

Mercury (Hg) — HMTc analyte

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THE ANALYTE

80 · Hg · Methylmercury, speciated

Methylmercury crosses the blood-brain barrier and the placenta and accumulates in developing neural tissue, so with the prenatal and early-postnatal windows the most vulnerable and no safe threshold established for developmental neurotoxicity, dietary exposure is limited to protect the developing brain.

Why it is limited

The government and expert-body assessments that underpin limiting mercury in food, and what each concluded. The maximum levels in force apply these findings; this page is the rationale, not the certification threshold.

BODY	YEAR	ASSESSMENT	WHAT IT CONCLUDED
EFSA (CONTAM Panel)	2012	Scientific Opinion on the Risk for Public Health Related to the Presence of Mercury and Methylmercury in Food, EFSA Journal 2012;10(12):2985	Set a tolerable weekly intake for methylmercury of 1.3 µg/kg bw/week, calibrated against the Faroe Islands cohort dose-response, with prenatal developmental neurotoxicity as the critical endpoint.
JECFA (Joint FAO/WHO Expert Committee on Food Additives)	2004	Evaluation of Certain Food Additives and Contaminants (Methylmercury), 61st Meeting, WHO Technical Report Series 922	Established a provisional tolerable weekly intake for methylmercury of 1.6 µg/kg bw/week, a less-conservative reading of the same developmental-neurotoxicity cohort evidence.
US EPA (Integrated Risk Information System)	2001	Methylmercury (MeHg) — IRIS Chemical Assessment Summary	Derived a reference dose (RfD) of 0.1 µg/kg bw/day (= 0.7 µg/kg bw/week) for methylmercury, the most conservative of the major assessments, applying an additional uncertainty factor to the Faroe developmental-neurotoxicity data.
Faroe Islands cohort and Seychelles Child Development Study (foundational epidemiology underpinning the agency assessments)	1986-ongoing	Prospective birth-cohort studies (Faroe initiated 1986; Seychelles initiated 1989)	The Faroe cohort found consistent associations between cord-blood mercury and neurodevelopmental deficits at ages 7 and 14 at maternal-hair Hg around 10 µg/g (fetal blood Hg around 40 µg/L), from pilot-whale consumption (MeHg often >2 mg/kg in muscle); the Seychelles cohort (ocean fish, mean maternal-hair Hg around 6-7 µg/g) found no comparable adverse association. Together they define the dose-response that anchors most regulatory advisories.

BODY	YEAR	ASSESSMENT	WHAT IT CONCLUDED
ATSDR (Agency for Toxic Substances and Disease Registry)	2024	Toxicological Profile for Mercury (October 2024)	Set a chronic-duration oral Minimal Risk Level for methylmercury of 0.1 µg/kg/day (total uncertainty factor 3), based on developmental effects. This is the value in the current October 2024 profile; it supersedes the 1999 MRL of 0.3 µg/kg/day, which is no longer in force.

Toxicological basis

Why regulators across the US, EU, and international expert bodies place binding and advisory limits on mercury in food, and why the certification species is methylmercury.

The endpoint that anchors every modern dietary mercury limit is developmental neurotoxicity from methylmercury (MeHg), the organometallic form that biomagnifies up aquatic food chains. Methylmercury crosses the blood-brain barrier and the placenta, binds cysteine residues on glutathione and other thiols, accumulates in the developing brain, and induces oxidative stress, glutamate excitotoxicity, and disruption of cellular calcium homeostasis. Because the fetal brain is affected at exposures well below those that produce any symptom in the exposed adult, the guidance values are set against the developing central nervous system rather than the adult. EFSA derived a tolerable weekly intake of 1.3 µg/kg body weight per week, calibrated against the Faroe Islands birth-cohort dose-response, and this is not a comfortable-headroom limit: frequent consumers of predatory fish can, on the wiki's reading of the literature, approach or exceed the weekly reference even when eating fish in normal serving sizes.

The population the metal reaches is defined by transplacental transfer and by the developmental window. The fetus, the breastfed infant, and the young child are the principal at-risk groups, and in-utero exposure is the most consequential window because it coincides with brain maturation. The dose-response comes from two long-running prospective cohorts: the Faroe Islands study, where mercury came from pilot-whale meat and found consistent associations between cord-blood mercury and neurodevelopmental deficits (verbal, visuospatial, and memory) at ages 7 and 14 at maternal-hair mercury around 10 µg/g, and the Seychelles study, where mercury came from ocean fish at lower maternal-hair levels and found no comparable adverse association. It is this contrast, not a single threshold, that regulators translate into the FDA/EPA joint fish-consumption advice targeting pregnant women, women who might become pregnant, and children. Long-term exposure is tracked through hair mercury, a validated biomarker roughly 250 times the simultaneous whole-blood level because methylmercury binds preferentially to cysteine in keratin.

Carcinogenicity is not the basis for any of these limits, and the frame must be stated precisely. None of the EPA IRIS, EFSA, JECFA, or ATSDR dietary reference values for mercury rests on a cancer endpoint; the methylmercury reference values are anchored on developmental neurotoxicity, and the separate inorganic-mercury reference dose on renal toxicity. A thyroid-cancer signal has been examined in meta-analysis, but the evidence base is small and suggestive rather than established, and cardiovascular associations remain contested; neither is treated by the literature as a basis for limits. The routes and species must also be kept distinct. Adult methylmercury neurotoxicity (paresthesia, ataxia, visual-field constriction, dysarthria, the Minamata syndrome) appears only at substantially higher exposure than the developmental endpoint. Inorganic mercury salts are primarily nephrotoxic

by the oral route, with autoimmune kidney effects anchoring a separate EPA reference dose; elemental mercury is primarily neurotoxic by inhalation (tremor, erethism) and is an occupational and dental-amalgam exposure, not a food-borne one. The dietary limit is a methylmercury limit.

The weight of agreement across bodies is unusual. The methylmercury reference values converge to within a factor of about 2.3 when expressed on a common daily basis: the EPA IRIS oral RfD of 0.1 µg/kg/day (equivalently 0.7 µg/kg/week, the most conservative), the EFSA TWI of 1.3 µg/kg/week, and the JECFA PTWI of 1.6 µg/kg/week, all anchored on the same Faroe and Seychelles developmental-neurotoxicity endpoint. This is the most harmonized of the heavy-metal regulatory landscapes covered by the underlying literature. The binding limits followed the science: the EU sets species-specific mercury maximum levels for fishery products under Reg. 2023/915, Codex carries methylmercury guideline levels for fish, and the FDA maintains a 1.0 ppm action level for methylmercury in fish. Where limits have not followed, the gap is visible rather than hidden: the major Western regulators (EU, FDA) set no mercury maximum level for any infant-food form (China's [GB 2762](#) is the exception, carrying a total-mercury limit for canned complementary infant foods), which is much of where a certification program has to reason from the toxicology rather than transcribe a statute.

Occurrence & exposure

How much mercury food actually carries, and why it is concentrated almost entirely in one part of the supply.

Total mercury (tHg) in the everyday prepared-food supply, µg/kg wet weight, from the FDA Total Diet Study FY2018-2020 (table-ready composites). All-zero foods are omitted; values are occurrence measurements from a government dataset, not certification thresholds. The TDS composite design under-samples large predatory fish, so the mercury-relevant signal appears in the second table.

FOOD (FDA TDS)	MEDIAN P50 MG/KG	P95 MG/KG	MAX MG/KG
Fish sticks or patties, frozen (n=3)	6.0	9.42	9.8
Cornbread, homemade (n=3)	2.9	4.07	4.2
Crisped rice cereal (n=3)	3.0	3.99	4.1
Flour tortilla (n=27)	0	0	3.4
Chocolate cake with icing (n=27)	0	1.57	1.9
Raisins (n=3)	1.3	1.57	1.6
White rice, cooked (n=27)	0	0	1.4
Collard greens, boiled (n=27)	0	1.3	1.4
Avocado, raw (n=27)	0	1.07	1.3

Methylmercury (MeHg) by fish tier, µg/kg wet weight, from the FDA/EPA joint fish-consumption advice as recorded on the Index mercury page, benchmarked against the EFSA TWI of 1.3 µg/kg bw/week (developmental-neurotoxicity endpoint). Tier ranges reflect where mercury concentrates in the food supply; these are occurrence ranges, not certification thresholds.

FDA/EPA FISH TIER	MEHG LOW MG/KG	MEHG HIGH MG/KG	SPECIES AND SERVING GUIDANCE
Best Choices	0	100	salmon, sardines, anchovies, tilapia, shrimp, trout, pollock, oysters, scallops; 2-3 servings/week
Good Choices	100	500	light canned tuna (100-300), halibut, mahi-mahi, snapper; 1 serving/week
Choices to Avoid	500	1500	swordfish, shark, king mackerel, Gulf tilefish, bigeye tuna, marlin, orange roughy; avoid

Mercury occurrence is governed by trophic position rather than by food category in general. In the everyday non-seafood supply, total mercury sits at or near the reporting floor across dairy, meat, grains, produce, and packaged foods; the few detectable readings are low and offer no meaningful exposure. The signal lives in fish, and within fish it lives in the largest, longest-lived predatory species, which biomagnify methylmercury over their lifespan to concentrations far above their prey and the surrounding water. This is why a by-food survey of prepared composites looks almost empty while the fish tiers span more than an order of magnitude.

The practical consequence for a certification program is that mercury risk is almost entirely a fish-and-seafood question, and the most consequential exposure falls on the prenatal window. Because concentration tracks species and size, the lever that moves exposure is species selection, not portion trimming alone; substituting lower-trophic species for apex predators changes the delivered dose more than any other single choice. A fish-containing product is where mercury needs to be measured and controlled, and it is measured as the species that carries the developmental risk, methylmercury.

Anchor dataset for the by-food table is the FDA Total Diet Study FY2018-2020 elemental results (A-tier government dataset). The fish-tier table draws on the FDA/EPA joint fish-consumption advice (A-tier) as recorded on the Heavy Metal Index mercury pages; corroborated by EFSA CONTAM (2012). The full occurrence corpus is on the [Heavy Metal Index](#).

How it is regulated

In-force maximum levels are almost entirely on fishery products rather than infant and child foods. The EU (Reg. 2023/915) sets species-specific mercury maximum levels for fishery products, applied as total Hg on the assumption that MeHg dominates fishery matrices; the listed-predatory-species ceiling of 1.0 mg/kg governs the cert fish-marine-predatory standard (tHg 1000 ppb, tag regulatory-alignment, id eu2023_hg_predatory_fish_1000). Codex CXS-193 carries methylmercury guideline levels for fish. The FDA action level of 1.0 ppm methylmercury in fish is nonbinding but enforcement-relevant, and the FDA/EPA joint consumption advisory adds nonbinding best/good/avoid tiers; both are documented in the Index synthesis (heavymetalindex.com/metals/mercury-methyl) rather than on a cert regulation page, because no HMTc fish standard binds to the FDA fish action level and there is no cert page that transcribes it. Critically, no government sets a mercury maximum level for any infant-food form, so across those categories HMTc reads across from China GB 2762 (total-Hg 20 for canned complementary infant foods) as a program-settled flat 20 ppb. See the cert regulation pages [/regulations/eu-2023-915](#), [/regulations/codex-cxs-193](#), and [/regulations/china-gb-2762](#) for the side-by-side derivation of the values that actually bind; do not restate the Index synthesis, which is linked outward at heavymetalindex.com/metals/mercury-methyl.

How the HMTc program treats it

Mercury is carried as two analytes on the 10-analyte panel (Pb, tAs, iAs, Cd, tHg, MeHg, Ni, Cr-VI, Sn, Al), and methylmercury is the certification species — speciated. MeHg is a priority toxic with no established safe threshold and is equal at the gate with every other claim analyte. Any exceedance enters Remediation unmarked; no metal has a transitional overage. For priority toxics the published limit is min(pooled occurrence percentile, strictest government maximum), meaning occurrence data can tighten the value below the government floor but never raise it above it. Speciation is a reflex, analogous to the total-[chromium](#)-to-Cr(VI) trigger: total mercury (tHg by TDA-AAS/CV-AFS) is the routine lot screen, and speciated MeHg by GC-ICP-MS or LC-ICP-MS is the confirmatory measurement wherever a result must distinguish MeHg from inorganic Hg. Where MeHg is the material analyte (fish and seafood) it is the binding value; where inorganic Hg dominates and MeHg is not material (infant grain and dairy foods, where MeHg is recorded 'not in scope'), tHg governs via the 20 ppb read-across. Grounded in manuals/infant-and-child-foods.md, standards/teething-and-snacks.md (mercury 20 ppb read-across; Cr(VI) reflex speciation model), and the seafood standards (standards/fish-marine-predatory.md, standards/canned-seafood.md) where MeHg is the in-development pathway species.

Literature baseline

The complete peer-reviewed and regulatory literature for mercury is maintained independently at the [Heavy Metal Index](#)^[2]. That reference reports what the literature says; this certification site applies it. The two are kept editorially separate by design.