

## Criteria for dietary recommendations for freshwater fish contaminated with dioxins and PCBs

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Dioxins and polychlorinated biphenyls (PCBs) are environmental contaminants that are mostly taken in through the consumption of fatty foods of animal origin. Because of their long residence time in the body as well as their toxic properties, human exposure to these substances should be reduced as much as possible. The consumption of freshwater fish constitutes a special entry path of these substances as the fish may exhibit high levels of dioxins and PCBs resulting from contaminated bodies of water which the fish inhabit and from which they are caught. Commercially available fish may (with the exception of eel) contain a maximum of 8 picograms (8 pg = 0.000 000 000 008 g) of so-called dioxin equivalents per gram of fish. However, such concentrations are scarcely detected in commercial fish. According to data provided by the official control of foodstuffs, the concentrations are usually much lower. BfR thus considers consumers to be adequately protected from health detriments especially if fish is consumed in accordance with recommendations of the German Nutrition Society (one to two meals per week).

However, anglers and their families constitute a special risk group as they prepare and consume self-caught freshwater fish from bodies of water that are more contaminated. This group of people is not protected by legislation since foodstuffs obtained in this manner are not subject to official controls. It cannot be ruled out that under these circumstances, fish are consumed with concentrations of dioxins and PCBs that exceed the legal maximum concentrations. In this regard, the *Länder* authorities responsible for food safety have already communicated special dietary recommendations for the risk group of anglers and their families. The Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) has now asked the Federal Institute for Risk Assessment (BfR) to compile criteria for dietary recommendations in order to ensure an approach throughout Germany that is as consistent as possible.

BfR on principle considers that the same protective aims apply to anglers and their families as those that apply to other consumers. This means that they should also not consume fish that contains dioxin and PCB exceeding the maximum levels in force. The weekly tolerable intake amount of 14 pg dioxin equivalents (WHO-TEQ)/kg body weight (BW) should therefore in no case be exceeded over a longer period of time.

### 1 Subject of the assessment

The Federal Institute for Risk Assessment (BfR) has been asked to compile criteria for dietary recommendations for freshwater fish that can be contaminated with dioxins and PCBs. The criteria should apply to the specific group of anglers and their families.

### 2 Results

In its health assessment "EU maximum levels of dioxins and dioxin-like PCBs in fish do not always ensure sufficient protection of consumers eating large quantities of fatty fish" (*EU-Höchstgehalte für Dioxine und dioxinähnliche PCB in Fisch schützen Vielverzehrer von fetthaltigem Fisch nicht immer ausreichend*, No. 041/2006 of 1 June 2006), the Federal Institute for Risk Assessment (BfR) shows that existing maximum levels do not always adequately protect consumer groups with particular eating habits. Among others, these groups include people who eat large quantities of fatty fish, such as salmon, mackerel and especially eel,

over an extended period of time, and anglers if they catch edible fish for their own consumption in contaminated water bodies over an extended period of time.

For “average” consumers, who only buy commercially available fish, these fish are likely to vary in terms of species and origin. It can therefore be expected that their dioxin and PCB contents in total do not reach the applicable maximum levels. The maximum levels for WHO-PCDD/F-WHO-PCB-TEQ (WHO-TEQ) are thus considered sufficient (Commission Regulation (EC) No. 1881/2006).

Anglers (and their families), who prepare and consume self-caught fish, are not protected by the provisions on maximum levels in fish, as they obtain this foodstuff for their own consumption, and such foodstuffs are not subject to official food inspection. Studies have revealed that river fish (especially eels) from certain water bodies may contain high levels of dioxins and dioxin-like PCBs, which are above the applicable maximum levels. Therefore, the above-mentioned group should be protected against an excess intake of dioxins and PCBs. In principle, there are two options to achieve this:

1) The most obvious solution is the recommendation not to eat fish that exceed the maximum levels stipulated by law. Such a recommendation could be published by the competent authorities of the Federal Länder.

The protection goals applying to anglers should be the same as for all consumers. Thus, as a rule, no fish should be consumed that contain dioxin or PCB concentrations (WHO-TEQ) exceeding the applicable maximum levels.

Anglers potentially consume a lot of fish. They must therefore take into account that, even if they consume fish with concentrations below the maximum levels, their total intake of dioxins and PCBs can still exceed the TWI. For example, regular consumption of fish with a concentration of 4 pg WHO-TEQ/g fish (200 g serving) every two (1.9) weeks is tolerable in order not to exceed the TWI, while allowing for additional WHO-TEQ exposure through other foodstuffs.

2) An alternative would be to ensure that the long-term WHO-TEQ intake by the group of anglers and their families does not exceed the tolerable weekly intake (TWI) set by the Scientific Committee on Food (SCF, 2001) at 14 pg WHO-TEQ/kg body weight (BW) per week. In this calculation the WHO-TEQ intake from other foodstuffs must be taken into account as well, assuming that the average daily WHO-TEQ intake from these foodstuffs in Germany is approximately 1 pg WHO-TEQ/kg BW/day (7 pg WHO-TEQ/kg BW/week).

### 3 Reasons

Model calculations to determine the amount of dioxins and PCBs taken in and the period over which the intake of these substances is tolerable are based on a standard serving size of 200 g. The table (see below) lists various concentrations of dioxins and PCBs in fish in conjunction with the frequency of consumption (examples). These data are used to calculate the total intake and to relate this to the tolerable weekly intake (TWI), indicating the shortest period in which the TWI is not exceeded. If a daily average intake of WHO-TEQ through food other than fish of about 1 pg WHO-TEQ/kg BW/day (7 pg WHO-TEQ/kg BW/week) is assumed, fish consumption accounts for the remainder of the TWI of 7 pg WHO-TEQ/kg BW/week.

**Table: Intake of dioxins and PCBs (WHO-TEQ) through fish consumption: list of various concentrations of these substances in conjunction with the frequency of consumption, making full use of the tolerable weekly intake (TWI)**

| Fish consumption frequency and serving size | concentration of dioxins and PCBs in the fish in WHO-TEQ <sup>2)</sup> | intake of dioxins and PCBs in WHO-TEQ <sup>2)</sup> by humans <sup>1)</sup> through fish consumption | frequency of fish consumption to make full use of <sup>4)</sup> the TWI <sup>3)</sup> |
|---|--|--|---|
| G   | pg/g fish  | pg/kg BW/day   | weeks   |
| 200   | 4  | 13.3   | 1.9   |
| 200   | 8 <sup>5)</sup>  | 26.7   | 3.8   |
| 200   | 10   | 33.3   | 4.8   |
| 200   | 12 <sup>6)</sup>   | 40.0   | 5.7   |
| 200   | 20   | 66.7   | 9.5   |
| 2 x 200                                     | 10   | 66.7   | 9.5   |
| 200   | 30   | 100  | 14  |
| 3 x 200                                     | 10   | 100  | 14  |
| 200   | 40   | 133  | 19  |
| 4 x 200                                     | 10   | 133  | 19  |
| 200   | 50   | 167  | 24  |
| 5 x 200                                     | 10   | 167  | 24  |
| 200   | 100  | 333  | 48  |

<sup>1)</sup> Human body weight (BW): 60 kg

<sup>2)</sup> WHO-PCDD/F-PCB-TEQ

<sup>3)</sup> Tolerable weekly intake (TWI): 14 pg WHO-TEQ/kg BW/day

<sup>4)</sup> Total intake from all other foodstuffs except for fish has been accounted for with an average daily intake of 1 pg WHO-TEQ/kg BW

<sup>5)</sup> Maximum content for fish (except for eel): 8 pg WHO-TEQ/g fish

<sup>6)</sup> Maximum content for eel: 12 pg WHO-TEQ/g fish

The table shows, for example, that in case of a concentration of 50 (10) pg WHO-TEQ/g fish, the consumption of 200 g fish once (five times) in a period of 24 weeks (about half a year) is just about tolerable. This is the maximum to ensure that the tolerable weekly intake (TWI) is not exceeded on average. The model "budget" approach used in the table, which sometimes can go along with considerable exceedances of the tolerable weekly intake in a particular week, is considered acceptable by BfR for the special case of dioxin and PCB intake if the average intake over a longer period of time (e.g. one year) does not exceed the TWI. This would also make it possible to subdivide a year into an "angling season" and an "off season", on condition that the total TWI is not exceeded on average during these two periods taken together.

The example also clearly illustrates that a budget approach based on a longer period of time may theoretically be in line with the overall model, but reaches its limits when it comes to practical implementation due to the long periods considered (frequency of fish consumption making full use of the TWI), in particular for fish containing concentrations that by far exceed the maximum levels (e.g. by a factor of two). Fish containing such high concentrations should not be consumed under any circumstances.

Moreover, from the point of view of health-related consumer protection, BfR recommends not to make full use of the tolerable weekly intake – also in view of the great success in minimising exposure of the population to these substances.

#### **4 Conclusion**

In general, foodstuffs with a comparatively high concentration of pollutants, such as river fish from certain regions, should not contribute to undesired and unnecessary exposure of individuals to pollutants – even if this only affects the small group of anglers and their families. BfR therefore recommends that the consumption of river fish containing high concentrations of dioxins and PCBs should be avoided out of precaution. Thus, from the point of view of health-related consumer protection, BfR recommends not to make full use of the tolerable weekly intake – also in view of the great success in minimising exposure of the population to these substances.