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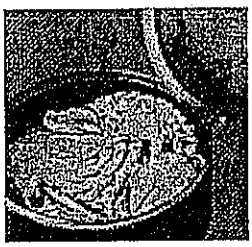

# Tuna advice updated

Wednesday, 24 March 2004

Pregnant women, and women who are intending to become pregnant, can now eat up to four medium-size cans or two tuna steaks a week according to updated Food Standards Agency advice issued today.

The Agency is updating its advice in light of a new opinion from the independent expert Committee on Toxicity of Chemicals in Food, Consumer Products and the Environment (COT).

A medium can of tuna has a drained weight of about 140g per can. A tuna steak is assumed to weigh about 140g cooked or 170g raw.

The Committee revised its opinion following the release of updated guidelines from the World Health Organization on the levels of mercury in fish. This advice has led the Agency to now relax its guidance to pregnant women on eating tuna in particular, doubling the maximum amount previously recommended.

A survey carried out by the FSA in 2002 revealed relatively high levels of mercury in tuna, marlin, swordfish and shark. The FSA requested advice from the Committee on Toxicity and, in line with the Committee's opinion, issued guidance because the mercury in these fish can harm an unborn baby or a developing baby's nervous system.

Advice not to eat shark, swordfish or marlin remains unchanged for pregnant women, women intending to become pregnant and children under 16. However, a weekly portion of these fish would not be harmful for other adults and there are no reasons for children and other adults to restrict the amount of tuna they eat.

**Mercury in fish**
Find out more about our latest advice on mercury and fish

**Updated COT statement on a survey of mercury in fish and shellfish**
Read the COT advice in full

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FOOD STANDARDS AGENCY

# Mercury in fish: your questions answered

Find out more about our latest advice about mercury in fish.

Q&A

## What is the problem with mercury in fish?

Nearly all fish contain traces of mercury and in most fish this is not a problem. But certain fish contain relatively higher levels of mercury.

Q&A

## Which fish are we talking about?

Pregnant women and women intending to become pregnant should avoid shark, marlin and swordfish. They may also need to limit the amount of tuna they eat.

Q&A

## Who could be affected by the mercury and why?

This is mainly an issue for pregnant women and women who intend to become pregnant. This is because of the possible risks to the developing nervous system of the unborn child.

Q&A

## Are other adults affected?

High levels of mercury can affect anyone, but while no one else over 16 years of age needs to avoid shark, marlin and swordfish, the Agency does advise that people should not eat more than one portion of any of these fish once a week.

Q&A

## Can I still eat tuna?

Yes, everyone can eat tuna. But the mercury that it contains means that the Agency is advising that if you are pregnant or intending to become pregnant, you shouldn't eat more than four medium-sized cans or two fresh tuna steaks per week.

Q&A

## What is the advice for children?

Children under 16 should avoid eating shark, marlin and swordfish.

### I'm pregnant and have been eating a lot of tuna, have I harmed my child?

You are unlikely to have caused your unborn child any harm, as this is a limit with a safety margin built in. But to be on the safe side, you should now limit the amount of tuna you eat.

### I'm pregnant and still want to eat fish, what should I do?

You should not eat shark, marlin or swordfish and you may need to limit how much tuna you eat. Everyday favourites such as cod, haddock and plaice are not affected at all by this advice. And there are other oily fish with known health benefits that you can eat as an alternative to fresh tuna, such as mackerel, herring, pilchard, sardine, trout or salmon.

### Is fish still an important part of a healthy diet?

Yes. And most of us don't eat enough of it. The Agency recommends that people eat at least two portions of fish a week, one of which should be oily. Oily fish provide known health benefits – for example, it contains nutrients that protect against heart disease. Although fresh tuna is an oily fish, during the canning process these fats are reduced, so canned tuna does not count as oily fish.

### Why is this advice being updated?

The Agency has updated its advice in the light of a new opinion from the independent Committee on Toxicity of Chemicals in Food, Consumer Products and the Environment. The COT revised its opinion following updated guidelines on mercury from the World Health Organization.

## 英国食品基準庁（Food Standards Agency）（仮訳）

２００４年３月２４日（水）

食品基準庁は、本日付で、妊婦や妊娠を予定している女性は、１週間に中サイズの缶詰は４缶、ツナステーキは２枚を超えて摂食すべきでない旨の勧告を発表した。

基準庁は、「食品、消費者製品、環境中の化学物質の毒性に関する委員会（Committee on Toxicity of Chemicals in Food, Consumer Products and the Environment: COT）（独立専門家委員会）」らの最新の意見に照らし、以前の勧告を更新した。

基準庁（FSA）は、WHO から提示された魚の水銀濃度に関する最新指針に伴い、従前の勧告を改正した。この勧告において、ＦＳＡは特に妊婦のマグロの摂食に関する手引きについて、以前に勧告した最大量を２倍にまで緩和した。

ＦＳＡは、2002 年の研究で、マグロ、メカジキ、マカジキ、サメ中の水銀は比較的高濃度であることを明らかにした。ＦＳＡは、これらの魚中に存在する水銀は、胎児または発達中の乳児の神経系に有害であるため、COT に意見を求め、更にその意見に基づき手引きを発表した。

「妊婦、妊娠を予定してい女性及び１６歳以下の子供は、サメ、メカジキ、マカジキを食べてはならない」とする勧告は変更ないが、その他の成人については、１週間当たりこの分量を食しても有害である恐れはなく、また、子供やその他の成人がマグロの摂食量を制限すべき理由はどこにもない。

### 魚の水銀の関するＱ＆Ａ

Ｑ．魚中の水銀に関しては何が問題なのか？
Ａ．殆ど全ての魚が水銀を含有しているが多くの魚について問題はない。しかし、特定の魚種は比較的高濃度の水銀を含有している。

Ｑ．どの魚が問題なのか？
Ａ．妊婦や妊娠を予定している女性は、サメ、メカジキ、マカジキは避けるべきである。また、マグロについても摂食制限が必要である。

Ｑ．誰が水銀の影響を受ける可能性があり、またそれは何故か？
Ａ．主として、妊婦及び妊娠を予定している女性の問題である。それは、胎児の発達途中の神経系に対して有害である可能性があるため。

Q．その他の成人も影響を受けるか？
A．高濃度の水銀は誰にでも影響を引き起こす。１６歳以上の者はサメ、メカジキ、マカジキを避ける必要はないが、基準庁として１週間に１回以上摂食しないよう助言する。

Q．マグロは食べても大丈夫か？
A．誰でも食べても良いが、その水銀含有量から、基準庁は、妊婦や妊娠を予定している女性は、１週間に中サイズの缶詰は４缶、ツナステーキは２枚を超えて摂食しないよう助言する。

Q．子供に対する注意の内容は？
A．１６歳以下の子供はサメ、メカジキ、マカジキの摂食を避けるべき。

Q．現在妊娠中で、今までにたくさんのマグロを摂食したが、子供に影響を及ぼしたか？
A．これは十分な安全性を考慮した制限であり、胎児に影響を与えたとは考えられない。しかし、安全を考慮してマグロの消費量は制限すべき。

Q．妊娠中だが魚を食べたい。どうしたらいいのか？
A．サメ、メカジキ、マカジキを摂食すべきではない。マグロについても、多量に摂食しない様に制限すべき。タラ、コダラ（haddock）、アカカレイ（plaice）等、日々好んで摂食している魚種はこの勧告とは関係ない。サバ、ニシン、ピルチャード、イワシ、マス、サケなどマグロの代わりに摂食でき、かつ既知の健康効果を有する多量の魚油を含む魚がある。

Q．魚はなお、健康的な食事を構成する重要な食品か？
A．そのとおりである。多くの人は十分な量の魚を食べおらず、基準庁は１週間に少なくとも２回魚を摂食し、その内１回は多量の魚油を含む魚を摂食するよう助言する。多量の魚油を含む魚には、例えば心臓病を防止する栄養素を含むといった既知の健康効果がある。新鮮なマグロは多量の魚油を含む魚として認知されているが、缶詰加工中に魚油が減少するため、マグロ缶詰は多量の魚油を含むものと見なされない。

Q．なぜ勧告を更新したのか？
A．基準庁は、食品、消費者製品、環境中の化学物質の毒性に関する委員会（COT）の意見を踏まえ勧告を更新した。COT は、WHO の水銀に関するガイドラインの更新を踏まえ意見を更新した。

**COMMITTEE ON TOXICITY OF CHEMICALS IN FOOD, CONSUMER PRODUCTS AND THE ENVIRONMENT**

# UPDATED COT STATEMENT ON A SURVEY OF MERCURY IN FISH AND SHELLFISH

## Introduction

1. In 2002, the Committee reviewed the results of a Food Standards Agency (FSA) survey of the mercury levels in imported fish and shellfish and UK farmed fish and their products[1] and the provisional results of blood mercury levels in UK adults[2].

2. The Committee concluded that the Provisional Tolerable Weekly Intake (PTWI) of 3.3 μg/kg bw/week could be used in assessing methylmercury intakes by the general population. This PTWI was initially established by the Joint FAO/WHO Expert Committee on Food Additives and Contaminants (JECFA) in 1972 and confirmed on a number of occasions up to the year 2000, However, the 2000 JECFA PTWI was not considered adequate to protect against neurodevelopmental effects. The EPA reference dose of 0.1 μg/kg bw/day (0.7 μg/kg bw/week) was therefore applied for women who are pregnant, or who may become pregnant within the following year, or for breast-feeding mothers. The COT also noted that its conclusions should be reviewed following the JECFA evaluation of methylmercury in 2003.[3]

3. In June 2003, JECFA recommended that the PTWI for methylmercury should be reduced from 3.3 μg/kg bw/week to 1.6 μg/kg bw/week. The Committee has therefore reviewed its previous evaluation in the light of the new JECFA PTWI, also taking into account more recent data on fish consumption by adults. This statement on mercury in fish and shellfish supersedes COT statement 2002-04.

4. The FSA has asked a subgroup of members of the COT and the Scientific Advisory Committee on Nutrition (SACN) to provide combined advice on the risks and benefits associated with fish consumption. The advice expressed in this COT statement therefore aims to protect the populations who are most susceptible to the risks of methylmercury, without being over-protective of individuals at lesser risk.

## Background

5. The toxicity of mercury is dependent on whether it is inorganic, elemental or organic (e.g. methylmercury). Methylmercury affects the kidneys and also the central nervous system, particularly during development, as it

crosses both the blood-brain barrier and the placenta[4]. Both neuro- and nephrotoxicity have been associated with acute methylmercury poisoning incidents in humans, and neurotoxicity, particularly in the developing fetus, has been associated with lower level chronic exposures.

6. Exposure of the general population to mercury can occur via inhalation of mercury vapour from dental amalgam fillings (elemental), or through the diet (methylmercury and inorganic mercury)[5]. Methylmercury in fish makes the most significant contribution to dietary exposure to mercury, although smaller amounts of inorganic mercury are present in other food sources. All forms of mercury entering the aquatic environment, as a result of man's activities or from geological sources, are converted into methylmercury by microorganisms and subsequently concentrated in fish and other aquatic species. Fish may concentrate the methylmercury either directly from the water or through consuming other components of the food chain. Methylmercury has a half-life of approximately 2 years in fish; thus, large older fish, particularly predatory species, will have accumulated considerably more methylmercury than small younger fish.

**Previous COT evaluation**

7. The COT previously considered the results of a survey of metals and other elements in marine fish and shellfish[6] published by the Ministry of Agriculture, Fisheries and Food (MAFF) in 1998. The survey examined a number of fish and shellfish species landed in the UK or imported from overseas ports including cod, haddock, herring, mackerel, lobster, mussels, crab and shrimps and samples of cod fish fingers. The survey also produced estimates of the mean and 97.5th percentile dietary intakes of the elements surveyed.

8. The 1998 survey demonstrated that the levels of mercury in the fish and shellfish tested were low and that average and high level fish and shellfish consumers in the UK would not exceed the then current JECFA PTWI for methylmercury of 3.3 μg/kg bw/week, even assuming all the mercury in fish was in this form. The estimated mercury intake for the highest level consumer was 1.1 μg/kg bw/week including mercury intake from the rest of the diet. The main conclusion drawn from the survey was that "dietary intakes of the elements surveyed were below safe limits, where defined, and did not represent any known health risk even to consumers who eat large amounts of marine fish or shellfish".

**International Safety Guidelines**

*Previous Joint FAO/WHO Expert Committee on Food Additives (JECFA) Evaluations*

9. In 1972, JECFA established a PTWI of 5 μg/kg bw/week for total mercury, of which no more than two thirds (3.3 μg/kg bw/week) should be from methylmercury[7]. The PTWI of 3.3 μg/kg bw/week for methylmercury was subsequently confirmed in 1989 and 2000 [8,9]. The PTWI was derived from

toxicity data resulting from poisoning incidents at Minamata and Niigata in Japan. In these incidents the lowest mercury levels associated with the onset of clinical disease in adults were reported to be 50 μg/g in hair and 200 μg/L in whole blood. Individuals displaying clinical effects, such as peripheral neuropathy, at these mercury levels were considered to be more sensitive than the general population, because there were a number of persons in Japan and other countries with higher mercury levels in hair or blood who did not experience such effects. However, the methods employed in determining the intake associated with toxicity, and the subsequent establishment of the PTWI are unclear.

10. In 1989, JECFA had noted that pregnant women and nursing mothers may be at greater risk than the general population to adverse effects from methylmercury. Therefore in its' 2000 re-evaluation of methylmercury, JECFA paid particular attention to possible effects of prenatal and postnatal exposure, looking at large long-term prospective epidemiological studies conducted in the Seychelles Islands and the Faroe Islands. These studies attempted to identify the lowest dietary mercury exposure associated with subtle effects on the developing nervous system [10,11,12,13]. They followed the neurological development of the children by testing their learning and spatial abilities at a number of time-points during their childhood. A number of smaller studies were also considered.

11. JECFA compared the two main studies;

- The Faroe Islands cohort was tested up to the age of 7 years, whereas at the time of the JECFA evaluation, the Seychelles cohort had only been tested up to the age of 5.5 years.
- Exposure in the Seychelles was through consumption of a range of fish species with average mercury concentrations between 0.05 and 0.25 mg/kg. In the Faroe Islands, most of the population consumed fish at least three times a week and occasionally (approximately once per month) consumed pilot whale, which contains up to 3 mg/kg mercury. Pilot whale also contains high concentrations of polychlorinated biphenyls (PCBs), but a reanalysis of the data indicated that any effects seen in the Faroes cohort could not be attributed to confounding by the PCBs [14].
- The two studies used different methodology in assessing methylmercury exposure. The Seychelles study used maternal hair samples (approx. 9cm long), one taken shortly after birth to estimate methylmercury exposure during pregnancy and one taken 6 months later. The Faroe Islands study used cord blood and maternal hair (various lengths) taken at birth.
- The studies used different batches of tests to assess the effects of methylmercury on neurological development. The tests used in the Faroe Islands study examined specific domains in the brain (visual, auditory, etc.). The Seychelles study used tests of a more global nature, with each test examining a number of domains.

12. JECFA found that although the mean mercury exposures during pregnancy (assessed by maternal hair mercury) were similar[§], the results of these two studies were conflicting. In the Faroes study, regression analysis showed an association between methylmercury exposure and impaired performance in neuropsychological tests, an association that remained even after excluding the results of children with exposures associated with greater than 10 μg/g maternal hair mercury. However in the Seychelles study regression analysis identified no adverse trends, but increased maternal hair mercury was associated with a small statistically significant improvement in test scores on several of the developmental outcomes. The investigators noted that this could be due to beneficial nutritional effects of fish. A secondary analysis was performed where the results were split into sub-groups based on the maternal hair mercury level. Test scores in children with the highest mercury exposures (12 - 27 μg/g maternal hair) were not significantly different from the test scores in children with lowest exposure (< 3μg/g maternal hair).

13. A smaller study carried out in New Zealand on 6 year-old children[15] used a similar batch of tests to the Seychelles study and had similar exposure to methylmercury, yet found methylmercury related detrimental effects on behavioural test scores. However there were possible confounding factors that may have influenced the results of the New Zealand study, such as the ethnic group and social class of the children studied.

14. Having considered all of the epidemiological evidence, JECFA concluded that it did not provide consistent evidence of neurodevelopmental effects in children whose mothers had hair mercury levels of 20 μg/g or less. Since there was no clear indication of a consistent risk, JECFA did not revise its' PTWI, but recommended that methylmercury should be re-evaluated when the latest evaluation of the Seychelles study and other relevant data become available[9].

*Environmental Protection Agency (EPA)*

15. In 1997 the US EPA established a reference dose of 0.1 μg/kg bw/day for methylmercury[16]. This was based on a peak maternal hair mercury level during pregnancy of 11 μg/g, which was associated with developmental effects (e.g. late walking, late talking, mental symptoms, seizures) in children exposed *in utero* during a poisoning incident in Iraq in 1971.

16. In 2000, the US National Research Council (NRC) published a review of this EPA reference dose[26]. Following analysis of the data resulting from the available epidemiological studies, the NRC identified a benchmark dose lower confidence limit of 12 μg/g in maternal hair (corresponding to 58 μg/L in cord blood, assuming a ratio of hair:cord blood of 200:1). This was the lower 5% confidence limit of the lowest dose considered to produce a sufficiently

[§] Seychelles: arithmetic mean 6.8 μg/g, range 0.5-26.7 μg/g;
Faroes: geometric mean, 4.27 μg/g, the upper mercury level in maternal hair is not clear from the reported data but may be as high as 70 μg/g.

reliable neurological endpoint (a 5% increase in abnormal scores on the Boston Naming Test[**]) in the Faroe Islands study. The NRC made a number of assumptions in deriving an estimate of methylmercury intake and included a composite uncertainty factor of 10, to account for interindividual variability and database insufficiencies, concluding that the reference dose of 0.1 μg/kg bw/day, as had previously been used by the EPA, was scientifically justifiable.

*2003 JECFA Evaluation*

17. At its 61st meeting in June 2003[17], JECFA reviewed the new data from the Seychelles Child Development Study[18], re-analyses of the Faroes and New Zealand studies, epidemiological data from a number of small scale cross-sectional studies, and additional epidemiological data on reproductive toxicity, immunotoxicity, cardiotoxicity and general medical status.

18. The 9-year neurodevelopmental evaluations from the Seychelles study were performed using neurodevelopmental tests which, in contrast to the earlier assessments, allowed a direct comparison with the results of the Faroes Islands Study. The new data from the Seychelles study were consistent with results obtained at younger ages and provided no evidence for an inverse relationship between maternal methylmercury exposure and neurodevelopmental performance in infants. Additional analyses carried out on the Seychelles data from younger ages did not alter the conclusion that in the Seychelles population of frequent fish-consumers, no adverse effects of prenatal methylmercury exposure have been detected.

19. No new data were available from the Faroes Islands study. New analyses of the existing data did not support a role of occasional exposure to higher levels of methylmercury or polychlorinated biphenyls (PCBs) from consumption of whale-meat, in accounting for the positive associations in this study[19,20,14,21]. The additional epidemiological data from smaller cross-sectional studies on neurodevelopmental effects of methylmercury were reviewed. Because of the cross-sectional design and because adult hair mercury levels do not accurately reflect previous exposure during the critical period for neurodevelopmental effects, JECFA did not consider that the results from these studies could be used to form the basis of a dose response assessment.

20. JECFA noted that despite additional evidence of immunotoxicity, cardiotoxicity, and reproductive toxicity, neurotoxicity was still considered to be the most sensitive endpoint, and concluded that the PTWI should be based on studies of this endpoint. It was uncertainty about the possibility that significant immunotoxicity or cardiovascular effects could occur at levels below the neurodevelopmental benchmark dose that had led to the inclusion of an additional safety factor for database insufficiencies in the composite factor of 10 recommended by the NRC.

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[**] The Boston Naming Test is a neuropsychological test that assesses an individual's ability to retrieve a word that appropriately expresses a particular concern, for example naming an object portrayed by a simple line drawing.

21. JECFA based its evaluation on the Seychelles and Faroe Islands studies. In the absence of a dose response analysis of the latest Seychelles data, the analysis of the data from younger ages was used since it was consistent with the latest data. Exposure associated with a maternal hair concentration of 15.3 µg/g mercury was identified as the no observed adverse effect level (NOAEL) for the Seychelles study[22]. A benchmark dose lower confidence limit (BMDL) of 12 µg/g mercury in maternal hair was determined from the Faroes data[23,24,25,26,27]. This was viewed as a surrogate for the NOAEL.

22. Averaging the NOAEL and the BMDL resulted in a composite maternal hair concentration of 14 µg/g mercury reflecting exposure that was without effects in these study populations. Dividing by the average hair:blood ratio of 250 allowed conversion of the 14 µg/g in hair to a maternal blood mercury level of 56 µg/L. A pharmacokinetic model appropriate to pregnancy was then used to convert the blood mercury level to a steady-state daily ingestion of methylmercury of 1.5 µg/kg bw/day, which would be without appreciable adverse effects in the offspring of the Seychelles and Faroe Islands study populations. The model assumed a maternal blood volume of 7 L (9% of body weight) whereas the EPA used a value of 5 L and the NRC 3.6 L.

23. JECFA then applied a data-specific adjustment factor of 2 to allow for inter-individual variability in the hair:blood ratio, and a default uncertainty factor of 3.2 to account for inter-individual variability in the association between blood mercury concentration and intake. This resulted in a PTWI of 1.6 µg/kg bw/week, which JECFA considered to be sufficiently protective of the developing fetus. A factor for inter-individual variability in toxicodynamics was not required because the PTWI was based on studies in the most sensitive subgroup.

24. In its review, JECFA found no additional information that would suggest that the general population is at risk of methylmercury toxicity at intakes up to the previous PTWI of 3.3 µg/kg bw/week.

**Survey of the mercury levels in fish**

25. The 2002 FSA survey complemented the previous MAFF survey since it examined a wider range of fish, including imported exotic species of fish that have become more widely available on the UK market. These included shark, swordfish, marlin, orange roughy, red snapper and monkfish, as well as UK farmed fish such as salmon and trout[1].

26. Of the fish species covered by the survey, all but 3 species had mean mercury levels falling within the range 0.01 –0.6 mg/kg of fish. This range is in line with the levels defined by European Commission Regulation 466/2001 as amended by European Commission Regulation 221/2002 (0.5 mg of mercury/kg for fish in general and 1.0 mg mercury/kg for certain larger predatory species of fish including shark, swordfish, marlin, tuna and orange roughy).

27. The 3 species with the highest mercury content were shark, swordfish and marlin. These fish had mean mercury levels of 1.52, 1.36, and 1.09 mg/kg respectively and were therefore above the levels defined in European Commission Regulation 221/2002. Fresh tuna contained mercury levels ranging from 0.141 to 1.50 mg/kg with a mean of 0.40 mg/kg (only one sample out of 20 exceeded 1 mg/kg, the maximum mercury concentration in the other 19 samples was 0.62 mg/kg), whereas canned tuna had a lower mean mercury level of 0.19 mg/kg.

**Blood mercury levels in British adults**

28. A report produced by the Medical Research Council Human Nutrition Research in March 2002 detailed the provisional blood total mercury data obtained from 1320 adults (aged 19-64 years) participating in the National Diet and Nutritional Survey (NDNS)[2].

29. The mean and 97.5$^{th}$ percentile blood mercury levels in the survey were 1.6 and 5.88 μg mercury/L respectively. The highest blood mercury level found in the study was approximately 26 μg/L in an individual with a high fish intake. If the blood mercury level was at steady state, and assuming a body weight of 70 kg and a blood volume of 9% of the body weight, then using the same pharmacokinetic model employed by JECFA in its 2003 evaluation, this would correspond to a mercury intake of approximately 5.39 μg/kg bw/week (0.77μg/kg bw/day).

30. Of the population covered by the survey, 97.5% had blood mercury levels indicating that their mercury intakes were within the 2003 JECFA PTWI of 1.6 μg/kg bw/week.

**COT evaluation**

31. The Committee discussed the possible risks associated with dietary exposure to methylmercury, in the light of the new JECFA PTWI and the information on intakes from fish and on blood mercury levels in the UK population.

*Toxicokinetic considerations*

32. Following ingestion, approximately 95% of methylmercury is absorbed through the gastrointestinal tract, and it is subsequently distributed to all tissues in about 30 hours with approximately 5% found in blood and 10% in the brain. The methylmercury concentration in red blood cells is approximately 20 times higher than that in the plasma. Methylmercury readily crosses the placental barrier. Fetal brain mercury levels are approximately 5-7 times higher than in maternal blood. Methylmercury readily accumulates in hair and the ratio of hair mercury level (μg/g) to maternal blood mercury level (μg/L) is approximately 250:1. Based on comparisons to hair concentrations, cord blood concentrations are reported to be 25% higher than the concentrations in maternal blood[10].