CODEX ALIMENTARIUS COMMISSION E

Food and Agriculture Organization of the United Nations

World Health Organization

Viale delle Terme di Caracalla, 00153 Rome, Italy - Tel: (+39) 06 57051 - E-mail: codex@fao.org - www.codexalimentarius.org

Agenda Item 13 **CX/CF 16/10/14**
February 2016

JOINT FAO/WHO FOOD STANDARDS PROGRAMME

CODEX COMMITTEE ON CONTAMINANTS IN FOODS

Tenth Session
Rotterdam, The Netherlands, 4 – 8 April 2016

DISCUSSION PAPER ON THE DEVELOPMENT OF MAXIMUM LEVELS FOR MYCOTOXINS IN SPICES AND POSSIBLE PRIORITIZATION OF WORK

(Prepared by the Electronic Working Group chaired by India and co-chaired by the European Union and Indonesia)

Codex Members and Observers are kindly invited to consider the conclusion and recommendation in paragraphs 4 and 5 while taking into account the data and information provided in Appendix I in order to assist the Committee on how to proceed further with the consideration of maximum levels for mycotoxins in spices and the possible prioritization of such work.

BACKGROUND

1. During the 8th Session of the Committee on Contaminants in Foods (March 2014), India and Indonesia had submitted new work proposals for the establishment of maximum levels for aflatoxins in spices and nutmeg respectively. After a general discussion, the Committee agreed to establish an electronic Working Group, chaired by India and co-chaired by the European Union and Indonesia, that will review mycotoxins in spices to assist the Committee to understand which mycotoxins to address and in which spices for consideration at its next session.[1]

2. During the 9th Session of the Committee (March 2015), the Delegation of India introduced the discussion paper and provided a summary of the work and the approach taken to understand which mycotoxins should be addressed and for which spices, to aid in the development of a priority list of spices. The Delegation indicated that MLs should be set for total aflatoxins, aflatoxin B_1 and Ochratoxin A and that the priority list of spices was presented in the paper.

3. In view of the interest to continue work on MLs in spices, but the need for further clarity on which mycotoxin/spice(s) combination to establish MLs and the rationale for this, as well as further need for prioritization of the work, the Committee agreed to re-establish the eWG, led by India and co-chaired by the European Union and Indonesia to prepare a new discussion paper on mycotoxin contamination in spices (Appendix I) and a project document for establishment of MLs for mycotoxins in spices (Appendices II and III). The discussion paper should also include proposals for possible MLs to assist the next session of the Committee to take a decision on new work.[2] The List of Participants of the eWG is presented in Appendix IV.

CONCLUSION

4. To effectively strategize the work of mycotoxins in spices, the above mentioned method of prioritization has been fulfilled. Cinnamon was not considered in this work due to lack of data, despite its high consumption as reported in Annex III. Annex V of this document outlines the list of spices which could be addressed by the Committee for the establishment of MLs. Included in the Annex are details on contaminating mycotoxins and frequently rejected spices. Based on this work, it was found that the spices such as dried or dehydrated forms of chilli, nutmeg, turmeric, pepper and ginger are traded predominantly in the international market and are contaminated with higher concentrations of mycotoxins. Project documents for spices in Group 1 and Group 2 are included in Appendix II and III. The discussion paper could assist the Committee to determine a possible prioritisation of the work on spices.

[1] REP14/CF, paras 131-137
[2] REP15/CF, paras 135-139

RECOMMENDATION

3. In accordance with the conclusion outlined in this document, the following table shows the priority list of spices which could assist the Committee for the establishment of MLs for mycotoxins.

Priority list of spices			
Group	**Spice**	**Forms**	**Mycotoxins type**
Group 1	Chilli and Paprika, Ginger, Nutmeg, Pepper, Turmeric	Dried or dehydrated for all spices listed	Aflatoxin B_1, Total Aflatoxins, Ochratoxin A
Group 2	Caraway, Celery seed, Cloves, Coriander seed, Garlic, Fenugreek		

APPENDIX I

DISCUSSION PAPER ON THE DEVELOPMENT OF MAXIMUM LEVELS FOR MYCOTOXINS IN SPICES AND POSSIBLE PRIORITIZATION OF WORK

1. BACKGROUND

1. During the 8th Session (2014) of the Codex Committee on Contaminants in Foods (CCCF), India and Indonesia had submitted new work proposals for the establishment of maximum levels for aflatoxins in spices and nutmeg respectively. After a general discussion, the Committee agreed to establish an electronic Working Group (eWG), chaired by India and co-chaired by Indonesia and the European Union, that will review mycotoxins in spices to assist the Committee to understand which mycotoxins to address and in which spices for consideration at its next session.

2. During the 9th Session (2015) of the Committee, the Delegation of India introduced the discussion paper and provided a summary of the work and the approach taken to understand which mycotoxins should be addressed and for which spices, to aid in the development of a priority list of spices. The Delegation indicated that MLs should be set for total aflatoxins, aflatoxin B_1 and Ochratoxin A and that the priority list of spices was presented in the paper.

3. In view of the interest to continue work on MLs in spices, but the need for further clarity on which mycotoxin/spice(s) combination to establish MLs and the rationale for this, as well as further need for prioritization of the work, the Committee agreed to re-establish the eWG, led by India and co-chaired by Indonesia and the European Union to prepare a new discussion paper on mycotoxin contamination in spices and a project document for establishment of MLs for mycotoxins in spices. The discussion paper should also include proposals for possible MLs to assist the next session of the Committee to take a decision on new work.

2. OBJECTIVE

4. The specific objective of this eWG is to review available data for mycotoxins in spices for prioritization of the work. This will assist the Committee to understand which mycotoxins need to be addressed and the spices in which they occur. This review would also help to develop guidelines for risk assessment of mycotoxins in spices. The ultimate of this work aims to establish maximum levels (MLs) for mycotoxins in spices in order to facilitate fair trade while protecting consumer health. The maximum levels for various mycotoxins in spices vary widely across the World (Table 1) and the lack of harmonization affects global trade of spices. Some countries have regulations for mycotoxins specifying different tolerated levels for individual foods, while others have set only one tolerated level for instance for “all foods” which also include spices.

Table 1: Maximum Levels of Mycotoxins fixed by some countries for spices/all food products								
Sl. No.	**Country/ Organisation**	**Product**	**Aflatoxin B_1 (µg/kg)**	**Aflatoxin Total (µg/kg)**	**Zearalenone (µg/kg)**	**T-2 Toxin (µg/kg)**	**Ochratoxin A (µg/kg)**	**Patulin (µg/kg)**
1)	Armenia	All foods	5		1000	100	10	
2)	Barbados	All foods		20				
3)	Brazil	Spices		20			30	
4)	Bulgaria “**	Spices	2	5				
5)	Chile	Spices		10				
6)	Colombia	All foods		10				
7)	Croatia	Spices	30					
8)	Cuba	All foods		5				
9)	Czech Republic “**	Spices	20					
10)	European Union	Spices*	5	10			15[a] 20[b]	
11)	Finland”**	All Spices		10				
12)	Honduras	All foodstuffs		1				
13)	Hong Kong	All foodstuffs	15	15				
14)	Iceland	Spices	5	10			15	
15)	India	All Foods		30				
16)	Indonesia	Spices powder	15	20				
17)	Iran (Islamic Republic of)	Spices	5	10				
18)	Jamaica	Foods and Grains		20				
19)	Japan	All foods	10					
20)	Latvia”**	Food products of plant & animal origin	5					
21)	Liechtenstein	Spices	5	10				
22)	Malaysia	All foods		35				
23)	Mauritius	All foods	5	10				
24)	Morocco	All foods	10					
25)	Nigeria	All foods	20					
26)	Norway	Spices	5	10		15		
27)	Oman	Complete food stuffs	10					
28)	Pakistan	Chilli		30				
29)	Salvador	All Foods		20				
30)	Serbia and Montenegro	Spices	30					
31)	Singapore	All foods except food for infants or young children	5	5				
		Food for infants or young children	0.1	NA				
32)	South Africa	All food stuffs	5	10				50

Table 1: Maximum Levels of Mycotoxins fixed by some countries for spices/all food products								
Sl. No.	**Country/ Organisation**	**Product**	**Aflatoxin B_1 (µg/kg)**	**Aflatoxin Total (µg/kg)**	**Zearalenone (µg/kg)**	**T-2 Toxin (µg/kg)**	**Ochratoxin A (µg/kg)**	**Patulin (µg/kg)**
33)	Sri Lanka	All foods		30				
34)	Switzerland	Spices excluding Nutmeg	5	10			20	
		Nutmeg	10	20				
35)	Thailand	All foods		20				
36)	Tunisia	All foods	2					
37)	Turkey	Spices	5	10				
38)	USA	All food except milk***		20				
39)	Uruguay	All foods and spices	5	20				
40)	Vietnam	All Foods		10				
41)	Zimbabwe	All Foods	5					

Spices*: *Capsicum spp.* (dried fruits thereof, whole or ground, including chillies, chilli powder, cayenne and paprika); *Piper spp.* (fruits thereof, including white and black pepper); *Myristica fragrans* (nutmeg); *Zingiber officinale* (ginger); *Curcuma longa,* based on Commission Regulation (EC) No 2174/2003.

a - Spices mentioned in footnote*, except from *Capsicum spp*. (Ref: Commission Regulation (EC) No 2015/1137)

b - Spices mentioned in footnote* from dried fruits of *Capsicum spp*. (Ref: Commission Regulation (EC) No 2015/1137)

**- Countries which comes under EU with MLs for mycotoxins

*** - The action level for aflatoxin M_1 in milk in the U.S. is 0.5 µg/kg.

- peanuts, almonds, walnuts, hazelnuts, pistachios, dried figs and brazil nuts.

Source: Worldwide regulations for mycotoxins in food and feed in 2003 (FAO); Pakistan Standard and Quality Control Authority (PSQCA) standard # PS: 1742- 2010;, Agri-Food and Veterinary Authority of Singapore; Commission Regulation (EU) No 105/2010 of 5 February 2010 amending Regulation (EC) No 1881/2006 setting maximum levels for certain contaminants in foodstuffs as regards Ochrwww.ava.gov.sgatoxin A: www.anvisa.gov.br; The National Agency on Drugs and Food Control, Republic of Indonesia: # HK. 00.06.1.52.4011-2009. Chilean Sanitary Food Regulation http://web.minsal.cl/sites/default/files/files/DECRETO_977_96%20actualizado%20a%20Enero%202015(1).pdf

3. INTRODUCTION

5. Spices are dried/dehydrated commodities and each one is a stand-alone item. These include dried seeds, fruits, bark, roots, rhizomes, stigmas and arils. These products are used as ingredients for the purposes of providing the desired seasoning, flavour or aroma to the food and are distinguished from products that are used as food additives. Spices are marketed in whole, ground, and cracked/crushed forms and as spice mixes/blends. Because of these assorted forms of spices, the fungi that can contaminate and its produced mycotoxins are greatly varied. In the Code of Hygienic Practice for Spices and Dried Aromatic Plants (CAC/RCP 42-1995), Spices and Dried Aromatic Plants are defined as “dried components or mixtures of dried plants used in foods for flavouring, colouring, and imparting aroma. This term equally applies to whole, broken, ground and blended forms”. According to European Spice Association, International Organisation for Standardisation and American Spice Trade Association, there are more than 50 commodities categorized as spices, most of which are susceptible to mycotoxins. Commodities which are categorized as spices in the “Codex Classification of Food and Feed” are considered in this work.

6. The word mycotoxin is derived from two words; *“mykes”* referring to “fungi” (Greek) and *“toxicum*” referring to “poison” (Latin). Mycotoxins are secondary metabolites produced by moulds, contaminating a wide range of commodities before and after harvest. Mycotoxins are relatively large molecules that are not significantly volatile (WHO 1978; Schiefer 1990). Commodities contaminated with mycotoxins may be toxic to humans and animals depending upon a number of factors such as extent of contamination, frequency and amount of consumption of the contaminated food by various populations, exposure and absorption into the host, species affected etc, and therefore, can be a major health issue for consumers. The presence of mycotoxins in various foods to a certain extent is unavoidable as their synthesis by contaminating fungi are environmentally induced. The main genera of mycotoxin producing fungi are listed in Table 2 below.

Table 2: Main genera of fungi producing mycotoxins		
Mycotoxins	**Fungi**	**Spices affected by mycotoxins**
Aflatoxin (B_1, B_2, G_1, G_2)	Aspergillus	Chilli, Clove, Ginger, Nutmeg, Paprika, Pepper, Turmeric
Ochratoxin (Ochratoxin A)	Aspergillus, Penicillium	Cayenne pepper, Celery seed, Chilli, Garlic, Mace, Nutmeg, Paprika, Pepper, Turmeric
Patulin	Aspergillus, Penicillium	
Cyclopiazonic acid (CPA)	Aspergillus	
Fumonisin (B_1, B_2, B_3)	Fusarium	
Fusaric acid		
Type A Trichothecenes (T-2 toxin, HT-2 toxin, diacetoxyscirpenol)		
Type B Trichothecenes (Nivalenol, deoxynivalenol, fusarenon-X)		
Zearalenone		
Penitrem A	Claviceps	
Ergot alkaloids: Clavines (Argoclavine)		
Lysergic acid, Lysergic acid amids (Ergin)		
Ergopeptines (Ergotamine, Ergovaline)		
Citrinin	Penicillium	
Roquefortine		
PR toxin		
Penitrem A		
Cyclopiazonic acid (CPA)		

4. APPROACH:

7. The eWG evaluated the data, provided by members, on global occurrence and rejection of spices due to various mycotoxins. The spices which have more importance with respect to the international trade data are given in Annex I. The summary of occurrence and rejections data provided by eWG members is shown in Annex II.

8. It was observed that some spices such as dried chilli and nutmeg were contaminated with mycotoxins even upto and occasionally exceeding concentration of 1000 µg/kg while other spices were contaminated no more than 1 to 2 µg/kg of mycotoxins. Certain spices such as dried garlic are produced and traded in higher quantities but appear to have less evidence of contamination due to mycotoxins. For these commodities, a greater number of samples would be required in order to adequately assess their typical mycotoxin levels. The extent of contamination is due to susceptibility, environmental condition of the cultivated regions and poor post-harvest practices.

9. In the Annex III, the per capita daily availability data of individual spices is listed (submitted by the United States). As the collected availability data were only from one country, the method of prioritization used is solely based on concentration of mycotoxins present in contaminated spices. Priority was given to spices which are contaminated with relatively higher amount of mycotoxins as they are rejected frequently in trade and also affects public health.

10. Occurrence data was ample for certain spices but there were few data collected on some other spices. Spices were classified into two groups as detailed in Annex IV based on the volume of data collected. Spices with less data (< 10 samples) were classified in Group 2 as more data would be necessary to understand the extent of risk due to mycotoxins. Other spices with ample data are classified in Group 1. Spices in Group 1 are given more priority than those classified in Group 2. The spices classified in two groups are shown in Table 9.

11. The median values of mycotoxins present for every spice were found from the collected occurrence and rejections data, using Microsoft Excel 2007. For spices in Group 1, concentration of total aflatoxins were taken in case of Aflatoxins. Spices were ranked based on median values of both total Aflatoxins (Table 10) and Ochratoxin A (Table 11). Median values of Aflatoxin B_1 in Spices of Group 1 were also shown in Table 12. Overall rank for spices were calculated based on the sum of ranks for total aflatoxins and Ochratoxin A in spices and shown in Table 13. As chillies and paprika belong to same genus Capsicum and have the same botanical name as *Capsicum annuum* L., those were given the same rank. Ginger and pepper have the same sum of rank (Table 13). As median value of Aflatoxin B_1 in ginger (Table 12) was higher, ginger was given more priority than pepper.

12. Spices in Group 2 were also prioritized (Table 14) based on median values of mycotoxins present. Overall rank were assigned for all spices studied in this work. Spices of both Group 1 and Group 2 are listed in Annex V (Table 15). All commodities considered in this work are only in dried or dehydrated forms.

5. OCCURRENCE OF MYCOTOXINS IN SPICES

13. Total Aflatoxins, Aflatoxin B_1 and Ochratoxin A were the listed mycotoxins in the collected data. Many countries have regulations for Total Aflatoxins as 10 µg/kg, 15 µg/kg, 20 µg/kg and 30 µg/kg (Table 1) and for Ochratoxin A as 10 µg/kg, 15 µg/kg, 20 µg/kg and 30 µg/kg. Based on the different existing national MLs, percentage of samples exceeding these limits were found and present in Table 6 and Table 7. Based on Graph 1 and 2, more lots of Nutmeg and Paprika are exceeding the different national MLs due to Aflatoxins and Ochratoxin A respectively. Least amount of exceeding lots were of Pepper and Turmeric with respect to various national MLs.

6. CONCLUSION

14. To effectively strategize the work of mycotoxins in spices, the above mentioned method of prioritization has been fulfilled. Cinnamon was not considered in this work due to lack of data, despite its high consumption as reported in Annex III. Annex V of this document outlines the list of spices which could be addressed by the Committee for the establishment of MLs. Included in the Annex are details on contaminating mycotoxins and frequently rejected spices. Based on this work, it was found that the spices such as dried or dehydrated forms of chilli, nutmeg, turmeric, pepper and ginger are traded predominantly in the international market and are contaminated with higher concentrations of mycotoxins. Project documents for spices in Group 1 and Group 2 are included in Appendix I and II. This discussion paper could assist the Committee to determine a possible prioritisation of the work on spices.

Annex I

Table 3: Worldwide Export data of Spices						
Spice	**Export Quantity (In Tonnes)**					**Average Export Quantity (in Tonnes)**
	2008	**2009**	**2010**	**2011**	**2012**	
Garlic	1,829,001.0	1,910,071.0	1,681,948.0	1,975,108.0	1,755,615.0	1,830,348.6
Chillies and Peppers, dry*	510566	532,418.0	533,970.0	536,163.0	651,280.0	552,879.4
Ginger	308,150.0	271,504.0	244,668.0	295,018.0	646,874.0	353,242.8
Pepper	322,688.0	342,403.0	343,075.0	330,857.0	350,356.0	337,875.8
Nutmeg	19,924	20,887	20,417	23,330	NA*	21,139.5
Turmeric	84,057.0	79,629.0	151,347.0	123,625.0	112,583.0	110,248.2
Cloves	41,333.0	54,701.0	43,609.0	55,268.0	50,302.0	49,042.6

* Red and cayenne pepper, paprika, chillies (*Capsicum frutescens; C. annuum*); allspice, Jamaica pepper (*Pimenta officinalis*)

Source: FAOSTAT, ITC

NA* - Not Updated in ITC website

Annex II

Table 4: Worldwide Occurrence data including Rejections of spices due to aflatoxins – 2009 to 2015			
Spice	**Mycotoxins Type**	**Range of the mycotoxins present (min to max) µg/kg**	**Total number of samples analyzed**
Dried chilli (whole & ground)	Aflatoxin B_1	0.0169 – 1462.4	20081
	Total Aflatoxins	0.0169–1489.9	
Turmeric (whole & ground)	Aflatoxin B_1	0.22 – 305.7	855
	Total Aflatoxins	0.02 - 336.6	
Dried ginger	Aflatoxin B_1	0.029 – 51.8	256
	Total Aflatoxins	0.029–362.9	
Nutmeg	Aflatoxin B_1	0.0203 – 1026.8	385
	Total Aflatoxins	0.0241-1200	
Pepper	Aflatoxin B_1	0.02 – 33.7	71
	Total Aflatoxins	0.02 – 40.1	
Dried paprika (whole & ground)	Aflatoxin B_1	0.055 – 349.8	107
	Total Aflatoxins	0.055 - 358.6	
Clove	Total Aflatoxins	29	1
Dried garlic (ground)	Aflatoxin B_1	0.7	1
	Total Aflatoxins	0.7	
Coriander seed	Aflatoxin B_1	0.5 – 0.7	3
	Total Aflatoxins	0.5 – 0.7	
Fenugreek	Aflatoxin B_1	1.6	1
	Total Aflatoxins	1.6	
Caraway	Aflatoxin B_1	0.5 – 2.3	2
	Total Aflatoxins	0.5 – 2.3	

Source: Austria, Canada, India, Indonesia, European Union, Singapore, UK, USA

Table 5: Worldwide Occurrence data including rejections of spices due to Ochratoxin A – 2009 to 2015		
Spice	**Range of the toxin present (min to max) µg/kg**	**Total number of samples analyzed**
Dried chilli (whole & ground)	0.05 – 724	439
Turmeric (whole & ground)	0.01 – 15.41	169
Dried ginger	0.01 – 44.4	85
Nutmeg	0.116 – 355	56
Pepper	0.044 – 24.2	87
Dried paprika (whole & ground)	0.2 – 2150	132
Dried garlic (ground)	0.0480 – 0.467	6
Celery Seed	0.215 – 0.73	2
Coriander seed	0.277 – 1.86	6

Source: Austria, Canada, India, Indonesia, European Union, Singapore, UK, USA

Table 6: Total Aflatoxins in spices in Occurrence data including rejections (2009 to 2015)				
Spice	**Percentage (%) of samples exceeding the concentration of**			
	> 10 µg/kg	**> 15 µg/kg**	**> 20 µg/kg**	**> 30 µg/kg**
Nutmeg	66.49	53.25	45.71	33.77
Paprika	13.08	8.41	7.48	7.48
Chilli	25.11	17.96	13.88	8.62
Ginger	10.55	7.81	3.51	1.56
Pepper (Piper spp.)	5.63	5.63	4.22	1.41
Turmeric	4.91	2.57	2.22	1.63

Graph 1

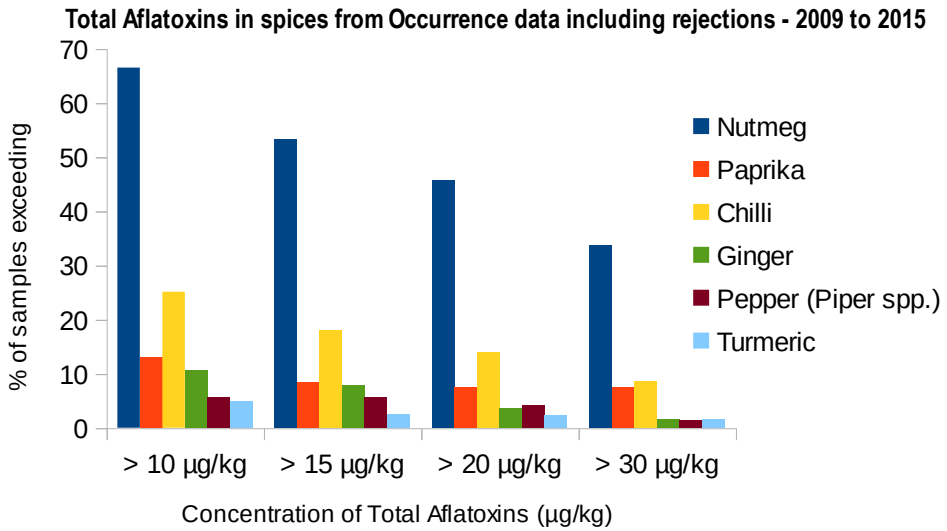
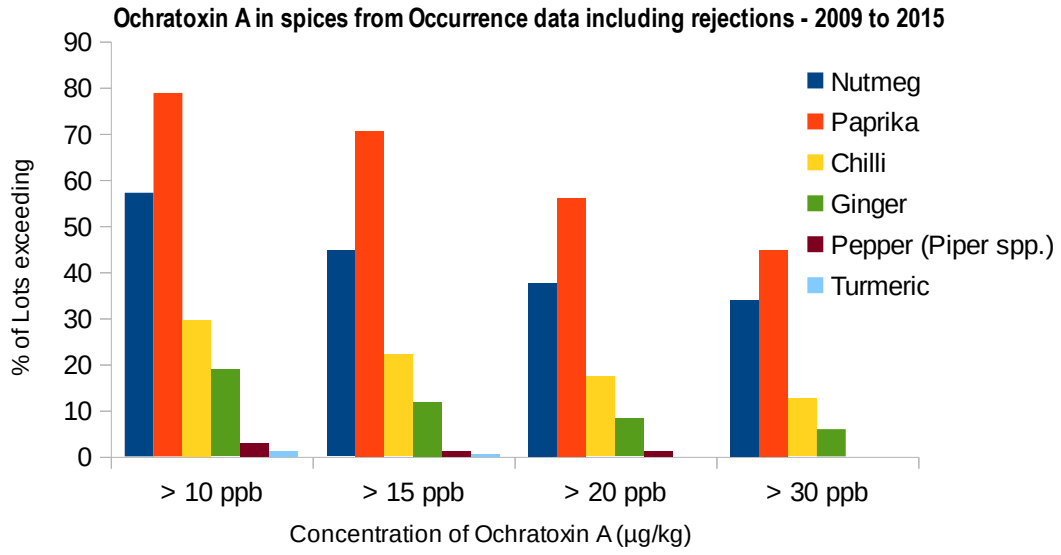


Table 7: Ochratoxin A in spices in Occurrence data including rejections (2009 to 2015)				
Spice	**Percentage (%) of samples exceeding the concentration of**			
	> 10 µg/kg	**> 15 µg/kg**	**> 20 µg/kg**	**> 30 µg/kg**
Nutmeg	57.14	44.64	37.5	33.92
Paprika	78.78	70.45	56.06	44.69
Chilli	29.61	22.09	17.31	12.52
Ginger	18.82	11.76	8.23	5.88
Pepper	2.873	1.149	1.149	0
Turmeric	1.18	0.59	0	0

Graph 2



Annex III

Table 8: Estimated per capita daily consumption of spices and herbs, using data on daily amounts of spices and herbs available per resident, as a proxy[a, b]

Spice/ Herb	Imports (In Tonnes)*	Production (In Tonnes)*	Total (In Tonnes)*	Availability[b] (gram per capita/day)
Anise seed, caraway seed, and Fennel seed	10315	0	10315	0.09
Cassia (includes cinnamon)	23743.58	0	23743.58	0.21
Celery seed	1265.788	0	1265.788	0.01
Clove	1743.056	0	1743.056	0.02
Coriander seed	4253.313	0	4253.313	0.04
Ginger root	56068.26	0	56068.26	0.49
Mace	531.426	0	531.426	0
Nutmeg	2101.44	0	2101.44	0.02
Paprika	28861.98	0	28861.98	0.25
Pepper, black and white	62445.51	0	62445.51	0.54
Pepper, capsicum, dried	89987.67	0	89987.67	0.79
Pepper, chili, dried	0	36616.05	36616.05	0.32
Turmeric	4035.14	0	4035.14	0.04
Other spices[c]	142462.5	0	142462.5	1.24

** The source data obtained in 1000 pounds was converted to tonnes with the conversion factor of 0.453592.*

[a] **Source:** USDA, Economic Research Service. Spices: Supply and Disappearance. Downloaded from http://ers.usda.gov/data-products/food-availability-(per-capita)-data-system.aspx#2794; per capita daily availability calculations are based on a 2012 U.S. population of 314,267,867, as provided in ERS documentation.

[b] Availability data may be over-estimates, since they are not corrected for small amounts exported to Puerto Rico and to other countries.

[c] Includes basil, cardamom seeds, capers, curry and curry powder products, dill, fenugreek seeds, oregano, parsley, rosemary, savory, thyme, mixed spices, and other spices and spice seeds (ground and unground) not individually reported.

Annex IV:

Table 9: Grouping of spices with scientific names		
S.No	**Spice**	***Scientific name***
Group 1:		
1	Chilli	*Capsicum annuum* L.
2	Ginger	*Zingiber officinale* Rosc.
3	Nutmeg	*Myristica fragrans* L.
4	Paprika	*Capsicum annuum* L.
5	Pepper	*Piper nigrum* L.
6	Turmeric	*Curcuma longa* L.
Group 2:		
7	Caraway	*Carum carvi* L.
8	Celery seed	*Apium graveolens* L.
9	Cloves	*Syzygium aromaticum* L.
10	Coriander seed	*Coriandrum sativum* L.
11	Fenugreek	*Trigonella foenum-graecum* L.
12	Garlic	*Allium sativum* L.

Prioritization of spices based on median concentration of mycotoxins

Group 1:

Table 10: Total Aflatoxins in spices		
Spice	**Median conc. (µg/kg)**	**Rank**
Nutmeg	16.60	1
Chilli	3.40	2
Paprika	1.40	3
Ginger	1.40	4
Turmeric	1.10	5
Pepper	0.92	6

Table 11: Ochratoxin A in spices		
Spice	**Median conc. (µg/kg)**	**Rank**
Paprika	26.10	1
Nutmeg	14.25	2
Pepper	12.12	3
Chilli	5.78	4
Ginger	1.90	5
Turmeric	1.19	6

Table 12: Aflatoxin B_1 in spices	
Spice	**Median (µg/kg)**
Nutmeg	14.60
Chilli	3.40
Paprika	1.64
Ginger	1.10
Turmeric	1.00
Pepper	0.38

Table 13: Ranking of spices in Group 1		
Spice	**Sum of the Ranks**	**Overall rank in Priority list**
Nutmeg	3	1
Paprika	4	2
Chilli	6	2[a]
Ginger	9	3[b]
Pepper	9	4
Turmeric	11	5

a - Chilli and Paprika were merged

b - Ginger was given more priority based on median value of Aflatoxin B_1

Table 14: Ranking of spices in Group 2					
S.No	**Spice**	**Mycotoxins**	**Median Conc. of mycotoxin present (µg/kg)**	**Priority rank in Group 2**	**Overall rank in Priority list**
1	Cloves	Total Aflatoxins	29	1	6
2	Fenugreek	Aflatoxin B_1	1.6	2	7
3	Caraway	Aflatoxin B_1	1.4	3	8
4	Garlic	Aflatoxin B_1	0.7	4	9
5	Coriander seed	Aflatoxin B_1	0.6	5	10
6	Celery seed	Ochratoxin A	0.47	6	11

Annex V

Table 15: Priority list of spices			
Group	**Spice**	**Forms**	**Mycotoxins type**
Group 1	Chilli and Paprika, Ginger, Nutmeg, Pepper, Turmeric	Dried or dehydrated for all spices listed	Aflatoxin B_1, Total Aflatoxins, Ochratoxin A
Group 2	Caraway, Celery seed, Cloves, Coriander seed, Garlic, Fenugreek		

APPENDIX II

PROJECT DOCUMENT

PROPOSAL FOR NEW WORK ON ESTABLISHMENT OF MAXIMUM LEVELS FOR MYCOTOXINS IN DRIED OR DEHYDRATED FORMS OF CHILLI, PAPRIKA, GINGER, NUTMEG, PEPPER AND TURMERIC

(Prepared by the Electronic Working Group chaired by India and co-chaired by the European Union and Indonesia)

1. Purpose and Scope

- The purpose of the work is to ensure fair practices in international food trade and to protect public health by harmonising the level of mycotoxins for chilli, paprika, ginger, nutmeg, pepper and turmeric in dried/dehydrated forms.
- The scope of the work is to establish Codex maximum levels (MLs) of mycotoxins (Aflatoxin B_1, Total Aflatoxins and Ochratoxin A) for chilli, paprika, ginger, nutmeg, pepper and turmeric in dried/dehydrated forms.

2. **Relevance and Timeliness**

Chilli, paprika, ginger, nutmeg, pepper and turmeric in dried or dehydrated forms are the spices prominently produced and traded globally. These products are traded in both whole and ground forms. Spices mentioned in this proposal are produced largely in tropic regions which have high temperature, humidity and rainfall. Therefore, these have higher susceptibility towards mycotoxins contamination due to favourable climate conditions for the growth of fungi in the tropic.

Common and binomial names of Spices mentioned in this work		
Common name	**Forms**	**Binomial name**
Chilli and paprika	Dried or dehydrated	*Capsicum annuum* L
Ginger		*Zingiber officinale* Rosc.
Nutmeg		*Myristica fragrans* L
Pepper		*Piper nigrum* L
Turmeric		*Curcuma longa* L

Aflatoxins (AFs) were evaluated by the JECFA at its thirty-first, forty-sixth, forty-ninth and fifty-sixth meetings. Ochratoxin A (OTA) was evaluated by the JECFA at its thirty-seventh, forty-fourth and fifty-sixth meetings. The Provisional tolerable weekly intake (PTWI) of 100 ng/kg body weight is maintained for OTA at the latest (JECFA, 2007).

The hazardous nature of mycotoxins to humans and animals has necessitated the need for establishment of control measures and tolerance levels by national and international authorities. Many countries in the world have MLs for Aflatoxin B_1, Total Aflatoxins and Ochratoxin A in spices. But different regulations (MLs) for mycotoxins in various countries are a potential impediment to the international trade.

3. **Main aspects to be covered**

Establishment of MLs and a sampling plan for Aflatoxins (for Total Aflatoxins & Aflatoxin B_1) and for Ochratoxins (Ochratoxin A) for chilli, paprika, ginger, nutmeg, pepper and turmeric in dried/dehydrated forms.

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

This proposal complies with the following criteria for establishing priorities of work:

a) Diversification of national legislation and apparent resultant or potential impediments to international trade.

About 40 countries and the European Union have different MLs for mycotoxins in spices/foods.

b) Work already undertaken by other organisations in this field

The risk assessment has been already done for Aflatoxins and Ochratoxin A by JECFA.

5. Relevance to the Codex Strategic Objectives

The proposed work has relevance with Codex Strategic Goals 1 and 2.

Goal 1: Establish international food standards that address current and emerging food issues.

Mycotoxins are potential food contaminants in various spices. Therefore, establishment of MLs for mycotoxins in spices mentioned in 'Scope' is necessary to ensure consumer health and to promote fair trade practices.

Goal 2: Ensure the application of risk analysis principles in the development of Codex standards.

The establishment of MLs based on risk analysis by scientific expert bodies is proposed.

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

Proposals for establishment of Aflatoxins in spices and in nutmeg had been submitted by India and Indonesia respectively at the eighth session of CCCF.

The discussion paper on "mycotoxin contamination in spices for possible prioritization of work" prepared by the eWG led by India, co-chaired by Indonesia and the European Union submitted at the ninth session of CCCF.

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

Scientific Risk Assessment by JECFA might be required.

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

Not anticipated at this stage.

9. Proposed time-line for completion of the work

Subject to approval by the Codex Alimentarius Commission, the proposed new work to establish maximum levels for mycotoxins in spices as per the Scope will be considered by the tenth Session of the CCCF (CCCF10) with a view to its adoption in 2017, depending upon the availability of scientific advice.

****

APPENDIX III

PROJECT DOCUMENT

PROPOSAL FOR NEW WORK ON ESTABLISHMENT OF MAXIMUM LEVELS FOR MYCOTOXINS IN DRIED OR DEHYDRATED FORMS OF CARAWAY, CELERY SEED, CLOVES, CORIANDER SEED, GARLIC AND FENUGREEK

(Prepared by the Electronic Working Group chaired by India and co-chaired by the European Union and Indonesia)

2. Purpose and Scope

- The purpose of the work is to ensure fair practices in international food trade and to protect public health by harmonising the level of mycotoxins for caraway, celery seed, coriander seed, garlic and fenugreek in dried/dehydrated forms.
- The scope of the work is to establish Codex maximum levels (MLs) of mycotoxins (Aflatoxin B_1, Total Aflatoxins and Ochratoxin A) in for caraway, celery seed, cloves, coriander seed, garlic and fenugreek in dried/dehydrated forms.

3. **Relevance and Timeliness**

Spices such as caraway, celery seed, coriander seed, garlic and fenugreek in dried or dehydrated forms have significant importance in global trade. These products are traded in both whole and ground forms. Spices mentioned in this proposal are produced largely in tropic regions which have high temperature, humidity and rainfall. Therefore, these have higher susceptibility towards mycotoxins contamination due to favourable climate conditions for the growth of fungi in the tropic.

Common and binomial names of spices mentioned in this work		
Common name	**Forms**	**Binomial name**
Caraway	Dried or dehydrated	*Carum carvi* L.
Celery seed		*Apium graveolens* L.
Cloves		*Syzygium aromaticum L.*
Coriander seed		*Coriandrum sativum* L.
Garlic		*Allium sativum* L.
Fenugreek		*Trigonella foenum-graecum* L.

Aflatoxins (AFs) were evaluated by the JECFA at its thirty-first, forty-sixth, forty-ninth and fifty-sixth meetings. Ochratoxin A (OTA) was evaluated by the JECFA at its thirty-seventh, forty-fourth and fifty-sixth meetings. The Provisional tolerable weekly intake (PTWI) of 100 ng/kg body weight is maintained for OTA at the latest (JECFA, 2007).

The hazardous nature of mycotoxins to humans and animals has necessitated the need for establishment of control measures and tolerance levels by national and international authorities. Many countries in the world have MLs for Aflatoxin B_1, Total Aflatoxins and Ochratoxin A in spices. But different regulations (MLs) for mycotoxins in various countries are a potential impediment to the international trade.

4. **Main aspects to be covered**

Establishment of MLs and a sampling plan for Aflatoxins (for Total Aflatoxins & Aflatoxin B_1) and for Ochratoxins (Ochratoxin A) for caraway, celery seed, cloves, coriander seed, garlic and fenugreek in dried/dehydrated forms.

5. **Assessment against the Criteria for the establishment of work priorities**

This proposal complies with the following criteria for establishing priorities of work:

a) Diversification of national legislation and apparent resultant or potential impediments to international trade.

About 40 countries and the European Union have different MLs for mycotoxins in spices/foods.

b) Work already undertaken by other organisations in this field

The risk assessment has been already done for Aflatoxins and Ochratoxin A by JECFA.

6. Relevance to the Codex Strategic Objectives

The proposed work has relevance with Codex Strategic Goals 1 and 2.

Goal 1: Establish international food standards that address current and emerging food issues.

Mycotoxins are potential food contaminants in various spices. Therefore, establishment of MLs for mycotoxins in spices mentioned in 'Scope' is necessary to ensure consumer health and to promote fair trade practices.

Goal 2: Ensure the application of risk analysis principles in the development of Codex standards.

The establishment of MLs based on risk analysis by scientific expert bodies is proposed.

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

Proposals for establishment of Aflatoxins in spices and in nutmeg had been submitted by India and Indonesia respectively at the eighth session of CCCF.

The discussion paper on "mycotoxin contamination in spices for possible prioritization of work" prepared by the eWG led by India, co-chaired by Indonesia and the European Union submitted at the ninth session of CCCF.

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

Scientific Risk Assessment by JECFA might be required.

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

Not anticipated at this stage.

10. Proposed time-line for completion of the work

Subject to approval by the Codex Alimentarius Commission, the proposed new work to establish maximum levels for mycotoxins in spices as per the Scope will be considered by the tenth Session of the CCCF (CCCF10) with a view to its adoption in 2017, depending upon the availability of scientific advice.

****

APPENDIX IV
LIST OF PARTICIPANTS

CHAIR - INDIA

Dr Dinesh Singh Bisht
Scientist
Quality Evaluation Laboratory,
Spices Board (Ministry of Commerce & Industry, Govt. of India),
New Delhi, INDIA – 110040
Tel: 011-27785379, E-mail: ccsch.bisht@gmail.com

CO-CHAIRS

EUROPEAN UNION

Mr Frans Verstraete
Administrator/European Commission
DG Health and Consumers Directorate-General
Rue Froissart 101
1040 Brussels
BELGIUM
Tel: +32 22956359
E-mail: frans.verstraete@ec.europa.eu

INDONESIA

Dr Joni Munarso
Principal Researcher
Ministry of Agriculture
Jl. Tentara Pelajar 12, Cimanggu
16114 BOGOR
INDONESIA
Tel: +62 251 8321762, Fax: +62 251 8350920
E-mail: jomunarso@gmail.com

BRAZIL

Mr Fabio Ribeiro Campos da Silva,
Specialist National Health Suveillance Agency- Anvisa,
BRAZIL.
Email: Fabio.Silva@anvisa.gov.br

CANADA

Ian Richard
Scientific Evaluator,
Bureau of Chemical Safety, Health Products and Food Branch, Health CANADA
Email: ian.richard@hc-sc.gc.ca

Elizabeth Elliott
Head, Food Contaminants Section
Bureau of Chemical Safety, Health Products and Food Branch, Health Canada
E-mail: Elizabeth.Elliott@hc-sc.gc.ca

CHILE

Lorena Delgado - National Coordinator of CCCF
Institute of Health Public, Ministry of Health
Email: ldelgado@ispch.cl

CHINA

Ms Shuan ZHOU
Associate Professor
China National Center for Food Safety Risk Assessment (CFSA)
7 Panjiayuan Nanli, Beijing 100021, CHINA
Tel: 86-10-67791259
E-mail: zhoush@cfsa.net.cn

Mr Yongning WU, Professor, Chief Scientist,
China National Center of Food Safety Risk Assessment (CFSA)
Diretor of Key Lab of Food Safety Risk Assessment, National Health and Family Planning Commission
7 PanjiayuanNanli, Beijing, CHINA – 100021
Tel: 86-10-67779118 or 52165589
Fax: 86-10-67791253 or 52165489
E-mail: china_cdc@aliyun.com

Ms Yi SHAO
Research Associate
China National Center of Food Safety Risk Assessment (CFSA)
Building 2 No.37, Guangqulu, Chanoyang District, Beijing 100022, CHINA
Tel: 86-10-52165421, E-mail: shaoyi@cfsa.net.cn

Yiping REN
Professor, Director of Food safety reference laboratory (mycotoxins)
Zhejiang Provincial Center for Disease Control and Prevention
3399 Bin Sheng Road hangzhou zhejiang 310051, CHINA
Tel: 86-571-87115261
Fax: 86-571-87115261
E-mail: renyiping@263.net

Prof. Peiwu Li
General Director, Chief Scientist Key Lab of Quality & Safety Risk Assessment for Oliseeds Product, MOA,PRC
Key Lab of Detection for Mycotoxins, Ministry of Agriculture,
MOA,PRC
Quality & Safety Inspection and Test Center of Oilseeds Products, MOA,PRC
Oil Crops Research Institute,CAAS,PRC
Xudong 2nd Rd NO.2 Wuchang, Wuhan, Hubei Province 430062, CHINA
Tel: 86-27-86812943, Fax: 86-27-86812862
E-mail: peiwuli@oilcrops.cn

Wang Jun, Ph.D.
Deputy Director
Division II of Food Safety Standard, China National Center for Food Safety
Risk Assessment
E-mail: lotuswj@126.com, wangjun@cfsa.net.cn

EL SALVADOR

Licda. Reyna Jovel
Laboratorio Nacional de Referencia
Ministerio de Salud
Email: jocosreyna@yahoo.com

Licda. Claudia Alfaro
Miembro CONACODEX y Docente investigador
Universidad Centroamericana José Simeón Cañas
Email: calfaro@uca.edu.sv

Lic. Ricardo Harrison
Jefe Departamento Codex Alimentarius
Email: rparker@osartec.gob.sv
Ing. Jennifer Trejo
Especialista Codex Alimentarius
Email: jtrejo@osartec.gob.sv

IRAN (ISLAMIC REPUBLIC OF)

Mansooreh Mazaheri Ph.D of Biophysics
Senior Expert of Mycotoxins and Iran Secretariat of CCCF & CCGP
Faculty of Food & Agriculture Standard Research Institute
Email: man2r2001@yahoo.com

JAMAICA

Linnette Peters DVM, MVSc, MPH, Associate Professor
Policy and Programme Director Veterinary Public Health
/codexghana@gmail.comEmail: PetersL@moh.gov.jm

KENYA

Ms. Owiti Phoebe
Food & Agriculture Standards
P. O. Box 54974 - 00200 Nairobi
Tel: +254 20 6948000
Cell: +254 724 255242/ 734 600471
Direct dial:Tel: +254 20 6948304,
E-Mail: owitip@kebs.org

MOROCCO

Mr Najib LAYACHI
Consultant,
Federation of Industries of Agricultural Products Retains Morocco (FICOPAM).
Email: playachi@gmail.com

Mr Aarar mustapha,
délégué from Autonomous Establishment of Export Control and Coordination (EACCE),
E-mail: aarar@eacce.org.ma

Mr Zerouali Elhassane
Laboratory manager from ONSSA,
mailto:Tayorob2000@yahoo.co.ukE- mail: zerouali@eacce.org.ma

NETHERLANDS

Mrs. Astrid Bulder,
Senior Risk Assessor,
Centre for Nutrition, Prevention and Health Services (VPZ)
National Institute for Public Health and the Environment (RIVM)
P.O. Box 1, 3720 BA, Bilthoven,
THE NETHERLANDS
Tel: +31 30 274 7048, Email: astrid.bulder@rivm.nl

Ms Ana VILORIA
Senior Policy Officer Ministry of Health, Welfare and Sport Nutrition
Health Protection and Prevention Department
P.O. Box 20350
2500 EJ The Hague NETHERLANDS
Tel: +31 70 3406482
E-mail: ai.viloria@minvws.nl

REPUBLIC OF KOREA

Ockjin, Paek,
Scientific officer,
Food Contaminants Division, Ministry of Food and Drug Safety (MFDS)
Email: ojpaek@naver.com

Seong-ju, Kim
Food Standard Division, Ministry of Food and Drug Safety (MFDS)
Scientific officer
E-mail: foodeng78@korea.kr

Min, Yoo,
Codex researcher,
Food Standard Division, Ministry of Food and Drug Safety (MFDS)
Email: minyoo83@korea.kr

Codex Contact Point – Republic of Korea
Ministry of Food and Drug Safety (MFDS)
Email: codexkorea@korea.kr

SWITZERLAND

Mrs. Lucia Klauser
Scientific Officer
Federal Food Safety and Veterinary Office FSVO
Email: lucia.klauser@blv.admin.ch

THAILAND

Mrs. Chutiwan Jatupornpong
Standards officer, Office of Standard Development,
National Bureau of Agricultural Commodity and Food Standards,
50 Phaholyothin Road, Ladyao, Chatuchak,
Bangkok 10900 Thailand
Tel (+662) 561 2277,
Fax (+662) 561 3357, (+662) 561 3373
E-mail: codex@acfs.go.th, chutiwan9@hotmail.com

UNITED KINGDOM

Dr Christina Baskaran,
Agricultural Contaminants Policy Advisor,
Food Safety Policy,
Food Standards Agency Aviation House, London WC2B 6NH
Email: Christina.Baskaran@foodstandards.gsi.gov.uk

UNITED STATES OF AMERICA

Henry Kim
U.S. Food and Drug Administration
Center for Food Safety and Applied Nutrition
5100 Paint Branch Parkway
College Park, MD 20740
Email: henry.kim@fda.hhs.gov

Anthony Adeuya
U.S. Food and Drug Administration
Center for Food Safety and Applied Nutrition
5100 Paint Branch Parkway
College Park, MD 20740
Email: Anthony.Adeuya@fda.hhs.gov

Kathleen (Kathy) L. D'Ovidio, Ph. D.
Plant Products Branch, Division of Plant Products and Beverages, Office of Food Safety
HFS-317
5100 Paint Branch Parkway
College Park, MD 20740
Phone: 240-475-7175 (New number)
Fax 301-436-2632
Email: Kathleen.D'Ovidio@fda.hhs.gov

SINGAPORE

Ms Yat Yun Wei
Senior Scientist, Food Safety Division, Applied Sciences Group, Health Sciences Authority, Singapore
mailto:foodeng78@korea.krEmail: YAT_Yun_Wei@hsa.gov.sg

SPAIN

Ana Lopez-Santacruz Serraller,
Head of the Food Contaminants Service,
Spanish Agency for Consumer Affairs, Food Safety and Nutrition, Spain
Email: alopezsantacruz@msssi.es

Pedro A. Burdaspal,
Head of Area in the National Food Center (CNA).
Ministry of Health, Social Services and Equality.
Email: pburdaspal@msssi.es

FOOD DRINK EUROPE
Mr. Patrick Fox,
Manager Food Policy, Science and R&D, Food drink Europe,
Avenue des Nerviens 9-31- 1040 Bruxelles - Belgium - Tel. 32
25141111 - Fax 32 2 5112905
Email: p.fox@fooddrinkeurope.eu