CODEX ALIMENTARIUS COMMISSION E

Food and Agriculture Organization of the United Nations

World Health Organization

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JOINT FAO/WHO FOOD STANDARDS PROGRAMME

CODEX COMMITTEE ON CONTAMINANTS IN FOODS

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DISCUSSION PAPER ON NON–DIOXIN LIKE PCBs IN THE CODE OF PRACTICE FOR THE PREVENTION AND REDUCTION OF DIOXINS AND DIOXIN-LIKE PCBs

BACKGROUND

1. At its 80th meeting in 2015, the Joint FAO/WHO Expert Committee on Food Additives (JECFA80) assessed the toxicity of non-dioxin-like polychlorinated biphenyls (NDL-PCBs)[1]. JECFA concluded that none of the available studies on the NDL-PCBs known as the six indicator PCBs (PCB 28, PCB 52, PCB 101, PCB 138, PCB 153 and PCB 180) and PCB 128, was suitable for derivation of health-based guidance values or for assessment of the relative toxic potency of the NDL-PCBs relative to a reference compound. Therefore, a comparative approach using the minimal effect doses was developed in order to estimate Margins of Exposure (MOEs) to provide guidance on human health risk. Owing to the long half-lives of these chemicals and to eliminate interspecies differences in toxicokinetics, JECFA considered it appropriate to estimate body burdens rather than using external dose (dietary exposure) for the risk characterization. Comparison of the human body burden estimates (derived from human milk concentrations) with the body burden estimates from animal studies derived as points of departure for each congener resulted in MOEs for adults ranging from 4.5 to 5000.

2. MOEs for breastfed infants, which may have a body burden up to 2-fold higher than that of adults, would be approximately half of the adult values. The MOEs for children would be expected to be intermediate between those for adults and those for breastfed infants, owing to the initial contribution from breastfeeding and the subsequent lower dietary contribution compared with human milk.

3. Because the MOEs are based on minimal effect doses, they were considered to give some assurance that dietary exposures to NDL-PCBs are unlikely to be of health concern for adults and children, based on the available data. For breastfed infants, the MOEs would be expected to be lower. However, based on present knowledge, the benefits of breastfeeding are considered to outweigh the possible disadvantages that may be associated with the presence of NDL-PCBs in breast milk.

4. The focus of efforts related to preventing exposure to persistent organic pollutants (POPs), including NDL-PCBs, is on limiting contamination of the food-chain, including exposure of food-producing animals to PCBs. With the knowledge that fish, meat and dairy product consumption makes the most significant contribution to human PCB exposure, methods of PCB reduction in animals from which these foods are derived are of primary interest. Transfer of dioxin-like (DL) PCBs and NDL-PCBs from feed to animal-based food products (e.g. milk) occurs; transfer of PCB 138, PCB 153 and PCB 180 is greater than that observed for PCB 28, PCB 52 and PCB 101. Adherence to good agricultural practices and good animal feeding practices will contribute to the efforts to reduce PCB concentrations in food for human consumption.

5. NDL-PCBs are thermally stable and resistant to degradation. Studies on the impact of processing of foods in relation to PCB concentrations have been largely focused on the cooking techniques used to prepare foods and techniques that change the fat content (e.g., PCB levels tend to be lower in skimmed milk, but higher concentrations are found in dairy foods with higher fat content, such as cheese or cream). Although the studies related to the impact of processing on PCB concentrations include both DL-PCBs and NDL-PCBs, the impact on the concentrations is similar for both types of PCBs. Ultimately, it was concluded that processing techniques, such as trimming, which result in the removal of lipids will lead to a decrease in PCB concentrations in the final food product.

[1] Safety evaluation of certain food additives and contaminants. Supplement 1: Non-dioxin-like polychlorinated biphenyls, WHO Food Additives Series: 71-S1. Available at: http://apps.who.int/iris/bitstream/10665/246225/1/9789241661713-eng.pdf

6. The 10th Session of the Codex Committee on Contaminants in Foods (CCCF10) (April 2015) agreed to establish an Electronic Working Group chaired by the European Union (the list of participants to the EWG is provided as Appendix III to this discussion paper) to prepare a discussion paper on the review of the *Code of Practice for the Prevention and Reduction of Dioxin and Dioxin-like PCB Contamination in Food and Feeds* (CAC/RCP 62-2006) to evaluate if recommendations from the JECFA assessment on NDL-PCBs could be included[2].

7. Dioxins, including polychlorinated dibenzo-p-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs), DL-PCBs and NDL-PCBs are POPs in the environment. Although dioxins and DL-PCBs show similarities in their toxicological and chemical behaviour, their sources of presence in feed and food are different. On the other hand while DL-PCBs and NDL-PCBs show a different toxicological behaviour, their sources of presence in feed and food are similar.

8. Therefore, the recommendations based on Good Agricultural Practices (GAPs), Good Manufacturing Practices (GMPs), Good Storage Practices (GSPs) Good Animal Feeding Practices (GAFPs) and Good Laboratory Practices (GLPs) included in the existing *Code of Practice for the Prevention and Reduction of Dioxin and Dioxin-like PCB Contamination in Food and Feeds* (CAC/RCP 62-2006), in particular the recommendations applicable to DL-PCBs, are also relevant to the prevention and reduction of NDL-PCBs.

9. The current *Code of Practice for the Prevention and Reduction of Dioxin and Dioxin-like PCB Contamination in Food and Feeds* (CAC/RCP 62-2006) should therefore be reviewed and updated to include NDL-PCBs in its scope.

10. Since the adoption of the Code of Practice in 2006 there has been several new findings of dioxin and/or PCB contamination in feed (and food) providing evidence of new or until 2006 unknown pathways of contamination by dioxins and PCBs, requiring additional management measures to prevent contamination by these pathways. For example, there could be more specific recommendations provided on (direct) drying techniques and traceability of the supply chain of fats and oils as experience has shown that these sources could result in unacceptable levels of dioxins and PCBs in feed and food. Therefore it might be appropriate to update the Code on these aspects related to the contamination of feed and food by dioxins and dioxin-like PCBs.

11. Also more information has become available since 2006 on the carry-over of dioxins and PCBs in feed to food of animal origin, such as differences in metabolic kinetics amongst animal species, accumulation in certain food of animal origin (e.g. in liver of sheep), differences in congener pattern in feed from food of animal origin from animals fed with that feed. Therefore, it is appropriate to consider to include relevant recent information on the carry-over of dioxins and PCBs from feed into food of animal origin in the revised Code.

12. NDL-PCBs are thermally stable and resistant to degradation. Studies on the impact of processing in relation to PCB concentrations have been largely focused on the cooking techniques used to prepare foods and techniques that change the fat content (e.g. PCB levels are lowered in skimmed milk, but increased concentrations are found in foods with higher fat content). Although the studies related to the impact of processing on PCB concentrations include both DL-PCBs and NDL-PCBs, the impact on the concentrations is similar for both groups. Processing resulting in the removal of lipids such as trimming, will lead to a decrease in PCB concentrations in the final food product.

13. Processing of feed and food, i.e., drying process, smoking, and milling, is included in the current Code of Practice and therefore, this element should remain and if appropriate further elaborated in the revised Code of Practice. Cooking practices have been included in some Code of Practices (e.g., *Code of Practice for the Prevention and Reduction of Lead Contamination in Foods* (CAC/RCP 56-2004) and *Code of Practice for the Reduction of Acrylamide in Foods* (CAC/RCP 67-2009)). Therefore, cooking practices should be considered for inclusion in the scope of the revised Code of Practice.

14. This update could consist of the following elements (non-exhaustive)

    a. Inclusion of the outcome of the risk assessment performed by JECFA at its 80th meeting in 2015 on the toxicity of NDL-PCBs in the introduction chapter under general remarks and inclusion of the provisions of the Stockholm Convention related to PCBs under source directed measures.

    b. Most of the recommended practices to reduce the presence of DL-PCBs are also applicable to NDL-PCBs and this could be addressed by replacing the term “DL-PCBs” within the existing code of practice with the more general term “PCBs” (which includes both DL-PCBs and NDL-PCBs)

[2] REP16/CF, para. 168

c. If necessary, completion of the *Code of Practice for the Prevention and Reduction of Dioxin and Dioxin-like PCB Contamination in Food and Feeds* (CAC/RCP 62-2006) with specific measures for the prevention and reduction of NDL-PCBs in feed and food

d. Inclusion of information on specific analytical methods/requirements for NDL-PCBs.

e. Update the current recommended practices on dioxins, DL-PCBs and NDL-PCBs, taking into account experiences gained as regards new and/or unknown pathways of contamination and the new developments in science and technology. For example, there could be more specific recommendations provided on (direct) drying techniques and traceability of the supply chain of fats and oils as experience has shown that these sources could result in unacceptable levels of dioxins and PCBs in feed and food.

f. Inclusion of relevant recent information on the carry-over of dioxins and PCBs from feed into food of animal origin.

g. Inclusion of cooking practices reducing the presence of dioxins and PCBs in food.

15. A preliminary version of the revised Code of Practice for the *Prevention and Reduction of Dioxin and Dioxin-like PCB Contamination in Food and Feeds* (CAC/RCP 62-2006), with limited elements of review mentioned in paragraph 14 a) to d), is enclosed as Appendix II to this discussion paper (proposed technical changes highlighted for convenience). The elements mentioned under paragraph 14 e), f) and g) are to be further elaborated if these elements are agreed by the CCCF to be included in the revised Code of Practice

RECOMMENDATIONS

16. The EWG makes the following recommendations to CCCF:

- To propose the review and update of the *Code of Practice for the Prevention and Reduction of Dioxin and Dioxin-like PCB Contamination in Food and Feeds* (CAC/RCP 62-2006) to include non-dioxin-like PCBs (NDL-PCBs) in its scope as new work for approval by CCEXEC/CAC and to agree on the project document enclosed as Appendix I to this discussion paper.
- To agree that the elements mentioned in paragraph 14 a) to d) above are to be considered for the update and review and to explicitly agree on the elements mentioned in paragraph 14 e) f) and g) to be considered for the update and review of the Code of Practice.

APPENDIX I

(For consideration by CCCF)

PROJECT DOCUMENT

PROPOSAL FOR NEW WORK ON THE "CODE OF PRACTICE FOR THE PREVENTION AND REDUCTION OF DIOXIN AND PCB CONTAMINATION IN FOOD AND FEED"

(FOR CONSIDERATION BY CCCF AND APPROVAL BY CAC)

1. Purpose and Scope

The purpose of the proposed new work is to provide to member countries and the food and feed producing industry, guidance to prevent and reduce non dioxin-like (NDL) polychlorinated biphenyl (PCB) contamination in food and feed.

2. Relevance and Timeliness

At its 80th meeting in 2015, the Joint FAO/WHO Expert Committee on Food Additives (JECFA) assessed the toxicity of NDL-PCBs[1]. JECFA concluded that based on the available data, dietary exposures to NDL-PCBs are unlikely to be a health concern for adults and children. For breastfed infants, the safety margins would be expected to be lower. However, based on present knowledge, the benefits of breastfeeding are considered to outweigh the potential disadvantages that may be associated with the presence of NDL-PCBs in breast milk.

Therefore it remains important that efforts are undertaken to reduce or prevent human exposure to NDL-PCBs by adherence to good agricultural practices and good animal feeding practices.

3. Main aspects to be covered

Review and update the *Code of Practice for the Prevention and Reduction of Dioxin and Dioxin-like PCB Contamination in Food and Feeds* (CAC/RCP 62-2006) to include NDL-PCBs in its scope and rename as Code of Practice for the Prevention and Reduction of Dioxin and PCB Contamination in Food and Feed (CAC/RCP 62-2006).

4. Assessment against the Criteria for the establishment of work priorities

a) Consumer protection from the point of view of health, food safety, ensuring fair practice in the food trade and taking into account the identified needs of the developing countries.

The updated Code of Practice will provide additional guidance for member countries and the food and feed industry to reduce or prevent NDL-PCB contamination in feed and food, thus minimising dietary exposure to NDL-PCBs.

b) Diversification of national legislations and apparent resultant or potential impediments to international trade.

The Code of Practice would provide internationally recognised scientific and technical guidance in order to eventually improve and/or enhance international trade.

c) Work already undertaken by other organisations in this field

A risk assessment for NDL-PCBs was completed by the JECFA in 2015 at its 80th meeting.

5. Relevance to the Codex Strategic Objectives

The work proposed falls under all five Codex Strategic Goals:

Goal 1: Promoting Sound Regulatory Frameworks

The result of this work will assist in promoting sound regulatory frameworks in international trade by using scientific knowledge and practical experience for the prevention and reduction of NDL-PCB contamination in food and feed.

This work will harmonise procedures for developed and developing countries with a view to promote maximum application of Codex standards for fair trade.

[1] Safety evaluation of certain food additives and contaminants. Supplement 1: Non-dioxin-like polychlorinated biphenyls, WHO Food Additives Series: 71-S1.
Available at: http://apps.who.int/iris/bitstream/10665/246225/1/9789241661713-eng.pdf

Goal 2: Promoting widest and consistent application of scientific principles and risk analysis.

This work will help in providing risk management options and strategies to control NDL-PCB contamination in food and feed.

Goal 3: Strengthening Codex work-management capabilities

The Code of Practice will provide a general framework for the management of feed and food safety risks associated with the prevention and reduction of NDL-PCB contamination of food and feed that can be applied by developed and developing countries.

Goal 4: Promoting cooperation between seamless linkages between Codex and other multilateral bodies.

The work will supplement the information already provided by the UN Stockholm Convention on Persistent Organic Pollutants.

Goal 5: Promoting maximum application of Codex standards

Due to the international nature of this problem, this work will support and embrace all aspects of this objective by requiring participation of both developed and developing countries to conduct the work and provide expert advice as needed.

6. Information on the relation between the proposal and other existing Codex documents

This new work is recommended by the Committee following discussion on the feasibility to review and update the *Code of Practice for the Prevention and Reduction of Dioxin and Dioxin-like PCB Contamination in Food and Feeds* (CAC/RCP 62-2006) to include NDL-PCBs in its scope. This is based on a discussion paper (CX/CF 17/11/13) presented at the 11th Session of the Codex Committee on Contaminants in Foods (2017).

The recommendations based on Good Agricultural Practices (GAPs), Good Manufacturing Practices (GMPs), Good Storage Practices (GSPs) Good Animal Feeding Practices (GAFPs) and Good Laboratory Practices (GLPs) contained in the *Code of Practice for the Prevention and Reduction of Dioxin and Dioxin-like PCB Contamination in Foods and Feeds* (CAC/RCP 62-2006), are also relevant to the prevention and reduction of NDL-PCBs, in particular the recommendations applicable to DL-PCBs.

7. Identification of any requirement for and availability of expert scientific advice

A risk assessment was completed by the JECFA at its 80th meeting (WHO Food Additives Series: 71-S1)

8. Identification of any need for technical input to the standard from external bodies

Currently, there is no need for additional technical input from external bodies.

9. Proposed time-line for completion of the work

Subject to approval by the Codex Alimentarius Commission in 2017, the draft Code of Practice will be submitted for consideration by CCCF in 2018. Final adoption by the Commission is foreseen for 2019.

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APPENDIX II

(For information)

CODE OF PRACTICE FOR THE PREVENTION AND REDUCTION OF DIOXIN AND PCB CONTAMINATION IN FOOD AND FEED

INTRODUCTION

General remarks

1. Dioxins, including polychlorinated dibenzo-p-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs), dioxin-like polychlorinated biphenyls (DL-PCBs) and non-dioxin-like PCBs (NDL-PCBs) are persistent organic pollutants in the environment. Although dioxins and DL-PCBs show similarities in their toxicological and chemical behaviour, their sources are different. On the other hand while DL-PCBs and NDL-PCBs show a different toxicological behaviour, their sources are similar. The NDL-PCBs account for the majority of the total PCB contamination, the remainder being DL-PCBs

2. Current sources of dioxins and PCBs entering the food chain include new emissions and remobilisation of deposits or reservoirs in the environment. New emissions are mainly via the air route. Dioxins and dioxin-like PCBs decompose very slowly in the environment and remain there for very long periods of time. Therefore, a large part of current exposure is due to releases of dioxin and dioxin-like PCBs that occurred in the past.

3. PCBs were produced intentionally and in considerable amounts between the 1930s and 1970s and were used in a wide range of applications. PCBs are still in use in existing closed systems in certain countries and contained in solid matrices (e.g., sealing materials and electrical capacitors). Certain commercial PCBs are known to be contaminated with PCDFs and could therefore be regarded as a potential source for dioxin contamination.

4. Today release of PCBs occurs from leakages, accidental spills and illegal disposal and through emissions via air from thermal processes. The emission of PCBs from paints and/or sealants into the environment e. g. during demolition and reconstruction works of older buildings appears to be of some importance today. Therefore, it should be paid more attention to investigate such PCB emission sources more in detail.

5. Dioxins are formed as unwanted by-products from a number of human activities including certain industrial processes (e.g., production of chemicals, metallurgical industry) and combustion processes (e.g., waste incineration). Accidents at chemical factories have been shown to result in high emissions and contamination of local areas. Other dioxin sources include domestic heaters, agricultural and backyard burning of household wastes. Natural processes such as volcanic eruptions and forest fires can also produce dioxins.

6. When released into the air, dioxins can deposit locally on plants and on soil contaminating both food and feed. Dioxins can also be widely distributed by long-range atmospheric transport. The amount of deposition varies with proximity to the source, plant species, weather conditions and other specific conditions (e.g. altitude, latitude, temperature).

7. Sources of dioxins in soil include deposition from atmospheric dioxins, application of contaminated sewage sludge to farm land, flooding of pastures with contaminated sludge, and prior use of contaminated pesticides (e.g., 2.4.5-trichlorophenoxy acetic acid) and fertilizers (e.g., certain compost). Other sources of dioxins in soil may be of natural origin (e.g., ball clay).

8. Dioxins and PCBs are poorly soluble in water. However, they are adsorbed onto mineral and organic particles suspended in water. The surfaces of oceans, lakes and rivers are exposed to aerial deposition of these compounds which are consequently concentrated along the aquatic food chain. The entry of waste water or contaminated effluents from certain processes, such as chlorine bleaching of paper or pulp or metallurgical processes, can lead to contamination of water and sediment of coastal ocean areas, lakes and rivers.

9. The uptake of dioxins and PCBs by fish occurs via gills and diet. Fish accumulate dioxins and PCBs predominantly in their fatty tissue and liver. Bottom dwelling/bottom feeding fish species are more exposed to contaminated sediments than pelagic fish species. However, levels of dioxins and PCBs in bottom dwelling/bottom feeding fish are not always higher than those in pelagic fish depending on the size, diet and physiological characteristics of the fish. In general, fish show accumulation of dioxins and PCBs dependent on factors like age, weight, lipid content or environmental status of their respective environment.

10. Food of animal origin is the predominant route of human exposure to dioxins and PCBs with approximately 80–90% of the total exposure via fats in fish, meat and dairy products. Levels of dioxins and PCBs in animal fat may be related to contamination of the local environment and to contamination of feed (e.g., fish-oil and fish-meal) or, to certain production processes (e.g., artificial drying).

11. The Joint FAO/WHO Expert Committee on Food Additives (JECFA) assessed at its 57th meeting in 2002 the toxicity of dioxins and DL-PCBs. The long half-lives of dioxins and DL-PCBs mean that each daily ingestion

has a small or even a negligible effect on overall body burden. In order to assess long- or short-term risks to health due to these substances, total or average intake should be assessed over months, and tolerable intake should be assessed over a period of at least 1 month. To encourage this view, the JECFA decided to express the tolerable intake as a monthly value in the form of a provisional tolerable monthly intake (PTMI). A PTMI of 70 pg/kg bw per month for dioxins and DL-PCBs expressed as TEFs was derived. In the GEMS/Food[1] regional diets[2], the range of estimated intake of toxic equivalents of dioxins was 7–68 pg/kg of body weight per month at the median and 15–160 pg/kg of body weight per month at the 90th percentile of mean lifetime exposure, and of DL-PCBs was 7–57 pg/kg of body weight per month at the median and 19–150pg/kg of body weight per month at the 90th percentile of consumption. The intakes estimated from national food consumption data were lower: 33–42 pg/kg of body weight per month at the median and 81–100pg/kg of body weight per month at the 90th percentile for dioxins and 9–47pg/kg of body weight per month at the median and 25–130 pg/kg of body weight per month at the 90th percentile for DL-PCBs. Estimates could not be made for the sum of dioxins and DL-PCBs because data on concentrations were submitted separately by countries.

JECFA concluded that despite the uncertainties, the intake estimates suggest that a considerable fraction of the population has a long-term mean intake above the PTMI.

11bis. JECFA assessed at its 80th meeting in 2015 the toxicity of NDL-PCBs. JECFA concluded that none of the available studies on the six indicator PCBs (PCB 28, PCB 52, PCB 101, PCB 138, PCB 153 and PCB 180) and PCB 128 was suitable for derivation of health-based guidance values or for assessment of the relative potency of the NDL-PCBs compared with a reference compound. Therefore, a comparative approach using the minimal effect doses was developed in order to estimate Margins of Exposure (MOEs) to provide guidance on human health risk. Owing to the long half-lives and to eliminate interspecies differences in toxicokinetics, JECFA considered it appropriate to estimate body burdens rather than using external dose (dietary exposure) for the risk characterization. Comparison of the human body burden estimates (derived from human milk concentrations) with the body burden estimates from animal studies derived as points of departure for each congener resulted in MOEs for adults ranging from 4.5 to 5000.
MOEs for breastfed infants, which may have a body burden up to 2-fold higher than that of adults, would be approximately half of the adult values. The MOEs for children would be expected to be intermediate between those for adults and those for breastfed infants, owing to the initial contribution from breastfeeding and the subsequent lower dietary contribution compared with human milk.

Because the MOEs are based on minimal effect doses, they were considered to give some assurance that dietary exposures to NDL-PCBs are unlikely to be of health concern for adults and children, based on the available data. For breastfed infants, the MOEs would be expected to be lower. However, based on present knowledge, the benefits of breastfeeding are considered to outweigh the possible disadvantages that may be associated with the presence of NDL-PCBs in breast milk.

12. In order to reduce the contamination of food, control measures at the feed level should be considered. These may involve developing Good Agricultural Practice, Good Animal Feeding Practice (see Codex Alimentarius Commission: Code of Practice on Good Animal Feeding), and Good Manufacturing Practice guidance and measures to effectively reduce dioxins and PCBs in feed, including:

[1] GEMS/food: the Global Environment Monitoring System - Food Contamination Monitoring and Assessment Programme, informs governments, the Codex Alimentarius Commission and other relevant institutions, as well as the public, on levels and trends of contaminants in food, their contribution to total human exposure, and significance with regard to public health and trade. WHO implements the programme in cooperation with a network Collaborating Centres and recognized national institutions located all around the world.

[2] Regional or cluster diets: WHO developed an approach to describe the various diets around the world based on the analysis of per capita supply available from the FAO Food Balance Sheets. The GEMS cluster diets consist in national dietary patterns grouped by similarities. These 17 cluster diets updated in 2012 are commonly used by international committees for exposure assessment to food contaminants and pesticide residues.

- Identification of agricultural areas with increased dioxin and PCB contamination due to local emission, accidents or illegal disposal of contaminated materials, and monitoring of feed and feed ingredients derived from these areas,
- Setting guidance values for soil and recommendation for special agricultural use (e.g., limitation of grazing or use of appropriate agricultural techniques),
- Identification of possibly contaminated feed and feed ingredients,
- Monitoring compliance with nationally-established guideline levels or maximum levels, if available, and minimizing or decontaminating (e.g., refining of fish oil) non-complying feed and feed ingredients, and
- Identification and control of critical feed manufacturing processes (e.g., artificial drying by direct heating).

13. Similar control measures, where applicable, should be considered for reducing dioxins and PCBs in food.

Source directed measures

14. Reducing sources of dioxins and PCBs is an essential prerequisite for a further reduction of contamination. Measures to reduce dioxin emission sources should be directed to reducing the formation of dioxin during thermal processes as well as the application of destruction techniques. Measures to reduce PCBs emission sources should be directed to minimizing releases from existing equipment (e.g. transformers, capacitors), prevention of accidents and better control of the disposal of PCBs containing oils and wastes.

15. The Stockholm Convention on Persistent Organic Pollutants (Stockholm Convention) is a global treaty to protect human health and the environment from persistent organic pollutants (POPs) including dioxins and PCBs.

15bis Part II of Annex A of the Stockholm Convention lists following priority measures:

a) with regard to the elimination of the use of PCBs in equipment (e.g. transformers, capacitors or other receptacles containing liquid stocks) by 2025:

(i) identify, label and remove from use equipment containing greater than 10% PCBs and volumes greater than 5 litres;

(ii) identify, label and remove from use equipment containing greater than 0.05% PCBs and volumes greater than 5 litres;

(iii) Endeavour to identify and remove from use equipment containing greater than 0.005% PCBs and volumes greater than 0.05 litres;

b) consistent with the priority measures under a), to reduce exposures and risk to control the use of PCBs:

(i) Use only with intact and non-leaking equipment and only in areas where the risk from environmental release can be minimised and quickly remediated;

(ii) Do not use in equipment in areas associated with the production or processing of food or feed;

(iii) When used in populated areas, including schools and hospitals, all reasonable measures to protect from electrical failure which could result in a fire, and regular inspection of equipment for leaks;

c) that equipment containing PCBs, as described under a) shall not be exported or imported except for the purpose of environmentally sound waste management;

(d) Except for maintenance and servicing operations, not allow recovery for the purpose of reuse in other equipment of liquids with polychlorinated biphenyls content above 0.005%

(e) Ensure environmentally sound waste management of liquids containing PCBs and equipment contaminated with PCBs having a PCB content above 0.005%, as soon as possible but no later than 2028.

(f) Identify other articles containing more than 0.005% PCBs (e.g. cable-sheaths, cured caulk and painted objects) and manage them in an environmentally sound manner.

16. Part II of Annex C of the Stockholm Convention lists the following industrial source categories, that have the potential for comparatively high formation and release of dioxins and PCBs to the environment.

a) Waste incinerators, including co-incinerators of municipal, hazardous or medical waste or of sewage sludge;

b) Cement kilns firing hazardous waste;

c) Production of pulp using elemental chlorine or chemicals generating elemental chlorine for bleaching;

d) Thermal processes in the metallurgical industry, i.e. secondary copper production; sinter plants in the iron and steel industry; secondary aluminium production; secondary zinc production.

17. Part III of Annex C also lists the following source categories that may unintentionally form and release dioxins and PCBs, to the environment:

a) Open burning of waste, including burning of landfill sites;

b) Thermal processes in the metallurgic industry not mentioned in Part II, Annex C;

c) Residential combustion sources;

d) Fossil fuel-fired utility and industrial boilers;

e) Firing installations for wood and other biomass fuels;

f) Specific chemical production processes releasing unintentionally formed persistent organic pollutants, especially production of chlorophenols and chloranil;

g) Crematoria;

h) Motor vehicles, particularly those burning leaded gasoline;

i) Destruction of animal carcasses;

j) Textile and leather dyeing (with chloranil) and finishing (with alkaline extraction);

k) Shredder plants for the treatment of end of life vehicles;

l) Smouldering of copper cables;

m) Waste of oil refineries.

18. Adopting technologies to minimize formation and release of dioxins and PCBs from these sources categories should be considered by national authorities when developing national measures to reduce dioxin, DL-PCBs and NDL PCBs.

18bis Other sources of PCB contamination of food and feed are e.g.

· Waste oil (transmission oil leakage, paintings with waste oil)

· Sisal (bags, binding twine)

· Care tyre used as feeding troughs or plaything

· Intake of contaminated soil (free ranging laying hens, flooded land, burned areas)

· Livestock trails filled with building waste

· Fences or shads painted with waste oil

· Open applications of PCB such as paints or coatings and releases from caulk.

Scope

19. This Code of Practice focuses on measures (e.g., Good Agricultural Practices, Good Manufacturing Practices, Good Storage Practices, Good Animal Feeding Practices, and Good Laboratory Practices) for national authorities, farmers, and feed and food manufacturers to prevent or reduce dioxin and PCB contamination in foods and feeds.

20. This Code of Practice applies to the production and use of all materials destined for feed (including grazing or free-range feeding, forage crop production and aquaculture) and food at all levels whether produced industrially or on farm.

21. Since the global limitation and reduction of dioxins and PCBs from non food / feed related industrial and environmental sources may lie outside of the responsibility of CCCF, these measures will not be considered within this Code of Practice.

RECOMMENDED PRACTICES BASED ON GOOD AGRICULTURAL PRACTICES (GAPS), GOOD MANUFACTURING PRACTICES (GMPS), GOOD STORAGE PRACTICES (GSPS), GOOD ANIMAL FEEDING PRACTICES (GAFPS), AND GOOD LABORATORY PRACTICES (GLPS)

Control measures within the food chain

Air, Soil, Water

22. To reduce dioxin and PCB contamination in the air, national food authorities should consider recommending to their national authorities responsible for air pollution measures to prevent uncontrolled burning of wastes, including the burning of landfill sites or backyard burning, and the use of PCB treated wood for domestic heaters.

23. Control measures to prevent or reduce contamination of the environment by dioxins and PCBs are important. To reduce possible contamination of feed or food, agricultural land with unacceptable dioxin and PCB contamination due to local emission, accidents, or illegal disposal of contaminated materials should be identified.

24. Agricultural production on contaminated areas should be avoided or should be restricted if a significant transfer of dioxins and PCBs to feed or food produced on these areas is anticipated. If possible, contaminated soil should be treated and detoxified or removed and stored under environmentally sound conditions.

25. The spreading of sewage sludge contaminated with dioxins and PCBs can lead to adhering of contaminants on the vegetation which can increase livestock exposure. Sewage sludge used in agriculture should be monitored, as necessary for dioxins and PCBs. Additionally, sewage sludge should be treated, as necessary, to render it inert or to detoxify it. National guidelines should be adhered to where applicable.

26. Livestock, game, and poultry, exposed to contaminated soil, may accumulate dioxins and PCBs by consumption of contaminated soil or plants. These areas should be identified and controlled. If necessary, the outdoor production in these areas should be restricted.

27. Source-reduction measures will take many years to reduce contamination levels in wild caught fish due to the long half-lives of dioxins and PCBs in the environment. To reduce exposure to dioxins and PCBs, highly contaminated areas (e.g., lakes, rivers or contaminated marine catching areas) and relevant fish species should be identified and fishing in these areas should be controlled and, if necessary, restricted.

Feed

28. The bulk of human dietary intake of dioxins and PCBs is due to the deposition of these substances in the lipid component of animal derived foods (e.g., poultry, fish, eggs, meat and milk). In lactating animals dioxins and PCBs are excreted partly with milk fat, and in laying hens the contaminants are concentrated in fat content of the yolk in laid eggs. To reduce this transfer, control measures at the feed and feed ingredients level should be considered. Measures to reduce the dioxin and PCB levels in feed would have a rapid effect on contaminant levels in food of animal origin originating from farm animals, including farmed fish. These measures should involve developing Codes of Good Agricultural Practices, Good Animal Feeding Practices (see, Good Manufacturing Practices, Good Storage Practices, and other control measures e.g., HACCP-like principles) which may reduce levels of dioxins and PCBs. Such measures may include:

- identification of possibly contaminated areas in the feed supply ecosystem,
- identification of the origin of frequently contaminated feed or feed ingredients, and
- monitoring the compliance of feed and feed ingredients with nationally-established guideline levels or maximum levels, if available. Threshold violating commodities should be investigated by the competent national authority, to determine whether those commodities should be excluded from further feeding.

29. Competent national authorities should periodically sample and analyse, using recognized international methods, suspect feed and feed ingredients to verify dioxin and PCB levels. This information will determine actions, if needed, to minimize dioxin and PCB levels and allow alternative feed and feed ingredients to be located, if necessary.

30. The purchaser and user should pay attention to:

- origin of feed and feed ingredients to ensure that producers and/or companies have certified production facilities, production processes and quality assurance programmes (e.g., HACCP-like principles);
- accompanying documents confirming compliance with nationally-established guideline levels or maximum levels, if available, according to national requirements.

Feed of animal origin

31. Due to the position of their precursors in the food chain, animal derived feed has a higher risk for dioxin and PCB contamination compared to plant derived feed. Attention should be paid to avoid these contaminants from entering the food chain through the feeding of animal derived feed to food producing animals. Animal derived feed should be monitored, as necessary, for dioxins and PCBs.

32. Accumulation of dioxins and PCBs in adipose tissues of livestock, with possible resultant violations of nationally-established guideline levels or maximum levels, if available, for meat and milk or their derived products should be prevented. Therefore, feed of animal origin that exceeds nationally-established guideline levels or maximum levels, if available, or contains elevated levels of dioxins or PCBs should not be fed to animals unless the fat has been removed.

33. If intended for use in feed, fish-oil and other products derived from fish, milk and milk substitutes, and animal fats should be monitored to the extent practicable for dioxins and PCBs. If there are nationally-established guideline levels or maximum levels, the feed manufacturer should ensure that the products are in compliance with these provisions.

Feed of plant origin

34. If potential sources of dioxins and PCBs are anticipated in the vicinity of fields, attention should be paid to monitor these areas, as necessary

35. Cultivation sites irrigated with water or treated with sewage sludge or municipal compost that may contain elevated dioxin and PCB levels should be monitored, as necessary, for contamination.

36. Prior treatment of crops with herbicides from the chlorinated phenoxyalkanoic acid type or chlorinated products like pentachlorophenol should be considered as a potential source for dioxin contamination. Dioxin levels in soil and forage plants from sites treated previously with dioxin-contaminated herbicides should be monitored as necessary. This information will enable competent national authorities, if necessary, to take appropriate management measures in order to prevent the transfer of dioxins (and PCBs) into the food chain.

37. Typically, oilseeds and vegetable oil are not significantly contaminated with dioxins and PCBs. This also applies to other by-products of oilseed processing (e.g., oilseed cakes) used as feed ingredients. However, certain oil refining by-products (e.g., fatty acid distillates) may contain increased levels of dioxins and PCBs and should be analysed, as necessary, if used for feed.

<u>Feed and food processing</u>

Drying processes

38. Certain processes for the artificial drying of feed and food (and feed or food ingredients) and the heating of indoor growing facilities (e.g. hothouses) requires a flow of heated gases, either a flue gas-air mix (direct drying or heating) or heated air alone (indirect drying or heating). Accordingly, fuels which are not generating dioxins and dioxin-like compounds and other harmful contaminants at unacceptable levels should be used. Feed, food and feed or food ingredients that are dried or subjected to heated air should be monitored as necessary to ensure that drying or heating processes do not result in elevated levels of dioxins and PCBs.

39. The quality of commercial dried feed materials, in particular green fodder and commercially dried foods depends on the selection of the raw material and the drying process. The purchaser should consider requiring a certificate from the manufacturer/supplier, that the dried goods are produced according to Good Manufacturing Practice, especially in the choice of the fuel and are in compliance with nationally-established guideline levels or maximum levels, if available.

Smoking

40. Depending on the technology used, smoking can be a critical processing step for increased dioxin content in foods, especially if the products show a very dark surface with particles of soot. Such processed products should be monitored, as necessary, by the manufacturer.

Milling / Disposal of contaminated milling fractions

41. In agricultural land in the vicinity of dioxin and PCB emission sources, the air borne external deposition of dioxins and PCBs on the surface of all parts of the grain plants as well as the adherent dust fraction from the standing crop is widely removed during the milling process and before the final grinding process. If present, most particle-bound contamination is removed in the loading chute with the remaining dust. Further external contaminations are significantly reduced during aspiration and sieving. Certain grain fractions, especially dust, can have increased dioxin and PCB levels and should be monitored, as necessary. If there is evidence for elevated contamination, such fractions should not be used in food or feed and treated as waste.

Substances added to feed and food

Minerals and trace elements

42. Some minerals and trace elements are obtained from natural sources. However, experience has shown, that geogenic dioxins may be present in certain prehistoric sediments. Therefore, dioxin levels in minerals and trace elements added to feed or food should be monitored as necessary.

43. Reclaimed mineral products or by-products from certain industrial processes may contain elevated levels of dioxins and PCBs. The user of such feed ingredients should verify that dioxin and PCBs are within nationally-established guideline or action levels or maximum levels, if available, through certification by the manufacturer or supplier.

44. Elevated levels of dioxins have been found in ball clay used as an anticaking agent in soybean meal in feed. Attention should be paid to minerals used as binders or anticaking agents (e.g., bentonite, montmorillonite, kaolinitic clay) and carriers (e.g., calcium carbonate) used as feed ingredients. As assurance to the user that these substances do not contain minerals with elevated levels (e.g., exceeding nationally-established guideline levels or maximum levels, if available) of dioxins (and PCBs), the distributor should provide appropriate certification to the user of such feed ingredients.

45. The supplementation of food producing animals with trace elements (e.g., copper or zinc) depends on the species, age and performance. Minerals, including trace elements, which are by-products or co-products of industrial metal production have been shown to contain elevated levels of dioxins. Such products should be monitored for dioxins (and PCBs), as necessary.

Ingredients

46. Feed and food manufacturers should ensure that all ingredients in feed and food have minimal levels of dioxins and PCBs to reduce possible contamination and to comply with nationally-established guideline or action levels or maximum levels, if available.

Harvesting, transport, storage of feed and food

47. To the extent feasible, it should be ensured that minimal contamination with dioxins and PCBs occurs during the harvest of feed and food. This can be achieved in possibly contaminated areas by minimizing soil deposition on feed and food during harvest by using appropriate techniques and tools according to Good Agricultural Practice. Roots and tubers, grown on contaminated soil, should be washed to reduce soil contamination. If roots and tubers are washed, they should be sufficiently dried before storage or be stored following techniques (e.g. ensilage) aiming to prevent mould formation.

48. After flooding, crops harvested for feed and food should be monitored, as necessary, for dioxins and PCBs, if there is evidence for flood water contamination by these contaminants.

49. To avoid cross-contamination, the transport of feed and food should only be performed in vehicles (including ships) or in containers not contaminated with dioxins and PCBs. Storage containers for feed and food should be painted only with dioxin and PCB-free paint.

50. Storage sites for feed or food should be free from contamination with dioxins and PCBs. Surfaces (e.g., walls, floors) treated with tar-based paints may result in transfer of dioxins and PCBs to food and feed. Surfaces that come in contact with smoke and soot from fires always bear a risk of contamination with dioxins and PCBs. These sites should be monitored as necessary for contamination before use for storage of feed and food.

Special problems of animal keeping (Housing)

51. Food producing animals may be exposed to dioxins and PCBs found in certain treated wood used in buildings, farm equipment and bedding material. To reduce exposure, animal contact with treated wood containing dioxins and PCBs should be minimized. In addition, sawdust from treated wood containing dioxins and PCBs should not be used as bedding material.

52. Due to contamination in certain soil, eggs from free living or free-range hens (e.g., organic farming) may have elevated levels of dioxins and PCBs compared to eggs from caged hens and should be monitored, as

necessary.

53. Attention should be paid to older buildings as they may have building materials and varnishes that may contain dioxins and PCBs. If they have caught fire, measures should be taken to avoid contamination of the feed and feed chain by dioxins and PCBs.

54. In housings without a floor covering, the animals normally will take up soil particles from the ground. If there are indications of increased levels of dioxins and PCBs, the contamination of the soil should be controlled as necessary. If needed, the soil should be exchanged.

55. Pentachlorophenol-treated wood in animal facilities has been associated with elevated levels of dioxins in beef. Wood (e.g., railroad ties, utility poles) treated with chemicals such as pentachlorophenol or other unsuitable materials should not be used as fence posts for enclosures of free-range animals or feed lines. Hay racks should not be constructed from such treated wood. In addition, the preservation of wood with waste oils should also be avoided.

55bis. In case there is a risk of adding dioxin to the housing environment for the livestock by cleaning or disinfecting the housing with chlor-containing agents, special attention should be paid thereto and the use of such cleaning/disinfecting agents should be avoided.

Monitoring

56. Farmers and industrial feed and food manufacturers have the primary responsibility for feed and food safety. Testing could be conducted within the framework of a food safety programme (e.g. Good Manufacturing Practices, On-Farm Safety programmes, Hazard Analysis and Critical Control Point programmes, etc.) In previous sections of this Code, it is mentioned where it could be appropriate to perform monitoring. Competent authorities should enforce the primary responsibility of farmers, feed and food manufacturers for feed and food safety through the operation of surveillance and control systems at appropriate points throughout the food chain, from the primary production to the retail level. In addition competent authorities should set up own monitoring programmes.

57. As analyses for dioxins are quite expensive in comparison to determination of other chemical contaminants, periodic tests should be performed to the extent feasible at least by industrial feed and food manufacturers including both incoming raw materials and final products and data should be kept (see para. 66). The frequency of sampling should consider results from previous analysis (by individual companies and/or via a pool of industry results within the same sector).

If there are indications of elevated levels of dioxins and PCBs, farmers and other primary producers should be informed about the contamination and the source should be identified and the necessary measures have to be taken to remediate the situation, to reduce or prevent further contamination.

58. Monitoring programmes dealing with contaminations originating from the environment, accidents or illegal disposals should be organized by operators in the feed and food chain to the extent feasible and competent national authorities in order to obtain additional information on food and feed contamination. Products or ingredients at risk or found with elevated contamination should be monitored more intensively. For example, monitoring programmes may include major fish species used in food or feed that have been shown to contain elevated levels of dioxins and PCBs.

PCBs 59. Advice concerning analytical requirements and qualification of laboratories is given in the literature. These recommendations and conclusions form the basis of the evaluation by JECFA and others. Furthermore, consideration of methods of analysis of dioxins and PCBs is addressed by the Codex Committee of Methods of Analysis and Sampling.

60. Traditional methods for the analysis of dioxin and DL-PCBs rely on gas chromatography coupled to high-resolution mass spectrometry (GC-HRMS) which is time-consuming and expensive. Also methods based on gas chromatography coupled to tandem mass spectrometry (GC-MS/MS) can be used to quantify dioxins and DL-PCBs. Alternatively, bioassay techniques have been developed as high throughput screening methods which can be less expensive than traditional methods. However, the cost of analysis remains an impediment to data collection thus research priority should be given to the development of less costly analytical methods for the analysis of dioxin and DL-PCBs.

Gas chromatography (GC) coupled to Electron Capture Detection (ECD) and mass spectrometers (including ion trap, low-resolution (LRMS), high-resolution (HRMS) and tandem mass (MS/MS) spectrometers) are used in the analysis of NDL-PCBs. The analysis of NDL-PCBs generally does not require as extensive a clean-up procedure as for the DL-PCBs or dioxins. For screening purposes, GC-ECD is often used. GC/MS may also be used for screening purposes.

Sampling

61. Important aspects of sampling for dioxin and PCB analysis are collecting representative samples, avoiding

cross contamination and deterioration of samples and unambiguously identifying and tracing back samples. To avoid cross-contamination, samples should be put in containers or other receptacles that are not reactive and that have been chemically cleaned or certified to be free of contaminants. All relevant information on sampling, sample preparation and sample description (e.g., sampling period, geographic origin, fish species, fat content, size of fish) should be recorded in order to provide valuable information.

Analytical methods and data reporting

62. Analytical methods should be applied only if they are fit for purpose meeting a minimum of requirements. If nationally-established maximum levels are available, the limit of quantification (LOQ) of the method of analysis should be in the range of one fifth of this level of interest. For control of time trends of background contamination, the limit of quantification of the method of analysis should be clearly below the mean of the present background ranges for the different matrices.

63. Performance of a method of analysis should be demonstrated in the range of the level of interest, e.g. 0.5 x, 1 x and 2 x level of maximum level with an acceptable coefficient of variation for repeated analysis. The difference between upper bound and lower bound levels (see next para.) should not exceed 20% for feed and food with a dioxin contamination of about 1 pg WHO-PCDD/PCDF-TEQ/g fat. If needed, another calculation based on fresh weight or dry matter could be considered.

64. Except for bioassay techniques, the results of total dioxin and DL-PCB levels in a given sample should be reported as lower bound, medium bound and upper bound concentration by multiplying each congener by their respective WHO Toxic Equivalency Factor (TEF) and subsequently summing them up to give the total concentration expressed as Toxic Equivalency (TEQ). The three different TEQ values should be generated reflecting assignment of zero (lower bound), half the limit of quantification (medium bound), and limit of quantification (upper bound) values to each non-quantified dioxin and DL-PCB congener.

Also for the analysis of NDL-PCBs the analytical result should be reported as lower-bound, medium bound and upper-bound and indicate clearly to what the analytical result refers to (sum of six indicator PCBs, total PCBs, etc…)

65. Depending on sample type, the report of the analytical results may include the lipid or dry matter content of the sample as well as the method used for lipid extraction and for determination of dry matter. This report should also include a specific description of the procedure used to determine the limit of quantification (LOQ).

66. A high throughput screening method of analysis with proven acceptable validation could be used to screen the samples with significant levels of dioxins and PCBs. Screening methods should have less than 1% false-negative results in the relevant range of interest for a particular matrix. Use of 13C-labelled internal standards for dioxins or PCBs allows for specific control of possible losses of the analytes in each sample. In this way, false-negative results can be avoided preventing contaminated food or feed being used or marketed. For confirmatory methods, use of these internal standards is mandatory. For screening methods without control of losses during the analytical procedure, information on correction of losses of compounds and the possible variability of results should be given. Levels of dioxins and PCBs in positive samples (above the level of interest) should be determined by a confirmatory method.

Laboratories

67. Laboratories involved in the analysis of dioxins and PCBs using screening as well as confirmatory methods of analysis should be accredited by a recognized body operating in accordance with ISO/IEC Guide 58:1993[3] as revised by ISO/IEC 17011:2004[4] or have quality assurance programmes that address all critical elements of accrediting agencies to ensure that they are applying analytical quality assurance. Accredited laboratories should follow the ISO/IEC/17025 standard “General requirements for the competence of testing and calibration laboratories”[5] or other equivalent standards.

68. The regular participation in interlaboratory studies or proficiency tests for the determination of dioxins and PCBs in the relevant feed and food matrices is recommended according to ISO/IEC/17025 standard.

[3] https://www.iso.org/standard/21678.html

[4] https://www.iso.org/standard/29332.html

[5] https://www.iso.org/obp/ui/#iso:std:iso-iec:17025:en

QUALITY MANAGEMENT AND EDUCATION

69. Good Agricultural Practices, Good Manufacturing Practices, Good Storage Practices, and Good Animal Feeding Practices are valuable systems for further reduction of dioxin and PCB contamination in the food chain. Farmers and feed and food manufacturers should consider educating their co-workers on how to prevent contamination by the implementation of control measures. Good Laboratory Practices is a valuable system to ensure high quality in the analytical outcome.

ANNEX**GLOSSARY OF TERMS**
(for the purpose of this Code of Practice)

Term	**Explanation**
Action level/threshold	Not legally binding but recommended levels by national authorities, if exceeded, triggering investigations to identify the source of contamination and possible mitigation measures
anticaking agent	Substance that reduces the tendency of particles of a feed or food to stick
binder	Substance that increases the tendency of individual particles of a feed or food to stick
coefficient of variation	Statistical parameter expressing: 100 x standard deviation of a set of values/mean value of set
confirmatory method of analysis	method of analysis with high quality parameters capable to confirm analytical results produced from screening methods with lower quality parameters
congener	one of two or more compounds of the same chemical similarity with respect to classification
dioxins (PCDD/PCDF)	Include 7 polychlorinated dibenzo-p-dioxins (PCDDs) and 10 dibenzofurans (PCDFs) that have dioxin-like toxicological properties which belong to a group of lipophilic and persistent organic substances. Depending on the degree of chlorination (1–8 chlorine atoms) and the substitution patterns, 75 different PCDDs and 135 different PCDFs (“congeners”), can be distinguished.
dioxin-like PCBs (DL-PCBs)	Include 12 non-ortho and mono-ortho substituted polychlorinated biphenyls (PCBs) showing toxicological properties (dioxin-like activity) that are similar to dioxins
fish	Poikilothermic vertebrate animals including Pisces, Elasmobranches and Cyclostomes. For the purpose of this code of practice, molluscs and crustaceans are also included
feed	Any single or multiple materials, whether processed, semi-processed or raw which is intended to be fed directly to food producing animals
food	Any substance, whether processed, semi-processed or raw which is intended for direct human consumption, and includes drink, chewing gum and any substance which has been used in the manufacture, preparation or treatment of “food” but does not include cosmetics, tobacco, medicinal products, narcotic or psychotropic substances, residues and contaminants
feed or food ingredient	A component or constituent of any combination or mixture making up a feed or food, whether or not it has a nutritional value in the diet, including additives. Ingredients are of plant, animal or aquatic origin, or other organic or inorganic substances.
guideline levels	The concentration of a substance recommended by a national or international authority that is acceptable to be present in feed or food, however not legally binding.
HACCP	Hazard Analysis Critical Control Point (HACCP) is a system that identifies, evaluates and controls hazards which are significant for food safety
limit of quantification (LOQ) (valid for dioxins and PCBs	The limit of quantification of an individual congener means the lowest concentration of the analyte that can be measured with reasonable statistical

Term	Explanation
only)	certainty, fulfilling the identification criteria as described in internationally recognised standards such as in EN 16215:2012 and/or EPA methods 1613 and 1668 as revised. The limit of quantification of an individual congener may be identified as the concentration of an analyte in the extract of a sample which produces an instrumental response at two different ions to be monitored with an S/N (signal/noise) ratio of 3:1 for the less sensitive signal and fulfilment of the basic requirements such as e.g. retention time, isotope ratio according to the determination procedure as described in EPA method 1613 as revised.
maximum levels	Legally binding maximum concentration of a substance in feed or food, established by a national or international authority.
minerals	Inorganic compounds used in food and feed being required for normal nutrition or used as processing aids.
non dioxin-like PCBs (NDL-PCBs)	Includes the 197 PCB congeners other than the 12 non-ortho and mono-ortho substituted PCBs. The NDL-PCBs account for the majority of the total PCB contamination, the remainder being DL-PCBs. The Stockholm Convention on POPs recommends the measurement of six indicator PCBs (PCB 28, PCB52, PCB 101, PCB, 138, PCB 153 and PCB 180) to characterise contamination by NDL-PCBs.
PCBs	Polychlorinated biphenyls belonging to a group of chlorinated hydrocarbons, formed by direct chlorination of biphenyl. Depending on the number of chlorine atoms (1 – 10) and their position at the two rings, 209 different compounds ("congeners") are theoretically possible. The 209 congeners of PCBs include the dioxin-like PCBs (12 congeners) and the non-dioxin-like PCBs (other 197 congeners).
pelagic fish species	Fish species living in free water (e.g., ocean, lake) without contact to the sediment
persistent organic pollutant (POP)	Chemical substance that persists in the environment, bioaccumulates through the food web, and poses a risk of causing adverse effects to human health and the environment
Stockholm Convention (POPs Convention)	The Stockholm Convention on Persistent Organic Pollutants is a global treaty to protect human health and the environment from persistent organic pollutants (POPs) including dioxins and dioxin-like PCBs. It entered into force on 17th May 2004. In implementing the Stockholm Convention governments will take measures to eliminate or reduce the release of POPs into the environment.
screening method of analysis	Method of analysis with lower quality parameters to select samples with significant levels of an analyte
trace elements	Chemical elements essential for plant, animal and/or human nutrition in small amounts
Toxic Equivalency Factor (TEF)	Estimates of the toxicity of dioxin-like compounds relative to the toxicity of 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD), which is assigned a TEF of 1.0. WHO-TEFs for human risk assessment are based on the conclusions of the World Health Organization (WHO) – International Programme on Chemical Safety (IPCS) expert meeting which was held in Geneva in June 2005[6]
Toxic Equivalency (TEQ)	Relative value calculated by multiplying the concentration of a congener by the toxic equivalency factor (TEF)
WHO-TEQ	TEQ value for dioxins and dioxin-like PCBs, established by WHO and based on established Toxic Equivalency Factors (TEFs)

[6] Martin van den Berg et al., The 2005 World Health Organization Re-evaluation of Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-like Compounds. Toxicological Sciences 93(2), 223–241 (2006)

APPENDIX III

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