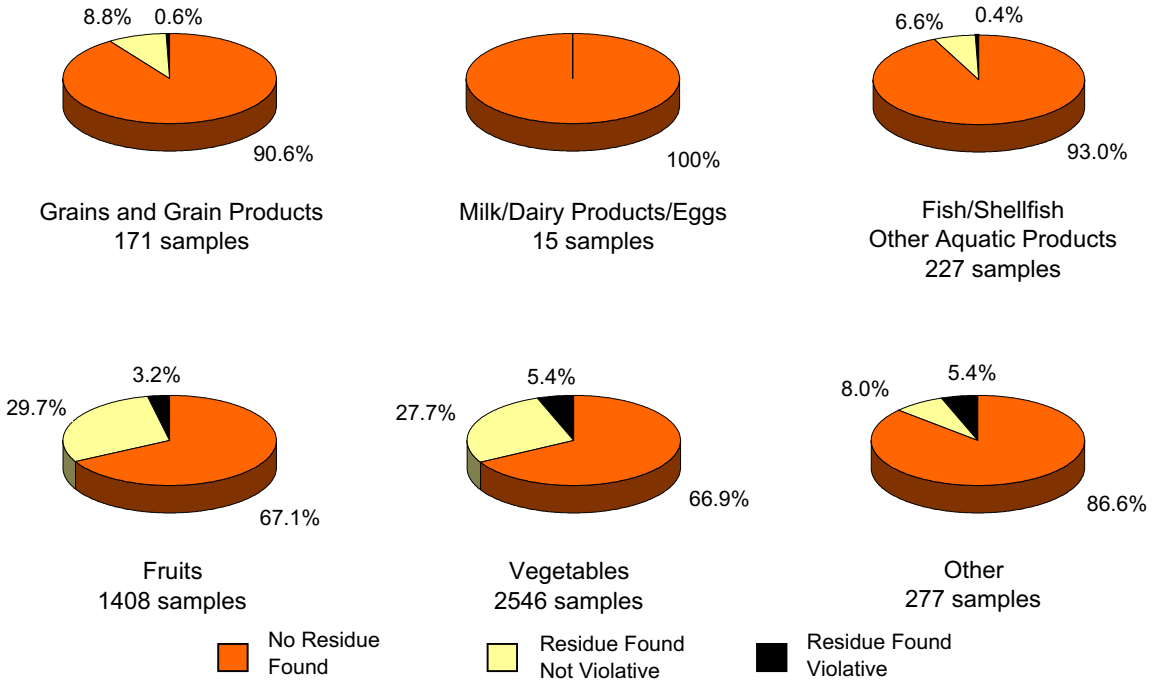


As in earlier years, fruits and vegetables accounted for the largest proportion of the commodities analyzed in 2002; those two commodity groups comprised 76.3% of the total number of domestic samples. In 2002, no violative residues were found in 99.2% of all domestic samples (99.1% in 1996, 98.8% in 1997, 99.2 % in 1998, 99.2% in 1999, 99.3% in 2000, 98.9% in 2001).

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 2,122 domestic samples, 65.5% had no detectable residues and 0.8% had violative residues. In the largest commodity groups, fruits and vegetables, 49.5% and 72.5% of the samples, respectively, had no residues detected; 0.7% of the fruit samples and 0.8% of the vegetable samples contained violative residues (Figure 1). In the grains and grain products group, 67.0% of the samples had no residues detected, and 1.4% had violative residues. In the fish/shellfish/other aquatic products group, 84.6% had no detectable residues, and no violative residues were found. In the milk/dairy products/eggs group, 96.0% of the samples had no residues detected, and no violative residues were found. A total of 15 samples of baby foods or formula was analyzed (see category Other). This total included 6 vegetable, 3 cereal, and 3 fruit juice samples. None of the samples had violative residues.

Findings by commodity group for the 4,644 import samples are shown in Figure 2. Fruits and vegetables accounted for 85.1% of these samples. Overall, no violative residues were found in 95.7% 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).

## *Figure 2. Summary of Results of Import Samples by Commodity*




Appendix B contains detailed data on the import samples. Of the 4,644 samples analyzed, 70.4% had no residues detected, and 4.3% had violative residues. Fruits and vegetables had 67.1% and 66.9%, respectively, with no residues detected. The fruit group and the vegetable group had 3.2% and 5.4%, respectively, with violative residues. No residues were found in any (100.0%) of the milk/dairy products/eggs group and in 93.0% of the fish/shellfish group; no violative residues were found in the milk/dairy products/eggs group, and 0.4% of the fish/shellfish group samples were violative. In the grains and grain products group, 90.6% had no detectable residues, and 0.6% had violative residues.

Pesticide monitoring data collected under FDA's regulatory monitoring approach in 2002 are available to the public as a computer database. This database summarizes FDA 2002 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 1992–2001 is provided at the end of this report.

## Geographic Coverage

**Domestic.** A total of 2,122 domestic samples was collected in 2002 from 39 states (no samples were collected from Tennessee, Alabama, West Virginia, Hawaii, Nevada, Vermont, Connecticut, Maine, Mississippi, Arkansas, or New Hampshire) 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.

*Table 1. Domestic Samples Collected and Analyzed, by State[a], in 2002*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| California | 216 | Illinois | 73 | Indiana | 35 | Nebraska | 17 |
| Louisiana | 210 | Colorado | 58 | Ohio | 31 | Kentucky | 14 |
| Washington | 206 | Idaho | 48 | Wyoming | 30 | North Dakota | 13 |
| Wisconsin | 120 | Iowa | 45 | Michigan | 30 | Rhode Island | 11 |
| Florida | 107 | Virginia | 43 | North Carolina | 27 | Delaware | 8 |
| Oregon | 105 | Montana | 42 | Maryland | 25 | Massachusetts | 7 |
| New York | 90 | Pennsylvania | 41 | Arizona | 25 | Oklahoma | 7 |
| Missouri | 90 | Utah | 40 | New Jersey | 23 | Alaska | 5 |
| Texas | 84 | Kansas | 37 | New Mexico | 20 | South Dakota | 2 |
| Minnesota | 74 | Georgia | 35 | South Carolina | 20 | | |

*Other domestic samples: Puerto Rico, 8 samples.

**Import.** A total of 4,644 samples representing food shipments from 100 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.

## Domestic/Import Violation Rate Comparison

In 2002, 2,122 domestic and 4,644 import samples were collected and analyzed. Pesticide residues were detected in 34.5% of the domestic samples and in 29.6% of the import samples. Only 0.8% of the domestic samples and only 4.3% of the import samples were violative. Among grains and grain products, the violation rate was 1.4% domestic *vs.* 0.6% import. No violations were found in the milk/dairy products/eggs group or the fish/shellfish/other aquatic products group among domestic samples; of import samples, none of the milk/dairy products/eggs group and 0.4% of fish/shellfish/other aquatic products group were violative. Of domestic fruits, 0.7% were violative; of import fruits, the violation rate was 3.2%. Of vegetables, 0.8% of domestic samples and 5.4% of import samples were violative. In the category "Other" the rates for domestic and import samples were, respectively, 0.0% and 5.4%. The overall rate of violations is approximately one domestic violation for five import violations. Of the violative samples, none of the domestic ones and 13 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; 16 domestic samples and 188 import samples fell in this category.

## Pesticide Coverage

Table 3 lists the 266 pesticides that were detectable by the methods used; each of the 129 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 2002 (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.

## *Table 2. Foreign Countries and Number of Samples Collected and Analyzed in 2002*

| | |
|---|---|
| Mexico | 1891 |
| China, Peoples Rep. | 228 |
| Chile | 227 |
| Netherlands (Holland) | 205 |
| Canada | 164 |
| Spain (inc. Canary Is.) | 153 |
| Guatemala | 131 |
| Dominican Republic | 103 |
| Thailand | 97 |
| India | 90 |
| Peru | 87 |
| Costa Rica | 86 |
| Poland | 79 |
| Ecuador | 72 |
| Turkey | 66 |
| Viet-Nam, Rep. of | 66 |
| Belgium | 58 |
| Brazil | 52 |
| Argentina | 43 |
| Italy | 40 |
| Greece | 36 |
| South Africa | 36 |
| France | 32 |
| Honduras | 31 |
| Korea, Rep. of (South) | 30 |
| Australia | 29 |
| Israel | 29 |
| Jamaica | 27 |
| Philippines | 25 |
| Colombia | 22 |
| Lebanon | 22 |
| El Salvador | 21 |
| Taiwan, Republic of | 19 |
| Indonesia | 18 |
| Iran | 18 |
| Unspecified | 18 |
| Egypt | 17 |
| Germany, Federal Rep. | 16 |
| New Zealand | 16 |
| Nicaragua | 13 |
| Pakistan | 13 |
| Hungary | 12 |
| Russia | 11 |

### *Ten or fewer samples collected from the following:*

Algeria
Armenia
Bangladesh
Belize
Bolivia
Bulgaria
Cameroon
Croatia
Cyprus
Denmark
Dominica
Estonia
Ethiopia
Fiji
Finland
Ghana
Guadeloupe
Haiti
Hong Kong
Iceland
Ireland
Japan
Jordan
Kampuchea
Kuwait
Lithuania
Luxembourg
Macedonia
Malawi
Malaysia
Mauritius
Moldova (Moldavia)
Morocco
Myanmar (Burma)
Norway
Oman
Panama
Paraguay
Portugal (inc. Azores)
Romania
Saudi Arabia
Slovakia
Slovenia
Sri Lanka
St. Lucia
Sweden
Switzerland
Syrian Arab Republic
Tanzania, United Republic of
Trinidad & Tobago
Tunisia
United Arab Emirates
United Kingdom
Uruguay
Vanuatu
Venezuela
Western Samoa
Yugoslavia

## Table 3. Pesticides Detectable and Found (*) by Methods Used in 2002 Regulatory Monitoring[a,b]

1-naphthol*
2,3,5,6-tetrachloroaniline*
2,4-dichloro-6-nitro= benzenamine
2,6-dichlorobenzamide
2-methoxy-3,5,6-trichloropyridine
4-(dichloroacetyl)-1-oxa-4-azaspiro[4.5]decane
4-cyclohexene-1,2-dicarboximide, cis*
acephate*
acetochlor
acibenzolar-S-methyl
acrinathrin
alachlor
aldicarb*
aldrin
allethrin*
alpha-cypermethrin
ametryn
amitraz*
anilazine
Aramite
atrazine
azinphos-ethyl
azinphos-methyl*
azoxystrobin*
benfluralin
benoxacor
bensulide
BHC*
bifenox
bifenthrin*
binapacryl
biphenyl*
bromacil
bromophos
bromophos-ethyl
bromopropylate*
Bulan
buprofezin*
butachlor
butralin
captafol
captan*
carbaryl*
carbofuran*
carbophenothion
carboxin
carfentrazone ethyl ester
chlorbenside
chlorbromuron
chlordane*
chlordecone
chlordimeform
chlorethoxyfos
chlorfenvinphos*
chlornitrofen
chlorobenzilate
chloroneb
chloropropylate
chlorothalonil*
chlorpropham*
chlorpyrifos*
chlorpyrifos-methyl*
chlorthiophos
clodinafop-propargyl
coumaphos
crotoxyphos
cyanazine*
cycloate*
cyfluthrin
cyhalofop butyl ester
cypermethrin*
cyprazine*
cyprodinil*
daminozide
DCPA*
DDT*
DEF
deltamethrin*
deltamethrin, trans
demeton*
dialifor
di-allate
diazinon*
dichlobenil*
dichlofenthion
dichlofluanid*
dichlone
dichlorvos*
diclofop-methyl
dicloran*
dicofol*
dicrotophos*
dieldrin*
difenoconazole*
Dilan
dimethoate*
dinitramine
dinocap
dioxathion
diphenylamine*
disulfoton*
endosulfan*
endrin*
EPN
EPTC
esfenvalerate*
ethalfluralin
ethion*
ethoprop
ethoxyquin*
etridiazole
etrimfos
famphur
fenamidone
fenamiphos*
fenarimol*
fenbuconazole*
fenhexamid*
fenitrothion*
fenoxaprop-ethyl
fenpropathrin*
fensulfothion
fenthion
fenvalerate*
fipronil

[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] The analytical methodology determines carbendazim, which may result from use of benomyl or carbendazim.

*Table 3 (continued)*

fluazifop butyl ester
fluazinam
fluchloralin
flucythrinate
fludioxonil*
flusilazole*
fluvalinate
folpet*
fonofos
Gardona
heptachlor*
hexachlorobenzene*
hexaconazole*
hexythiazox
imazalil*
iprodione*
isazofos
isofenphos
isoprocarb*
isopropalin
isoxaflutole
kresoxim-methyl
lactofen
lambda-cyhalothrin*
leptophos
lindane*
linuron*
malathion*
mephosfolan
merphos
metalaxyl*
methamidophos*
methidathion*
methiocarb
methomyl*
methoxychlor*
metolachlor
metribuzin
mevinphos*
MGK 264*
mirex
monocrotophos*
myclobutanil*
N-(3,5-dichlorophenyl)-3-(1-methylethyl)-2,4-dioxo-1-imidazolidinecarboxamide*
naled
naphthalene*
nitralin
nitrapyrin
nitrofen
nitrofluorfen
norflurazon
nuarimol*
omethoate*
ovex
oxadiazon*
oxadixyl*
oxamyl*
oxydemeton-methyl
oxyfluorfen
oxythioquinox
parathion*
parathion-methyl*
pebulate
penconazole*
pendimethalin
pentachlorobenzene*
pentachlorobenzonitrile*
pentachlorophenyl methyl ether*
permethrin*
Perthane
phenthoate*
phenylphenol, ortho-*
phorate*
phosalone*
phosmet*
phosphamidon
piperonyl butoxide*
pirimicarb*
pirimiphos-ethyl
pirimiphos-methyl*
prochloraz*
procymidone*
profenofos*
profluralin
prometryn
pronamide*
propanil
propargite*
propazine
propetamphos
propham
propiconazole*
prothiofos
pyraclostrobin
pyrazon
pyrazophos*
pyrethrins
pyridaben*
pyrimethanil*
pyriproxyfen*
quinalphos*
quinoxyfen*
quintozene*
ronnel
salithion
S-bioallethrin
simazine*
Strobane
sulfallate
sulfotep*
Sulphenone
sulprofos
TCMTB
tebuconazole*
tebupirimfos
tecnazene*
terbacil
terbufos
terbuthylazine
tetradifon*
tetraiodoethylene
tetrasul
thiabendazole*
thiazopyr
thiobencarb
thionazin
tolylfluanid*
toxaphene*
tralomethrin
triadimefon*
triadimenol*
tri-allate*
triazophos
tridiphane
triflumizole*
trifluralin*
triphenyl phosphate*
tris(2-butoxyethyl) phosphate*
vernolate
vinclozolin*
zoxamide

## Animal Feeds

In 2002, 445 domestic and 89 import feed samples were collected and analyzed for residues. Of the 445 domestic samples, 320 (71.9%) contained no detectable pesticide residues, and 7 (1.6%) contained residues which exceeded regulatory guidance. Of the 89 import samples, 74 (83.1%) contained no detectable pesticide residues, and 6 (6.7%) contained residues which exceeded regulatory guidance. Table 4 summarizes the combined findings in domestic and import samples.

*Table 4. Summary of 2002 Domestic and Import Feed Samples*

| Type of Feed | Total # Samples | Without residues # | Without residues % | Exceeding Guidance # | Exceeding Guidance % |
|---|---|---|---|---|---|
| Whole/Ground Grains | 227 | 181 | 79.7 | 4 | 1.8 |
| Plant By-products | 150 | 107 | 71.3 | 5 | 3.3 |
| Mixed Feed Rations | 94 | 58 | 61.7 | 0 | 0.0 |
| Animal By-products | 32 | 24 | 75.0 | 0 | 0.0 |
| Hay & Hay Products | 28 | 21 | 75.0 | 4 | 14.3 |
| Supplements | 3 | 3 | 100.0 | 0 | 0.0 |
| **Total** | **534** | **394** | **73.8** | **13** | **2.4** |

The following 7 residues in domestic samples were considered to have exceeded regulatory guidance because there is no tolerance or action level established for the pesticide-commodity combination: 0.051 ppm of chlorpyrifos-methyl on a sample of shelled corn from Ohio (collected by the Cincinnati district); 0.068 ppm of o-phenylphenol on a soybean meal sample from Vermont (collected by the New York district); 0.009 ppm of quintozene on a cracked corn sample from California (collected by the Los Angeles district); 0.207 ppm of dimethoate on a sample of oat hay pellets from Idaho (collected by the Los Angeles district); 0.082 ppm imazalil and 0.246 ppm cypermethrin on a sample of cantaloupe peels from California (collected by the San Diego district); 0.075 ppm of chlorpyrifos-methyl on a ground alfalfa sample from Montana (collected by the Seattle district).

One domestic sample had a residue that exceeded an EPA tolerance or a FDA requested maximum level. A sample of wheat screenings from Montana and collected by the Seattle district contained 24.2 ppm of malathion. This level exceeded the 8 ppm tolerance for malathion on wheat in 40 CFR 180.111.

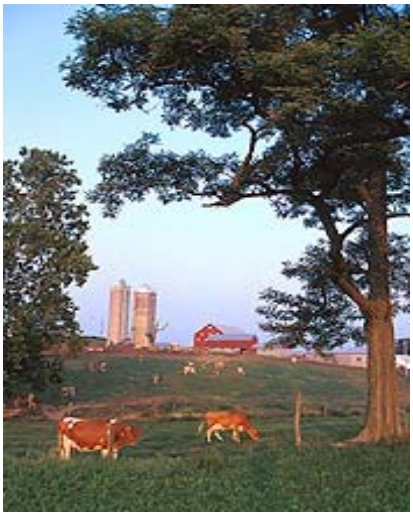
Six import samples contained 6 pesticide residues that exceeded regulatory guidance because there is no tolerance or action level established for the pesticide-commodity combination:. 0.211 ppm of pirimiphos-methyl on a hydrolyzed wheat protein sample from the Netherlands (collected by the Minneapolis district); 0.009 ppm of chlorpyrifos-methyl on a sample of white millet (pet bird food) from Canada (collected by the San Juan district); 0.24 ppm of chlorpyrifos-methyl on a rolled/ground corn sample from Canada (collected by the Seattle district); 0.043 ppm of malathion on a canola meal sample from Canada (collected by the Seattle district); 0.016 ppm of chlorpyrifos on a sample of salt bush from Mexico (collected by the Los Angeles district); 0.030 ppm of endosulfan (I + II + sulfate) on a Sudan hay sample from Mexico (collected by the Los Angeles district).

In the 125 domestic and 15 import samples of feed in which one or more pesticides were detected, there were 210 residues (146 quantifiable and 64 trace). Malathion, chlorpyrifos-methyl, and chlorpyrifos were the most frequently found and accounted for 64.8% of all residues detected (Table 5).

## Table 5. Residues Found in Domestic and Import Feeds in 2002

| Pesticide | # of Samples with Trace Amount[a] | # of Samples with Quantifiable Levels | Range[b] (ppm) | Median[b] (ppm) |
|---|---|---|---|---|
| malathion | 21 | 65 | 0.020 - 24.2 | 0.082 |
| chlorpyrifos-methyl | 12 | 27 | 0.009 - 4.87 | 0.080 |
| chlorpyrifos | 3 | 8 | 0.016 - 0.300 | 0.029 |
| methoxychlor (p,p' + o,p') | 8 | 3 | 0.013 - 0.051 | 0.028 |
| tribufos (DEF) | 6 | 3 | 0.031 - 0.069 | 0.034 |
| pirimiphos-methyl | 3 | 4 | 0.033 - 0.211 | 0.040 |
| diazinon | 1 | 5 | 0.019 - 0.070 | 0.049 |
| ethoxyquin | 1 | 3 | 0.109 - 71.0 | 5.750 |
| ethion | 0 | 3 | 0.037 - 0.246 | 0.056 |
| Gardona | 1 | 2 | 0.078- 0.115 | N/A |
| all others[c] | 8 | 23 | 0.002 - 4.500 | 0.082 |

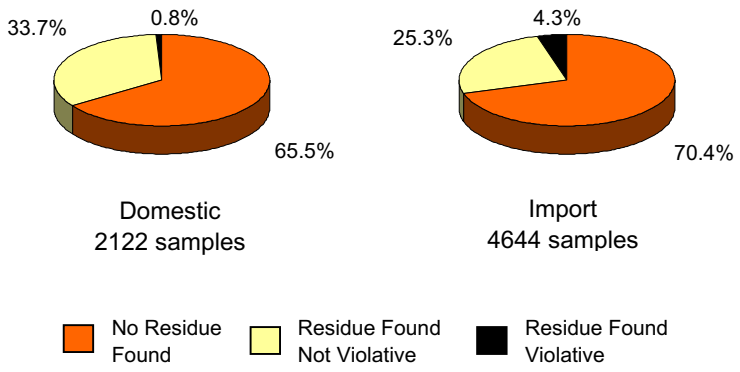
[a] Residue found is below that normally quantifiable, but its presence and identity are known.
[b] In samples containing quantifiable levels.
[c] n=2 for azinphos-methyl, chlorpropham, endosulfan, methamidophos, parathion or its methyl homolog, permethrin, o-phenylphenol, phosmet, and quintozene; n=1 for carbaryl, cypermethrin, DCPA, DDT + metabolites, dicofol, dieldrin, dimethoate, imazalil, iprodione, malathion oxygen analog, profenofos, thiabendazole, and vinclozolin.



## Summary: Regulatory Monitoring

No residues were found in 65.5% of domestic and in 70.4% of import samples (Figure 3) analyzed under FDA's regulatory monitoring approach in 2002. Only 0.8% of domestic and 4.3% of import samples had residue levels that were violative. The findings for 2002 demonstrate that pesticide residue levels in foods are generally well below EPA tolerances, corroborating results presented in earlier reports (4a, 4b). Animal feed samples (445 domestic, 89 import) were analyzed. No residues were found in 71.9% of the domestic samples and in 83.1% of the import samples.

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




## Incidence / Level Monitoring

### Special Surveys

As part of a collaborative effort with EPA, in August 2001, FDA initiated a project of measuring organophosphorous pesticides (OPs) in a selected variety of fruits and vegetables that are a significant part of children's diets. The objective of this interagency project is to obtain the residue data at the lowest possible detectable levels for dietary risk assessment. FDA has for many years provided pesticide residue data to EPA, but the Food Quality Protection Act requires reassessment of pesticide tolerances in foods and feeds. To meet this requirement, EPA needed data at levels lower than the regulatory levels routinely used in FDA monitoring and reported by FDA. EPA identified "top priority" and "high priority" lists of 28 parent OPs and their metabolites based on their degree and mechanism of toxicity. EPA also compiled a list of ten commodities based on their significance in the diets of children, and requested that FDA collect 1000 domestic and import samples of these commodities, 100 samples for each commodity, and analyze them for the presence of these OPs.

The commodities included apples, blackberries, carrots, cranberries, grapes, head lettuce, oranges, peaches, strawberries, and tomatoes. The numbers of domestic samples collected from the various regions were based on EPA's estimates of crop production, and those of import samples reflect a reasonable percentage of import volume of each commodity. All samples were analyzed for the selected OPs by a modification of a method in FDA's Pesticide Analytical Manual Volume I (PAM I). EPA modified the method by incorporating use of a pulsed flame photometric detector, which allows detection of residues at a much lower level (1 ppb) than those detected in regulatory monitoring (10, 11). Most FDA Districts participated in collecting the samples. Analyses were performed by the FDA's Pacific Regional Laboratory (PRL) - Southwest and PRL - Northwest. The analyses of the samples were completed in FY 02. The data are being used by EPA for dietary risk assessment.

## Summary: Incidence / Level Monitoring

Results of the interagency project are being used by EPA for dietary risk assessment.

## 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 01-4, 02-1, 02-2, and 02-3). Among these were 64 pesticides, including 15 which represent more than one related compound counted as a "total", 22 volatile organic compounds for which 70 TDS foods per basket are now being examined, and 12 other organic compounds.

Table 6 lists the 20 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 2002 (1,030 food items). The five most frequently observed chemicals, DDT, chlorpyrifos-methyl, malathion, endosulfan, and dieldrin, are the same as those observed for the past several years. The levels of these 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; these intakes 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. This adjunct to the TDS included 19 or 20 different food items in the four baskets represented here (6 fruit juices, 6 fruits, 3 fruit desserts, and 4 grain products). Table 7 lists the 15 pesticide residues found in four collections of these foods (78 samples total) in 2002, the percentage occurrence, and ranges of levels found.

## Summary: Total Diet Study

In 2002, 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 1991-2002 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 2002*[a]

| Pesticide[b] | Total No. of Findings | Occurrence, % | Range, ppm |
|---|---|---|---|
| DDT | 212 | 21 | 0.0001 - 0.025 |
| chlorpyrifos-methyl | 175 | 17 | 0.0002 - 0.059 |
| malathion | 156 | 15 | 0.0007 - 0.071 |
| endosulfan | 142 | 14 | 0.0001 - 0.166 |
| dieldrin | 115 | 11 | 0.0001 - 0.010 |
| chlorpropham | 62 | 6 | 0.0007 - 1.278 |
| chlorpyrifos | 49 | 5 | 0.0001 - 0.105 |
| permethrin | 43 | 4 | 0.0004 - 1.680 |
| carbaryl[c] | 42 | 4 | 0.001 - 2.040 |
| dicloran | 33 | 3 | 0.0002 - 0.263 |
| thiabendazole[d] | 31 | 3 | 0.013 - 0.991 |
| lindane | 20 | 2 | 0.0001 - 0.002 |
| methamidophos | 19 | 2 | 0.001 - 0.345 |
| hexachlorobenzene | 19 | 2 | 0.0001 - 0.002 |
| dicofol | 19 | 2 | 0.002 - 0.538 |
| pirimiphos-methyl | 17 | 2 | 0.001 - 0.024 |
| quintozene | 17 | 2 | 0.0001 - 0.0424 |
| toxaphene | 17 | 2 | 0.002 - 0.028 |
| acephate | 16 | 2 | 0.002 - 0.350 |
| ethion | 16 | 2 | 0.0003 - 0.007 |

[a] Based on 4 market baskets analyzed consisting of 1,030 total items.
[b] Isomers, metabolites, and related compounds are included with the "parent" pesticide from which they arise.
[c] Reflects overall incidence; however, only 93 selected foods per market basket (*i.e.,* 372 items total) were analyzed for N-methylcarbamates.
[d] Reflects overall incidence; however, only 67 selected foods per market basket (*i.e.,* 268 items total) were analyzed for the benzimidazole fungicides.

## *Table 7. Frequency of Occurrence of Pesticide Residues Found in Selected Baby Foods in 2002*[a]

| Pesticide[b] | Total No. of Findings | Occurrence, % | Range, ppm |
|---|---|---|---|
| carbaryl[c] | 11 | 14 | 0.001 - 0.008 |
| chlorpyrifos-methyl | 9 | 12 | 0.0009 - 0.012 |
| malathion | 8 | 10 | 0.004 - 0.026 |
| permethrin | 7 | 9 | 0.0007 - 0.013 |
| thiabendazole[d] | 7 | 9 | 0.018 - 0.056 |
| ethylenethiourea[e] | 5 | 6 | 0.003 - 0.008 |
| endosulfan | 3 | 4 | 0.0002 - 0.0018 |
| esfenvalerate | 2 | 3 | 0.008 - 0.011 |
| dimethoate | 2 | 3 | 0.002 - 0.007 |
| phosmet | 2 | 3 | 0.007 - 0.020 |
| chlorpyrifos | 2 | 3 | 0.0007 - 0.0009 |
| iprodione | 1 | 1 | 0.002 |
| pirimiphos-methyl | 1 | 1 | 0.002 |
| carbofuran[c] | 1 | 1 | 0.004 |
| dicofol | 1 | 1 | 0.040 |

[a] Based on 4 market baskets consisting of 78 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 selected foods permarket basket (*i.e.,* 52 items total) were analyzed for N- methylcarbamates.

[d] Reflects overall incidence; however, only 13 selected foods per market basket (*i.e.,* 52 items total) were analyzed for the benzimidazole fungicides.

[e] Reflects overall incidence; however, only 12 selected foods per market basket (*i.e.,* 48 items total) were analyzed for ethylenethiourea.

# Summary

A total of 6,766 samples of domestically produced food and imported food from 100 countries was analyzed for pesticide residues in 2002. FDA collected and analyzed animal feed samples (445 domestic, 89 import) for pesticides. No residues were found in 71.9% of the domestic samples and in 83.1% of the import samples. Total Diet Study findings for 2002 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 Marion G. Clower, Jr., 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 2001 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.*

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## *Appendix A. Analysis of Domestic Samples by Commodity Group in 2002*

| Commodity Group | Total Samples | Samples without Residues, % | Samples Violative[a], % | # over tolerance | # no tolerance |
|---|---|---|---|---|---|
| **A. Grains and Grain Products** | | | | | |
| Barley & barley products | 17 | 82.3 | 0.0 | | |
| Corn & corn products | 70 | 70.0 | 5.7 | | |
| Oats & oat products | 4 | 100.0 | 0.0 | | |
| Rice & rice products | 39 | 71.8 | 0.0 | | |
| Soybeans & soybean products | 13 | 61.5 | 0.0 | | |
| Wheat & wheat products | 115 | 58.3 | 0.0 | | |
| Other grains & grain products | 9 | 55.6 | 0.0 | | |
| Breakfast cereals | 14 | 92.9 | 0.0 | | |
| Bakery products, crackers, etc. | 1 | 100.0 | 0.0 | | |
| **Total** | **282** | **67.0** | **1.4** | **0** | **0** |
| **B. Milk/Dairy Products/Eggs** | | | | | |
| Cheese & cheese products | 6 | 83.3 | 0.0 | | |
| Eggs | 9 | 100.0 | 0.0 | | |
| Milk/cream & milk products | 10 | 100.0 | 0.0 | | |
| **Total** | **25** | **96.0** | **0.0** | **0** | **0** |
| **C. Fish/Shellfish/Other Aquatic Products** | | | | | |
| Fish and Fish Products | 82 | 79.3 | 0.0 | | |
| Shellfish & Crustaceans | 34 | 100.0 | 0.0 | | |
| Other Aquatic Animals & Products | 1 | 0.0 | 0.0 | | |
| **Total** | **117** | **84.6** | **0.0** | **0** | **0** |
| **D. Fruits** | | | | | |
| Blackberries | 4 | 75.0 | 0.0 | | |
| Blueberries | 27 | 88.9 | 0.0 | | |
| Cranberries | 5 | 60.0 | 0.0 | | |
| Grapes, raisins | 20 | 55.0 | 0.0 | | |
| Raspberries | 15 | 13.3 | 0.0 | | |
| Strawberries | 55 | 43.6 | 0.0 | | |
| Other berries | 12 | 16.7 | 0.0 | | |
| Grapefruit | 10 | 60.0 | 0.0 | | |
| Lemons | 8 | 75.0 | 0.0 | | |
| Oranges | 65 | 66.2 | 0.0 | | |
| Other citrus fruit | 6 | 50.0 | 0.0 | | |
| Apples | 167 | 32.3 | 0.0 | | |
| Pears | 40 | 60.0 | 0.0 | | |
| 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 A. (continued)*

| Commodity Group | Total Samples | Samples without Residues, % | Samples Violative[a], % | # over tolerance | # no tolerance |
|---|---|---|---|---|---|
| Apricots | 8 | 62.5 | 0.0 | | |
| Avocadoes | 3 | 100.0 | 0.0 | | |
| Cherries | 32 | 21.9 | 6.2 | | 2 |
| Nectarines | 12 | 58.3 | 8.3 | | 1 |
| Peaches | 96 | 34.4 | 2.1 | | 2 |
| Plums | 10 | 40.0 | 0.0 | | |
| Other pit fruit | 2 | 100.0 | 0.0 | | |
| Mangoes | 2 | 100.0 | 0.0 | | |
| Pineapple | 2 | 100.0 | 0.0 | | |
| Other sub-tropical fruit | 1 | 100.0 | 0.0 | | |
| Cantaloupe | 22 | 77.3 | 0.0 | | |
| Honeydew | 2 | 50.0 | 0.0 | | |
| Watermelon | 23 | 78.3 | 0.0 | | |
| Other melons | 11 | 81.8 | 0.0 | | |
| Apple juice | 27 | 81.5 | 0.0 | | |
| Citrus juice | 4 | 100.0 | 0.0 | | |
| Other fruit juices | 12 | 91.7 | 0.0 | | |
| Fruit jams/jellies/pastes/toppings | 20 | 25.0 | 0.0 | | |
| **Total** | **725** | **49.5** | **0.7** | **0** | **5** |
| E. Vegetables | | | | | |
| Corn | 30 | 93.3 | 0.0 | | 4 |
| Peas (green/snow/sugar/sweet) | 34 | 94.1 | 5.9 | | 3 |
| String beans (green/snap/pole/long) | 82 | 59.8 | 1.2 | | 1 |
| Other beans & peas & products | 51 | 90.2 | 2.0 | | |
| Cucumbers | 33 | 75.8 | 0.0 | | |
| Eggplant | 3 | 100.0 | 0.0 | | |
| Okra | 2 | 100.0 | 0.0 | | |
| Peppers, hot | 1 | 0.0 | 0.0 | | |
| Peppers, sweet | 14 | 78.6 | 0.0 | | |
| Squash/pumpkins | 40 | 85.0 | 0.0 | | |
| Tomatoes | 84 | 70.2 | 0.0 | | |
| Other fruiting vegetables | 2 | 100.0 | 0.0 | | |
| Asparagus | 18 | 100.0 | 0.0 | | |
| Bok choy & Chinese cabbage | 3 | 100.0 | 0.0 | | |
| Broccoli | 28 | 92.9 | 0.0 | | |
| Cabbage | 40 | 80.0 | 0.0 | | |
| Cauliflower | 5 | 80.0 | 0.0 | | |
| Celery | 9 | 22.2 | 22.2 | | 2 |

[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 |
|---|---|---|---|---|---|
| Collards | 5 | 80.0 | 0.0 | | |
| Endive | 2 | 0.0 | 50.0 | | 1 |
| Kale | 3 | 66.7 | 0.0 | | |
| Lettuce, head | 19 | 57.9 | 0.0 | | |
| Lettuce, leaf | 19 | 79.0 | 0.0 | | |
| Spinach | 12 | 41.7 | 0.0 | | |
| Other leaf & stem vegetables | 6 | 83.3 | 0.0 | | |
| Mushrooms and Truffles | 3 | 100.0 | 0.0 | | |
| Carrots | 49 | 67.3 | 0.0 | | |
| Onions/leeks/scallions/shallots | 65 | 96.9 | 0.0 | | |
| Potatoes | 124 | 37.9 | 0.0 | | |
| Radishes | 6 | 50.0 | 0.0 | | |
| Red beets | 6 | 83.3 | 0.0 | | |
| Sweet potatoes | 24 | 91.7 | 0.0 | | |
| Turnips | 7 | 85.7 | 0.0 | | |
| Other root & tuber vegetables | 10 | 60.0 | 0.0 | | |
| Vegetables, dried or paste | 27 | 88.9 | 0.0 | | |
| Other vegetables/vegetable products | 29 | 65.5 | 0.0 | | |
| **Total** | **895** | **72.5** | **0.8** | **0** | **11** |
| F. Other | | | | | |
| Almonds & almond products | 2 | 100.0 | 0.0 | | |
| Peanuts & peanut products | 23 | 82.6 | 0.0 | | |
| Other nuts & nut products | 13 | 100.0 | 0.0 | | |
| Edible seeds & seed products | 4 | 75.0 | 0.0 | | |
| Beverage bases | 1 | 100.0 | 0.0 | | |
| Honey & other sweeteners | 19 | 94.7 | 0.0 | | |
| Baby foods/formula | 15 | 93.3 | 0.0 | | |
| Other food products, incl. prepared foods | 1 | 100.0 | 0.0 | | |
| **Total** | **78** | **91.0** | **0.0** | **0** | **0** |
| **Total A-F** | **2,122** | **65.5** | **0.8** | **0** | **16** |

[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 2002*

| Commodity Group | Total Samples | Samples without Residues, % | Samples Violative[a], % | # over tolerance | # no tolerance |
|---|---|---|---|---|---|
| **A. Grains and Grain Products** | | | | | |
| Barley & barley products | 13 | 84.6 | 0.0 | | |
| Corn & corn products | 4 | 100.0 | 0.0 | | |
| Oats & oat products | 14 | 92.9 | 0.0 | | |
| Rice & rice products | 45 | 88.9 | 0.0 | | |
| Soybeans & soybean products | 1 | 100.0 | 0.0 | | |
| Wheat & wheat products | 26 | 73.1 | 3.9 | 1 | |
| Other grains & grain products | 7 | 100.0 | 0.0 | | |
| Breakfast cereals | 13 | 100.0 | 0.0 | | |
| Bakery products, crackers, etc. | 25 | 100.0 | 0.0 | | |
| Pasta and noodles | 23 | 95.7 | 0.0 | | |
| **Total** | **171** | **90.6** | **0.6** | **1** | **0** |
| **B. Milk/Dairy Products/Eggs** | | | | | |
| Butter | 1 | 100.0 | 0.0 | | |
| Cheese & cheese products | 11 | 100.0 | 0.0 | | |
| Eggs | 1 | 100.0 | 0.0 | | |
| Milk/cream & milk products | 2 | 100.0 | 0.0 | | |
| **Total** | **15** | **100.0** | **0.0** | **0** | **0** |
| **C. Fish/Shellfish/Other Aquatic Products** | | | | | |
| Fish and Fish Products | 189 | 94.2 | 0.0 | | |
| Shellfish & Crustaceans | 32 | 90.6 | 3.1 | | 1 |
| Other Aquatic Animals & Products | 6 | 66.7 | 0.0 | | |
| **Total** | **227** | **93.0** | **0.4** | **0** | **1** |
| **D. Fruits** | | | | | |
| Blackberries | 27 | 51.9 | 0.0 | | |
| Blueberries | 16 | 68.8 | 0.0 | | |
| Cranberries | 4 | 100.0 | 0.0 | | |
| Grapes, raisins | 80 | 48.8 | 2.5 | | 2 |
| Raspberries | 39 | 46.1 | 2.6 | | 1 |
| Strawberries | 122 | 32.0 | 9.0 | | 11 |
| Other berries | 2 | 100.0 | 0.0 | | |
| Clementines | 16 | 0.0 | 0.0 | | |
| Grapefruit | 1 | 100.0 | 0.0 | | |
| Lemons | 10 | 70.0 | 0.0 | | |
| Limes | 11 | 100.0 | 0.0 | | |
| Oranges | 61 | 47.5 | 1.6 | | 1 |
| Other citrus fruit | 4 | 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 B. (continued)*

| Commodity Group | Total Samples | Samples without Residues, % | Samples Violative[a], % | # over tolerance | # no tolerance |
|---|---|---|---|---|---|
| Apples | 38 | 63.2 | 2.6 | | 1 |
| Pears | 45 | 68.9 | 4.4 | | 2 |
| Other pome fruit | 2 | 50.0 | 50.0 | | 1 |
| | | | | | |
| Apricots | 1 | 100.0 | 0.0 | | |
| Avocadoes | 35 | 100.0 | 0.0 | | |
| Cherries | 13 | 53.9 | 7.7 | | 1 |
| Dates | 6 | 83.3 | 16.7 | | 1 |
| Nectarines | 7 | 28.6 | 0.0 | | |
| Olives | 45 | 75.6 | 4.4 | | 2 |
| Peaches | 43 | 62.8 | 2.3 | 1 | |
| Plums | 10 | 70.0 | 0.0 | | |
| Other pit fruit | 4 | 100.0 | 0.0 | | |
| | | | | | |
| Bananas, plantains | 93 | 48.4 | 0.0 | | |
| Guavas | 4 | 100.0 | 0.0 | | |
| Kiwi fruit | 18 | 77.8 | 5.6 | 1 | |
| Mangoes | 50 | 92.0 | 2.0 | | 2 |
| Papaya | 73 | 76.7 | 5.5 | | 4 |
| Pineapple | 59 | 83.0 | 0.0 | | |
| Other sub-tropical fruit | 50 | 80.0 | 12.0 | | 6 |
| | | | | | |
| Bitter melon | 11 | 45.5 | 0.0 | | |
| Cantaloupe | 49 | 38.8 | 0.0 | | |
| Honeydew | 32 | 46.9 | 0.0 | | |
| Watermelon | 21 | 61.9 | 9.5 | | 2 |
| Other melons | 2 | 100.0 | 0.0 | | |
| | | | | | |
| Other fruits | 6 | 100.0 | 0.0 | | 3 |
| | | | | | |
| Apple juice | 65 | 92.3 | 0.0 | | |
| Citrus juice | 8 | 100.0 | 0.0 | | |
| Other fruit juices | 77 | 97.4 | 1.3 | | 1 |
| Fruit jams/jellies/pastes/toppings | 148 | 88.5 | 4.0 | | 3 |
| | | | | | |
| **Total** | **1,408** | **67.1** | **3.2** | **2** | **44** |
| **E. Vegetables** | | | | | |
| Corn | 36 | 97.2 | 0.0 | | |
| | | | | | |
| Mung beans and bean sprouts | 12 | 83.3 | 0.0 | | |
| Peas (green/snow/sugar/sweet) | 69 | 58.0 | 18.8 | 1 | 16 |
| String beans (green/snap/pole/long) | 78 | 61.5 | 9.0 | 1 | 6 |
| Other beans & peas & products | 138 | 75.4 | 3.6 | | |

[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 | 97 | 37.1 | 1.0 | 1 | |
| Eggplant | 35 | 80.0 | 0.0 | | |
| Okra | 19 | 94.7 | 5.3 | | 1 |
| Peppers, hot | 291 | 45.0 | 9.3 | 2 | 26 |
| Peppers, sweet | 294 | 57.8 | 7.1 | 2 | 18 |
| Squash/pumpkins | 195 | 40.0 | 5.1 | | 10 |
| Tomatoes | 229 | 66.4 | 3.9 | | 9 |
| Other fruiting vegetables | 51 | 78.4 | 2.0 | | 1 |
| | | | | | |
| Artichokes | 13 | 100.0 | 0.0 | | |
| Asparagus | 77 | 89.6 | 0.0 | | |
| Bamboo shoots | 14 | 92.9 | 7.1 | | 1 |
| Bok choy & Chinese cabbage | 9 | 77.8 | 0.0 | | |
| Broccoli | 52 | 80.8 | 0.0 | | |
| Cabbage | 22 | 72.7 | 0.0 | | |
| Cauliflower | 12 | 100.0 | 0.0 | | |
| Celery | 13 | 38.5 | 7.7 | 1 | |
| Collards | 1 | 0.0 | 0.0 | | |
| Endive | 11 | 100.0 | 0.0 | | |
| Kale | 13 | 30.8 | 7.7 | | 1 |
| Lettuce, head | 27 | 66.7 | 3.7 | 1 | |
| Lettuce, leaf | 13 | 76.9 | 0.0 | | |
| Mustard greens | 2 | 100.0 | 0.0 | | |
| Radicchio | 6 | 83.3 | 0.0 | | |
| Spinach | 24 | 58.3 | 12.5 | | 3 |
| Other leaf & stem vegetables | 123 | 72.4 | 16.3 | | 21 |
| | | | | | |
| Mushrooms and Truffles | 43 | 93.0 | 4.7 | | 2 |
| | | | | | |
| Carrots | 48 | 75.0 | 2.1 | | 1 |
| Cassava | 16 | 100.0 | 0.0 | | |
| Onions/leeks/scallions/shallots | 175 | 78.9 | 1.1 | | 2 |
| Potatoes | 33 | 87.9 | 0.0 | | |
| Radishes | 37 | 91.9 | 2.7 | | 1 |
| Red beets | 9 | 88.9 | 11.1 | | 1 |
| Sweet potatoes | 24 | 91.7 | 4.2 | | 1 |
| Turnips | 6 | 83.3 | 0.0 | | |
| Water chestnuts | 16 | 100.0 | 0.0 | | |
| Other root & tuber vegetables | 24 | 91.7 | 8.3 | | 2 |
| | | | | | |
| Vegetables with sauce | 3 | 100.0 | 0.0 | | |
| Vegetables, dried or paste | 85 | 83.5 | 7.1 | 1 | 5 |
| Other vegetables/vegetable products | 51 | 86.3 | 0.0 | | |
| | | | | | |
| **Total** | **2,546** | **66.9** | **5.4** | **10** | **128** |

[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 | | | | | |
| Almonds & almond products | 2 | 100.0 | 0.0 | | |
| Cashews | 33 | 93.9 | 0.0 | | |
| Peanuts & peanut products | 17 | 82.3 | 5.9 | | 1 |
| Other nuts & nut products | 24 | 95.8 | 0.0 | | 1 |
| Edible seeds & seed products | 30 | 96.7 | 3.3 | | |
| Vegetable oil, crude | 1 | 100.0 | 0.0 | | |
| Vegetable oil, refined | 8 | 100.0 | 0.0 | | |
| Spices & condiments & flavors | 38 | 55.3 | 15.8 | | 13 |
| Beverages & water | 8 | 100.0 | 0.0 | | |
| Beverage bases | 8 | 100.0 | 0.0 | | |
| Coffee/tea/wine | 11 | 100.0 | 0.0 | | |
| Cocoa beans & chocolate products | 3 | 66.7 | 0.0 | | |
| Honey & other sweeteners | 53 | 98.1 | 0.0 | | |
| Baby foods/formula | 8 | 87.5 | 0.0 | | |
| Other food products, incl. prepared foods | 16 | 87.5 | 0.0 | | |
| Nonfood items | 17 | 52.9 | 41.2 | | |
| **Total** | **277** | **86.6** | **5.4** | **0** | **15** |
| **Total A-F** | **4,644** | **70.4** | **4.3** | **13** | **188** |

[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.