

codex alimentarius commission



FOOD AND AGRICULTURE
ORGANIZATION
OF THE UNITED NATIONS

WORLD
HEALTH
ORGANIZATION



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Agenda Item 14b

CX/FAC 02/16

JOINT FAO/WHO FOOD STANDARDS PROGRAMME

CODEX COMMITTEE ON FOOD ADDITIVES AND CONTAMINANTS

Thirty-fourth Session

Rotterdam, The Netherlands, 11-15 March 2002

SCHEDULE 1 OF THE PROPOSED DRAFT CODEX GENERAL STANDARD FOR CONTAMINANTS AND TOXINS IN FOOD

A first version of the Schedule 1 is presented by The Netherlands, to discuss the format and content and other issues such as maintenance.

CODEX ALIMENTARIUS - GENERAL STANDARD FOR CONTAMINANTS AND TOXINS IN FOOD SCHEDULE I - MAXIMUM AND GUIDELINE LEVELS FOR CONTAMINANTS AND TOXINS IN FOOD

Introduction

Schedule I of the Codex General Standard for Contaminants and Toxins in Food (GSCTF) is the list of Codex Standards for individual contaminants and toxins in foods and feeds. It contains all the provisions for food and feed contaminants adopted by the Codex Alimentarius Commission.

Schedule I is not yet (officially) published in the format mentioned in Annex III of the Preamble to the GSCTF. Schedule I can only be officially published containing adopted standards. Since it is a dynamic document that needs to be changed regularly on the basis of progress in Codex Committees, it is considered necessary to present to all delegates a Working Document in the format of Schedule I, updated annually, on the development and progress of standards in CCFAC and other Codex Committees. This working document shall contain all existing and proposed Codex Standards for contaminants and toxins in foods and feeds, with notes and references regarding relevant Codex decisions and information sources. In this way also the obligations of Annex IV of the GSCTF can be met.

Schedule I can only be read in conjunction with the GSCTF and its annexes. Schedule II is a product-based presentation of the Codex contaminant standards which may come available when these data are assembled in a suitable data base format. Schedule I as presented here is a Working Document provided to the Committee for information purposes; it is a first draft and no guarantees can be given regarding the exact validity of the contents. It is hoped that with the aid of suggestions for improved texts by the participants of the CCFAC and other interested parties, it will become a valuable informatory document to the discussions of the CCFAC. The annually redrafted Schedule I will provide an overview of the situation regarding contaminants to the CCFAC, albeit an unofficial document.

On the next pages a format for a Table of standards with references and remarks is used as it could appear in the Working Document for Schedule I.

The document is due to time constraints now not yet complete and for the main part only elaborated regarding the essential standard aspects; it could in future also contain more explanatory notes and a more or less elaborate general introduction per substance. Some examples (mercury, some mycotoxins) are more fully elaborated with explanatory notes. References to Codes of Practice being developed or established are (or should be) made.

Information contained

The following information will be contained in the Working Document Schedule I, according to the agreed format (Annex III of the GSCTF).

- Name of the contaminant, Codex number and short monograph (synonym; TDI; ref JECFA; definition)
- In the form of a table:
 - Commodity
 - Product code
 - Maximum or Guideline Level in mg/kg or other appropriate expression
 - Suffix to specify the application of the ML/GL
 - Type of standard (ML or GL)
 - Step or other indication of status (adopted by CAC)
 - Reference to official documents, relevant Codex Committee meetings with decisions etc.

- Notes and remarks to the table, including short summaries of decisions, requests for information etc.
- An Index of contaminants in Code order and in alphabetic order will be provided.
- Explanatory notes to the terms used.

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1.16	tin	short concept
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3.4	polychlorobiphenyls	
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INDEX OF CONTAMINANTS IN ALPHABETIC ORDER

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Deoxynivalenol	5.3.8	
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EXPLANATORY NOTES

Code nr.:	The codes for food commodities are according to the food and feed categorization system adopted in the GSCTF, as mentioned in Annex V. The codes for substances are derived from the coding system mentioned in Annex IV of the GSCTF.
Definition:	Definition of the contaminant in the form to which the ML applies or which may or should be analysed in commodities.
Reference: (ref.)	references, e.g. to JECFA or CCFAC meetings in which the contaminant was discussed, characterised by the year in which the meeting took place and/or the number of the meeting.
Step:	Step in the Codex Procedure for developing standards; see the Codex Procedural Manual. The term CXL is used for a definitive Codex Standard.
suffix:	Note accompanying a ML or GL, used to specify the application or the future revision of the ML. E.g. specific residue definitions can be mentioned by abbreviations here. See also Qualification of MLs.
synonym:	symbols, synonyms, abbreviations, scientific descriptions and identification codes used to define the contaminant.
Toxicology:	Toxicological advice about the maximum acceptable or tolerable intake level of the contaminant for humans, expressed in milligrammes (mg) or microgrammes (mcg or µg) per kg body weight (bw).
Type:	Refers to type of maximum level, e.g. ML or GL. See the definitions in the preamble of the GSCTF

Qualification of MLs

(*)	At or about the limit of determination
C	In canned products only
F	Fat soluble contaminant (Further provisions about the application of the ML may be necessary)
R	Under review
T	Temporary

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1.3 Arsenic

Synonym: As
 Toxicology: PTWI 15 mcg/kg bw for inorganic arsenic
 Reference: JECFA 1983, 1988
 Definition: arsenic, total (As-tot) when not otherwise mentioned; or inorganic arsenic (As-in), or other specification

Commodity/Product Code	Product Name	Level mg/kg	Suffix	Type	Step/ Status	Committee	Reference, Standard	Notes, remarks
	Cereals*						CPL 94	* Development of MLs
	discontinued							
	Pulses*						CPL 94	* "
	Legumes*						CPL 94	* "
	Edible fats and oils	0.1		ML	CXL			
	Fruit juices and nectars	0.2		ML	CXL			
	Cocoa butters	0.5		ML	CXL			
	Chocolate	0.5		ML	CXL			
	Other cocoa products	1.0		ML	CXL			
	Vinegar	1		ML	CXL		162-87*	* regional European Standard
	Natural mineral water	0.05#		ML	CXL		108-81, rev.1	# to be changed to 0.01

Notes and remarks**General**

A position document CX/FAC 99/22 was last discussed in CCFAC 1999; see ALINORM 99/12A, para. 137.

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1.6 Cadmium

Synonym: Cd
 Toxicology: PTWI 7 mcg/kg bw
 Reference: JECFA 1988, 2000 (55)
 Definition: cadmium, total

Commodity/Product Code	Product Name	Level mg/kg	Suffix	Type	Step/ Status	Committee	Reference, Standard	Notes, remarks
rice	Cereals*	0.1		ML	CXL	CPL, FAC 01		* excl. bran, germ, wheat grain,
	Pulses*	0.1		ML	CXL	CPL, FAC 01		* does not include peanut
	Legumes*	0.1		ML	CXL	CPL, FAC 01		* excl. soybean
	Fruit	0.05		ML	5 #	FAC 01		# See Alinorm 03/3, para. 20
	Vegetables, excl. tomatoes and *	0.05		ML	5 #	FAC 01		* see other mentioned vegetables
	Leafy vegetables, fresh herbs,	0.2		ML	5 #	FAC 01		
	Fungi, celeriac	0.2		ML	5 #	FAC 01		
	Potatoes*, stem & root vegetables**	0.1		ML	5 #	FAC 01		* peeled ** excl. celeriac
	Wheat grain and rice*	0.2		ML	5 #	FAC 01		* incl. bran and germ
	Soybeand and peanuts	0.2		ML	5 #	FAC 01		
	Meat of cattle, poultry, pig, sheep	0.05		ML	5 #	FAC 01		
	Meat of horse	0.2		ML	5 #	FAC 01		
	Liver of cattle, poultry, pig, sheep	0.5		ML	5 #	FAC 01		
	Kidney of cattle, poultry, pig, sheep	1.0		ML	5 #	FAC 01		
Crustaceans*	0.5		ML	5 #	FAC 01		*excl. lobster & brown meat from crab	
Molluscs	1.0		ML	5 #	FAC 01			

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1.11 Lead

Synonym: Pb
 Toxicology: PTWI 25 mcg/kg bw per week
 Reference: JECFA 1972, 1978, 1987, 1993
 Definition: lead, total

Commodity/Product Code	Product Name	Level mg/kg	Suffix	Type	Step/ Status	Committee	Reference, Standard	Notes, remarks
FC1 FP9 FS12 FB18	Fruit, except...	0.1		ML	CXL	FAC 00		
FT26 F130	Small fruit and berries	0.2		ML	CXL	FAC 00		
VA 35 VO50 VC45 VR75	Vegetables, except ...* #	0.1		ML	CXL	FAC 00		* see other mentioned vegetables and product codes # includes potatoes as peeled p.
VB 40	Brassica, except kale	0.3		ML	CXL	FAC 00		
VL 53	Leafy vegetables, except spinach	0.3		ML	CXL	FAC 00		
C 81	Cereal grains	0.2		ML	CXL	FAC 00		
VD 70	Pulses	0.2		ML	CXL	FAC 00		
VP 60	Legume vegetables	0.2		ML	CXL	FAC 00		
MM97 PM100	Meat of cattle, pig, sheep, poultry	0.1		ML	CXL	FAC 00		
MF 97 PF 111	Fat from meat, poultry	0.1		ML	CXL	FAC 00		
MO 97	Edible offal of cattle, pig, poultry	0.5		ML	CXL	FAC 00		
ML 107	Milk* 1) 2)	0.02	R	ML	CXL	FAC 00		* also sec. milk products, as consumed.
FM 183	milk fat 2)	0.1	R	ML	CXL	FAC 00		
FF 269	wine 3)	0.20		ML	CXL	FAC 00		

LM unspec.	Infant formulae	0.02		ML	CXL	FAC 00	
WF115 VD120 WS 125	Fish * #	0.2		ML	6	FAC 01	* as fish muscle # comments asked
WC 143	Crustaceans*	0.5		ML	6	FAC 01	
IM 151	Molluscs		1.0		ML	6	FAC 01
JF 175	Fruit juices*	0.05		ML	CXL	FAC 01	* ready to drink; includes nectars

Notes and remarks

Further notes and MLs to be incorporated (e.g. situation regarding lead MLs in commodity standards not covered here yet)

The CAC agreed (ALINORM 01/41, para. 124) that the CCFAC should develop a Code of Practice on the prevention and reduction of lead contamination in food and recommended that the FAO Guidelines on lead-soldered cans could be useful in this regard.

- 1) For dairy products, an appropriate concentration factor should apply.
- 2) The 2001 CAC requests reevaluation of the lead MLs in milk and milk fat (ALINORM 01/41, para. 121)
- 3) The OIV requested special consideration to be given to levels of lead in wines that had been stored for long periods of time (ALINORM 01/41).

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1.13 Mercury

Synonym: Hg
 Toxicology: PTWI 5 mcg/kg bw total mercury, of which no more than 3.3 mcg/kg bw as methylmercury
 Reference: JECFA 1972, 1978, 1988, 1999, (2002?)
 Definition: Specified per product and per standard as total mercury (tm) or methylmercury (mm)

Commodity/Product Code	Product Name	Level mg/kg	Suffix	Type	Step/ Status	Committee	Reference, Standard	Notes, remarks
WF 115, except.) WD 120, except.) WS 125, except.)	Fish, except predatory fish	0.5	mm	GL	CXL	CCFFP CCFAC *	CAC/GL 7-91	(1) (3); *: 92, 94,00
WS 131, 132 WF 865	Predatory fish, such as shark, tuna, swordfish, pike and others (2)	1.0	mm	GL	CXL	CCFFP	CAC/GL 7-91	(1), (2) (3)
DW	Natural mineral water	0.001 mg/l	tm	ML	CXL	CCNMW	C-STAN 108-81* * Rev. 1 -1997	

Notes and remarks

General: Mercury is a naturally occurring element which can be present in foodstuffs by natural causes; elevated levels can occur due to e.g. environmental contamination by industrial

or other uses of mercury. No CCFAC position document available. See also remark 4.

(1) The Guideline levels are intended for methylmercury in fresh or processed fish and fish products moving in international trade.

(2) The CGLs for methylmercury in fish were adopted by the CAC-19 in 1991, on the understanding that the levels would be kept under review by the CCFAC as

well as the CCFFP, especially as to the identification of predatory species of fish to which the higher GL applies.

- (3) The 1992 CCFAC informed the CAC and the CCFFP that the recommended GLs for mercury in fish referred to total mercury rather than methylmercury. The 20th CAC (1993) decided to maintain the GLs for methylmercury in fish as previously adopted, while recommending that the establishment of corresponding GLs for total mercury in fish be considered by the CCFAC at its next meeting. The 26th CCFAC (1994) noted that analysis of total mercury was generally adequate to ensure that GLs for methylmercury were not exceeded and decided that the establishment of GLs for total mercury in fish was not necessary. The 29th CCFAC noted that the 43rd CXEXEC had recommended that the CCFAC initiate a new risk analysis on mm. It was decided to defer any decision on the question of GLs based on mm or tm until JECFA had performed the risk assessment. The 53rd JECFA (1999) maintained the existing PTWI for mm and recommended that mm be re-evaluated in 2002 when a new information on the cohort in one of the studies could be assessed and possibly other new relevant data could be available. The 53rd JECFA also recommended that the nutritional benefits of fish consumption are weighed against the possibility of harm when limits on mm concentrations in fish or on fish consumption are being considered. The 32nd CCFAC(2000) took note of these recommendations.
- (4) The draft Code of Practice for Source Directed Measures to Reduce Contamination of Food with Chemicals (ALINORM 01/12A, Appendix XIII, was adopted by the 24th CAC (2001), with an amendment to paragraph 3 of the introduction.

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1.16 Tin

Synonym: Sn
 Toxicology: PTWI 14 mg/kg bw per week for inorganic tin
 Reference: JECFA 1988, 2000 (55)
 Definition: tin, total (Sn-tot) when not otherwise mentioned; or inorganic tin (Sn-in), or other specification

Commodity/Product Code	Product Name	Level mg/kg	Suffix	Type	Step/ Status	Committee	Reference, Standard	Notes, remarks
	Liquid canned foods	200	C	ML	5	FAC 99, 01		1)
	Solid canned foods	250	C	ML	5	FAC 99, 01		
	Fruit juices and nectars, except...	200	R	ML	CXL			1)
	Apple, grape, blackcurrant, small fr. j/n	150	R	ML	CXL			1)

Notes and remarks

General

A position document on tin (CX/FAC 98/24) was last discussed in CCFAC 1998; see also ALINORM 99/12A, para. 127-131.

- 1) The 23rd CAC (1999) held the proposed draft MLs at step 5, pending the evaluation by JECFA in 2001. The 55th JECFA maintained the existing PTWI and reiterated that limited human data available indicate that concentrations of 150 mg/kg tin in canned beverages and 250 mg/kg in other canned foods may produce acute manifestations of gastric irritation in certain individuals.

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3.8 Dioxins

Synonym: chlorinated dibenzodioxins and -furans
 Toxicology: PTMI 70 µg TEQ/kg bw/month (including dioxin like PCBs)
 Reference: JECFA, 2001
 Definition: dioxins, total

Commodity/Product Code	Product Name	Level mg/kg	Suffix	Type	Step/ Status	Committee	Reference, Standard	Notes, remarks
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Notes and remarks

To be prepared by NL.

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5.1 Aflatoxins

Synonym: Abbreviations used are AFB, AFG, AFM, with numbers, to designate specific compounds; AF-tot for the total (see def.).
 Toxicology: Aflatoxins are carcinogenic for animals and probably also for humans. Exposure should be restricted to a minimum, without threatening an adequate food supply. The carcinogenic potency has been assessed by the JECFA .
 Reference: JECFA 1987, 1997, 2001
 Definition: Depending on the commodity, the contaminant is defined as aflatoxins total (B1 +B2 + G1 + G2), or (in milk) as the metabolite AFM1.

Commodity/Product Code	Product Name	Level mcg/kg	Suffix	Type	Step/ Status	Committee	Reference, Standard	Notes, remarks
SO 703	Peanuts, raw Peanuts, processed	15	AF-tot	ML	CXL	FAC 88-98	CS 209-99	1 1
TN 675	Pistachio nuts					FAC 02		Discussion Paper CX/FAC 02/22
DF 297	Figs, dried					FAC 94		Information was asked by the 1994 FAC
GC 81	Cereals					FAC 88-91		
GC 645	Corn (maize)							4
ML 106	Milk	0.5	AFM1	ML	CXL	FAC 88-01		2
	Animal Feedingstuffs					FAC 87-94	RCP 45-97	3

Notes and remarks

General

The 23rd CCFAC (1991) decided to discontinue the development of a ML for aflatoxins in foods in general, and to discuss the problems on a commodity basis.

It is acknowledged that for primary plant products the aflatoxin contamination is often not homogenous and a sampling plan is necessary to assure reasonable application of MLs. A general position paper on aflatoxins in food and feeds (CX/FAC 97/16) was presented to the 1997 CCFAC.

1. The 1994 CCCPL decided not to proceed with the proposed GL for processed peanuts and to advance the proposed GL for raw peanuts (intended for further processing), associated with a specific sampling plan. It is assumed that raw peanuts are the major commodity in international trade. The 49th JECFA (1997) evaluated hypothetical standards of 10 and 20 mcg/kg AFB in peanuts and concluded that the higher standard would not result in any observable difference in rates of liver cancer. As a result of this evaluation, the 1998 CCFAC (discussing about options of 10 and 15 mcg/kg as a ML for AF-total in peanuts), decided to propose 15 mcg/kg as ML.
2. The 24th CCFAC (1993) decided to stop the development of a specific standard for AFM1 in milk destined for use in baby foods. The CCFAC has discussed 2 options for a standard for AFM1 in milk: 0.05 mcg/kg and 0.5 mcg/kg. At the request of the 32nd CCFAC (2000), the 56th JECFA (2001) evaluated the exposures and cancer risks associated with these 2 options and concluded that the additional risks for liver cancer for the higher ML are very small. As a result, 0.5 mcg/kg was forwarded as proposed ML at step 8 by the 2001 CCFAC. The 2001 CAC adopted this proposed draft ML, noting that data supporting the lower level, if and when available, could be examined by the CCFAC at a future meeting when necessary. It is acknowledged that the AFM1 level in milk is related to the AFB1 level in the animal feed. See note 3.
3. The 1994 CCFAC decided to discontinue the establishment of GLs for AFB1 in supplementary feedingstuffs for milk-producing animals (previously proposed at the level of 5 mcg/kg), based on the assumption that the relationship between aflatoxins in milk and feeds is not (completely) clear and that there is not much international trade in (composite) supplementary feedingstuffs. International trade mostly is in the form of individual commodities which can be used as feed components in various quantities, directed to other feed uses than milk producing animals, or to other uses in general, or be decontaminated etc. Therefore, a Code of Practice was developed (and forwarded by the 1997 CCFAC to the CAC for adoption at step 8).
4. Corn was included in a Technical Consultation on sampling plans for aflatoxins in commodities. See FAO Food and nutrition Paper 55 (Rome, 1993).

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5.2 Ochratoxins

Synonym:	Ochratoxins include a number of related mycotoxins (A, B, C and their esters and metabolites), the most important one being ochratoxin A, abbreviated here as OTA.
Toxicology:	PTWI 100 ng/kg bw for OTA
Reference:	JECFA 37 (1990), 44 (1995), 56 (2001), [2004]
Definition:	ochratoxin A (OTA)

Commodity/Product Code	Product Name	Level	Suffix	Type	Step/ Status	Committee	Reference, Standard	Notes, remarks
GC 640, 650, 654	Wheat, barley, rye	5	*	ML	5	FAC 91-02		1) * includes derived products

Notes and remarks

General

Ochratoxin A is the major compound of a group of chemically related mycotoxins produced by species of the genera *Aspergillus* and *Penicillium*. OTA contamination is commonly found in various cereals, some pulses, coffee, cocoa, figs, nuts and coconut products. It can also be transferred through the feed to animal products and concentrates especially in the kidney, but may also be found in meat and milk. Most OTA is however converted to the less harmful ochratoxin- α in the rumen of ruminants. OTA is a nephrotoxic mycotoxin, which is carcinogenic to rodents and has also teratogenic, immunotoxic and possibly neurotoxic properties. It has been associated with Balkan Endemic Nephropathy.

The situation regarding ochratoxin has been reviewed in a position paper (last version CX/FAC 99/14).

1. A Code of Practice for the prevention of mycotoxin contamination in cereals is being prepared (CX/FAC 02/21, per nov. 2001 at step 3), which includes an annex on OTA.

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5.6.1 Patulin

Synonym:

Toxicology: PMTDI 0.4 mcg/kg bw

Reference: JECFA 44 (1995)

Definition: patulin

Commodity/Product Code	Product Name	Level mcg/kg	Suffix	Type	Step/ Status	Committee	Reference, Standard	Notes, remarks
JF 226 ingredient	Apple juice*	50		ML	6	FAC 97-02		1); 2); * includes apple juice as in other beverages

Notes and remarks

General

Patulin is a low molecular weight hemiacetal lactone mycotoxin produced by species of the genera *Aspergillus*, *Penicillium* and *Byssoschlamys*. The major sources of patulin

contamination are apples with brown rot and blue mould. Because patulin does not spread much from spoilt tissue, the main human exposure can be expected from processed products, like apple juice and apple sauce, in which the contamination is not visible. Because fermentation destroys patulin, it is not normally present in cider and perry, unless unfermented apple juice has been added after fermentation.

Patulin may also be a contaminant of soft fruits, some vegetables, barley, wheat and corn.

The PMTDI was set by applying a safety factor of 100 from the lowest NOAEL. Potential health problems related to patulin are due to immunotoxic, neurotoxic, mutagenic, carcinogenic and possible adverse gastrointestinal effects observed in animals. Patulin is mostly eliminated within a few days after ingestion.

The situation regarding patulin has been reviewed in a position paper (last version CX/FAC 99/14).

1. A Code of Practice for the prevention of patulin contamination in apple juice and apple juice ingredients in other beverages is being developed (last version CX/FAC 02/20).

2. As an alternative ML, a level of 25 mcg/kg has been discussed within the CCFAC and the CAC. Because consensus could not be reached, the 2001 CAC returned the draft ML to step 6 for further consideration by the CCFAC.

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5.4.3 Zearalenone

Synonym: Zearalenone is the most important of a group of related mycotoxins and relevant metabolites. It is abbreviated here as ZEN. A metabolite of ZEN, Zeranol (ZAL) is used as veterinary drug.

Toxicology: PMTDI 0.5 mcg/kg bw

Reference: JECFA 53 (1999)

Definition: Zearalenone for residues of the mycotoxin in plant products;
zeranol for residues of the veterinary drug in animal products.

Commodity/Product Code	Product Name	Level	Suffix	Type	Step/ Status	Committee	Reference, Standard	Notes, remarks
	Cattle liver	10	ZAL	ML*	CXL	RVDF		* based on use as veterinary drug
	Cattle muscle	2	ZAL	ML*	CXL	RVDF		

Notes and remarks

General

Zearalenone is the most important of a group of resorcyclic acid lactone mycotoxins, produced by several species of *Fusarium* moulds.

It is found worldwide in a number of cereal crops and also in derived products like beer. It has been implicated in numerous incidents of mycotoxicosis in farm animals, especially pigs. ZEN is rapidly metabolized and excreted in animals; residues of this mycotoxin in animal products are probably not significant from a health point of view. A metabolite of ZEN, α -zearalanol (zeranol, abbreviated here as ZAL) is however relevant relating to its potential use as a veterinary drug. Also β -zearalanol (taleralanol) has hormonal activity. Besides these substances which can be used as anabolic growth promoters, also α - and β -zearalenol (ZEL) and zearalanone (ZAN) are mentioned as possibly occurring metabolites of or co-occurring substances with ZEN.

The PMTDI for ZEN was set by applying a safety factor of 100 from the lowest NOAEL, related to the estrogenic effect in pigs.

ZAL has an ADI of 0,5 mcg/kg bw (ref. JECFA 26, 27 and 32)

The situation regarding ZEN has been reviewed in a position paper (last version CX/FAC 00/19). Preliminary intake calculations indicate values well below the PMTDI. It is mentioned however that further action seems required to reduce the levels of ZEN in risk products (especially maize containing products) for especially children with a high intake of these products. The 31st CCFAC (1999) agreed that, recognizing that there were no identified trade problems with ZEN, a Codex ML was not necessary for the time being.

ZEN is incorporated with a specific Annex in the Code of Practice for the prevention of mycotoxin contamination in cereals, which is being developed (CX/FAC 02/21, per nov. 2001 in step 3).

- 1) Residues of ZEN and ZAL together in an animal product may be regarded as evidence that the animal feed was contaminated with ZEN. In order to distinguish between contamination of the feed with mycotoxins of the ZEN group or use of ZAL as veterinary drug, it may be necessary to determine the relative proportions of the different residues, e.g. as ZEN + α - and β -ZEL against ZAL. A ratio of 5 or more probably indicates only contamination by mycotoxins.