

Chapter 23: Environmental Chemical Contaminants and Pesticides

Updated:

- [Potential Food Safety Hazard](#)
 - [Control Measures](#)
 - [FDA Guidelines](#)
 - [Deleterious substances](#)
 - [Toxic elements](#)
 - [Analytical Procedures](#)
 - [Lead](#)
 - [Mercury](#)
 - [Pesticides](#)
 - [References](#)
-

Potential Food Safety Hazard

[Top](#)

Environmental chemical contaminants and pesticides in fish pose a potential human health hazard. Fish are harvested from waters that are exposed to varying amounts of industrial chemicals, pesticides, and toxic elements. These contaminants may accumulate in fish at levels that can cause illness. The hazard is most commonly associated with long-term exposure to these contaminants; illnesses associated with a single exposure (one meal) are very rare. Concern for these contaminants primarily focuses on fish harvested from fresh water, estuaries, and near-shore coastal waters (e.g. areas subject to shoreside contaminant discharges), rather than from the open ocean. Pesticides used near aquaculture operations may also contaminate fish. (FDA, 2001).

Control Measures

[Top](#)

Federal tolerances, action levels, and guidance levels are established for some of the most toxic and persistent contaminants that are found in fish. These levels are listed under "[FDA Guidelines](#)." States often use the Federal tolerances, action levels, and guidance levels for deciding whether to issue consumption advisories or to close waters for commercial harvesting of all or certain species of fish.

In the case of molluscan shellfish, State and foreign government agencies, called Shellfish Control Authorities, consider the degree of chemical contamination as part of their classification of harvesting waters. As a result of these classifications, molluscan shellfish harvesting is allowed from some waters, not from others, and only at certain times or under certain conditions from others. Shellfish Control Authorities then exercise control over the molluscan shellfish harvesters to ensure that harvesting takes place only when and where it has been permitted.

Significant elements of Shellfish Control Authorities' efforts to control the harvesting of molluscan shellfish include: 1) a requirement that containers of in-shell molluscan shellfish (shellstock) bear a tag that identifies the type and quantity of shellfish, harvester, harvest location, and date of harvest; 2) a requirement that molluscan shellfish harvesters be licensed; 3) a requirement that processors that shuck molluscan shellfish or ship, reship, or repack the shucked product be certified; and, 4) a requirement that containers of shucked molluscan shellfish bear a label with the processor's name, address, and certification number (FDA, 2001).

FDA Guidelines

[Top](#)

Deleterious substances

[Top](#)

Deleterious Substance	Level	Food Commodity	Reference
Aldrin/Dieldrin ^a	0.3 ppm	All fish	FDA, 1996a
Benzene hexachloride	0.3 ppm	Frog legs	FDA, 1996a
Chlordane	0.3 ppm	All fish	FDA, 1996a
Chlordecone ^b	0.3 ppm 0.4 ppm	All fish Crabmeat	FDA, 1996a
DDT, TDE, DDE ^c	5.0 ppm	All fish	FDA, 1996a
Diquat ^d	0.1 ppm	All fish	40 CFR 180.226
Fluridone ^d	0.5 ppm	Fin fish and crayfish	40 CFR 180.420
Glyphosate ^d	0.25 ppm 3.0 ppm	Fin fish Shellfish	40 CFR 180.364
Heptachlor / Heptachlor Epoxide ^e	0.3 ppm	All fish	FDA, 1996a
Mirex	0.1 ppm	All fish	FDA, 1996a
Polychlorinated Biphenyls (PCB's) ^d	2.0 ppm	All fish	21 CFR 109.30
Simazine ^d	12 ppm	Fin fish	40 CFR 180.213a
2,4-D ^d	1.0 ppm	All fish	40 CFR 180.142

Toxic elements

[Top](#)

Toxic elements	Level	Food Commodity	Reference
Arsenic (total)	76 ppm 86 ppm	Crustacea Molluscan bivalves	FDA, 1993 FDA, 1993
Cadmium	3 ppm 4 ppm	Crustacea Molluscan bivalves	FDA, 1993 FDA, 1993
Chromium	12 ppm 13 ppm	Crustacea Molluscan bivalves	FDA, 1993 FDA, 1993
Lead	1.5 ppm 1.7 ppm	Crustacea Molluscan	FDA, 1993 FDA, 1993

		bivalves	
Nickel	70 ppm 80 ppm	Crustacea Molluscan bivalves	FDA, 1993 FDA, 1993
Methyl Mercury ^f	1 ppm	All fish	FDA, 1996b

^aThe action level for aldrin and dieldrin are for residues of the pesticides individually or in combination. However, in adding amounts of aldrin and dieldrin, do not count aldrin or dieldrin found at below 0.1 ppm.

^bPreviously listed as Kepone, the trade name of chlordecone.

^cThe action level for DDT, TDE, and DDE are for residues of the pesticides individually or in combination. However, in adding amounts of DDT, TDE, and DDE, do not count any of the three found below 0.2 ppm.

^dThe levels published in 21 CFR & 40 CFR represent tolerances, rather than guidance levels or action levels.

^eThe action level for heptachlor and heptachlor epoxide is for the pesticides individually or in combination. However, in adding amounts of heptachlor and heptachlor epoxide, do not count heptachlor or heptachlor epoxide found below 0.1 ppm.

^fSee Chapter 25 for additional information.

Note: the term "fish" refers to fresh or saltwater finfish, crustaceans, other forms of aquatic animal life other than birds or mammals, and all mollusks, as defined in 21 CFR 123.3(d).

Analytical Procedures

[Top](#)

Lead

[Top](#)

- Lead in fish: Atomic absorption spectrophotometric method (AOAC, 1995d).
- Lead in fish: Polarographic method (AOAC, 1995e).

Mercury

[Top](#)

- Mercury (methyl) in fish and shellfish: Gas chromatographic method (AOAC, 1995f)
- Mercury (Methyl) in fish and shellfish: Rapid gas chromatographic method (AOAC, 1995g)
- Mercury (methyl) in seafood: Liquid chromatographic - atomic absorption spectrophotometric method (AOAC, 1995h)

Pesticides

[Top](#)

- Organochlorine and organophosphorous pesticide residues: General multiresidue method (AOAC, 1995a).
- Organochlorine and organophosphorous pesticide residues: Gas chromatographic method (AOAC, 1995b).
- Organochlorine pesticide and polychlorinated biphenyl residues in fish - Gas chromatographic method (AOAC, 1995c).

References

[Top](#)

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