

An overview of the FDA Pesticide Residue Monitoring Program

AFDO Food Chemistry 101 Workshop June 8, 2024 Grand Rapids, MI



US FDA Pesticide Residue Monitoring Program Fiscal Year 2021 Pesticide Report <u>https://www.fda.gov/media/173207/download?attachment</u>

FDA Compliance Program Guidance Manual, Pesticides and Industrial Chemicals in Domestic and Imported Foods, June 27, 2011 https://www.fda.gov/media/129167/download?attachment

FDA Investigations Operations Manual 2024 https://www.fda.gov/media/166525/download?attachment

FDA Field Science and Laboratories <u>https://www.fda.gov/science-research/field-science-and-laboratories</u> (accessed May 2024)

FDA Office of Regulatory Affairs Quality ORA Lab Manual Vol. IV Section 5 – Pesticides Analysis (IV-05), Revision # 03, Revised 07 Nov 23, Document Number : MAN-000058 <u>https://www.fda.gov/media/73560/download?attachment</u>

Information presented in these slides is derived from these references.



Three agencies regulate pesticides in foods.





Two main objectives of FDA Pesticide Residue Monitoring Program

Determine incidence and level of pesticide residues

Enforce EPA tolerances for pesticide residues



Pesticides control pests that:





Public Health Significance

Pesticides, herbicides, insecticides, rodenticides, etc.

Very broad range of activities

- Short- or long-term/Mild to severe health effects
 - Irritant (rash, stinging, itching)
 - One or more organs
 - Diarrhea
 - Dizziness
 - Blindness
 - Interfere with hormones
 - Birth defects
 - Carcinogen



Pesticide Residues

Substance that remains on food after pesticide application

- Parent form
- Breakdown product
 - Exposed to sunlight, soil, pH change
 - Metabolized by plants, animals, microbes



Tolerance = Maximum Residue Level (MRL)



- Residue level allowed in food
 - If applied correctly, residue should be within tolerance.
- Violations
 - Over-tolerance (result is above tolerance)
 - No-tolerance (found in food when should not be there)
- 40 CFR Parts 180, 185, 186



Tolerance = Maximum Residue Level (MRL)

§ 180.220 Atrazine; tolerances for residues.

(a) *General.* Tolerances are established for the combined residues of the herbicide atrazine (2-chloro-4-ethylamino-6-isopropylamino-s-triazine) and its chlorinated metabolites 2-amino-4-chloro-6-isopropylamino-s-triazine, 2-amino-4-chloro-6-ethylamino-s-triazine, and 2,4-diamino-6-chloro-s-triazine, in or on the following food commodities:

Commodity	Parts per million
Cattle, fat	0.02
Cattle, meat	0.02
Cattle, meat byproducts	0.02
Corn, field, forage	1.5
Corn, field, grain	0.20
Corn, field, stover	0.5
Corn, pop, forage	1.5
Corn, pop, grain	0.20
Corn, pop, stover	0.5
Corn, sweet, forage	15
Corn, sweet, kernel plus cob with husks removed	0.20
Corn eweet etover	2 0



FDA Action Level



FDA creates if EPA has not set a tolerance



Environmental contaminants

No longer EPA-registered (DDT, 1972) Persistent in environment Cannot be avoided by best practices



Non-binding

CFSAN evaluates on case-by-case basis.



Strategies

Selective Monitoring

Focused sampling

Total Diet Study -

• Broad range of domestic and imported foods • 740 pesticides and industrial compounds • Pesticides: current or cancelled EPA registration • Domestically Produced Animal Derived Foods • Milk, shell eggs, honey, game meat • Collection of Selected Domestic and Imported Foods for Herbicide Analysis • Glyphosate, glufosinate (corn, soybean, milk, egg) • 28 acid herbicides in grain (six types) and root crops (8 types) • One violation in 2 years (2,4-D in soybeans) Ongoing monitoring of nutrients and contaminants in the US diet



Sample Collection





Domestic (Raw ag commodities)

Unwashed, whole, raw Processed, single ingredient (concentrated juice) No pre-harvest, organic, or medicinal herbs Grower, packer, distributor

Domestic fish/shellfish

Chesapeake – striped bass, bluefish, shad Great Lakes – commercial finfish Pacific Northwest – Pacific salmon Aquaculture – collect fish and fish feed



Sample Collection

50% of samples: foods consumed by infants and children





Sample Collection

Imported Foods

- Collected in commerce after release from import status
 - Past compliance issues
 - Foreign pesticide usage data

Animal Foods

- FDA Center for Veterinary Medicine oversees collection
 - Animal Food Contaminant Program
 - Ingested pesticide could enter human food supply

CFSAN and ORA set monthly sampling schedule

• Consult with EPA and USDA





Ship samples for analysis



FDA OHAFLO Laboratories

- Arkansas (Jefferson, AR)
- Irvine (Irvine, CA)
- Kansas City (Lenexa, KS)
- New York (Queens County, NY)
- Seattle (Bothell, WA)



Sample preparation



Test methods

Sources of methods	 FDA Pesticide Analytical Manual (PAM) Official Methods of Analysis of the AOAC (OMA) Other AOAC methods Scientific Literature
FDA Pesticide Analytical Manual (PAM)	 Multi-residue method (MRM) or Single residue method (SRM) Fatty vs. non-fatty food
SRM: specific pesticide	 Acid, base, phenol, n-methyl carbamate, phenylurea, etc. Developed by manufacturer and submitted to EPA



Test methods

- Gas or liquid chromatography
 - GC-MS/MS
 - LC-MS/MS
 - GLC plus detector
 - HPLC for heat-sensitive residues
- Identify: parent compound, isomer, breakdown product, metabolite



Photo credits: K-State College of Veterinary Medicine, Analytical Chemistry Core <u>https://www.vet.k-</u> <u>state.edu/academics/anatomy-</u> <u>physiology/core/analytical-chemistry-core/</u>



- Multi-residue methods
 - 740 pesticide residues and industrial chemicals
 - 75% of pesticides: current or cancelled EPA registration
 - 400 pesticides: no EPA tolerance established → FDA action level
- Single-residue methods



Results

Initial screen is presumptive.

• Above tolerance OR no tolerance is set

Test it again to confirm.

- Second test portion
- Second analyst

If results agree, then report.

Enforcement action



LOQ vs. LOD

- Limit of Quantitation (LOQ)
 - Lowest point to get a reliable measurement



- Limit of Detection (LOD)
 - Lowest point where method can detect presence
 - Trace





LOD vs. LOQ

- Below LOD
 - Measurement not reliable
 - Not reportable





Import Alerts





Detention Without Physical Examination (DWPE)

Placed on Red List if actionable residue level

Stays on Red List until resolved

- Five or more consecutive shipments w/o violation
- Corrective Action plan

Country-wide DWPE if same commodity has multiple violations

Where to find Import Alerts:

Raw agricultural commodities: <u>https://www.accessdata.fda.gov/cms_ia/importa</u> <u>lert_258.html</u>

Processed Foods: https://www.accessdata.fda.gov/cms_ia/importa lert_259.html



FDA Pesticide Residue Monitoring Reports

Annual reports since 1987

- FY2021: most recent report
- <u>https://www.fda.gov/food/pesticides/pesticide-residue-monitoring-program-reports-and-data</u>

Report compiled by:

- Center for Food Safety and Nutrition (CFSAN)
- Center for Veterinary Medicine (CVM)
- Office of Regulatory Affairs



FDA Pesticide Residue Monitoring Report FY2021

- 1,367 human food samples
- Foods found to be largely compliant.
 - 96.7% Domestic
 - 89.3% Imported
- Mostly fruits and vegetables
 - 86% Domestic
 - 61% Imported



FDA Pesticide Residue Monitoring Report FY2021

- 300 samples domestic human food
- 26 states



State	Sum of Samples ▼
California	109
New York	47
Kansas	29
Florida	19
Washington	15
lowa	13
Texas	11
Oregon	7
Massachusetts	6
New Jersey	6
Ohio	6
Colorado	5
Hawaii	4
Connecticut	3
Louisiana	3
Nevada	3
Minnesota	2
New Mexico	2
North Dakota	2
West Virginia	2
Kentucky	1
Maine	1
Michigan	1
Nebraska	1
Tennessee	1
Wisconsin	1



Data source: Pesticide Residue Monitoring Program Fiscal Year 2021 Pesticide Report, U. S. Food and Drug Administration

FDA Pesticide Residue Monitoring Report FY2021

- 1,067
 imported
 human food
 samples
- 26 states



Country	Sum of Samples
Mexico	437
Canada	132
China	82
India	39
Turkey	37
United States	30
Dominican Republic	28
Pakistan	23
Peru	22
Vietnam	17
Chile	15
Yemen	14
Afghanistan	13
Myanmar	10
Thailand	10



Data source: Pesticide Residue Monitoring Program Fiscal Year 2021 Pesticide Report, U. S. Food and Drug Administration

FDA Pesticide Residue Monitoring Report FY2021

172 pesticides detected

Top 5 pesticide residues in human foods

- Imidacloprid
- Azoxystrobin
- Cypermethrin
- Pyraclostrobin
- Fludioxonil



Data source: Pesticide Residue Monitoring Program Fiscal Year 2021 Pesticide Report, U. S. Food and Drug Administration

FDA Pesticide Residue Monitoring Report FY2021

- 80 animal food samples
 - 16 domestic
 - 64 imported
- One violation
 - Chlorpropham in carrot powder
 - No-tolerance

Image copied from Table 4., Pesticide Residue Monitoring Program Fiscal Year 2021 Pesticide Report, U. S. Food and Drug Administration



N = Number of samples analyzed for commodity group

Thank you for participating in Food Chemistry 101!

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