codex alimentarius commission

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS | WORLD HEALTH ORGANIZATION

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DRAFT MAXIMUM LEVELS FOR LEAD

(Prepared by Denmark)

Governments and international organizations wishing to submit comments on the following subject matter are invited to do so **no later than 1 February 2000** as follows: M.S.P. Hagenstein, Ministry of Agriculture, Nature Management and Fisheries, P.O. Box 20401, 2500 EK, The Hague, The Netherlands (Telefax: +31.70.378.6141; E-mail: s.p.j.hagenstein@vvm.agro.nl), with a copy to the Secretary, Codex Alimentarius Commission, Joint FAO/WHO Food Standards Programme, FAO, Viale delle Terme di Caracalla, 00100 Rome, Italy (Telefax: +39.06.5705.4593; E-mail: Codex@fao.org).

INTRODUCTION

1. A document concerning "Draft Maximum Levels for Lead" (CX/FAC 99/19) was presented to the 31st Session of the Codex Committee on Food Additives and Contaminants (CCFAC) by the Danish delegation. This paper was based upon a "Discussion Paper on Lead" (CX/FAC 95/18) and "Draft Standard for Lead in Food"(CX/FAC 96/23) as well as on comments received in writing and discussions held in the CCFAC over several years, including discussions concerning lead exposure in children.

2. The 31st CCFAC returned the draft maximum levels for lead to step 6 for redrafting by the delegation of Denmark, with the assistance of the USA, on the basis of the CCFAC discussions and comments received, with the understanding that the revised document would include appropriate references for the levels proposed.[1]

3. The 53rd meeting (June 1999) of the Joint FAO/WHO Expert Committee on Food Additives (JECFA) maintained the provisional tolerable weekly intake (PTWI) of 25µg/kg body weight for lead. JECFA concluded that, "Based on a quantitative risk assessment, current levels of lead in food would have negligible effects on neurobehavioral development in infants and children. However, examples of foods with high levels of lead remain in commerce…. A complete risk assessment of lead should also take other environmental exposures into account" (see the Summary Report of the 53rd Meeting of the Joint FAO/WHO Expert Committee on Food Additives, agenda item 4a).

4. Table 2 of the present paper (*Revised Draft Maximum Levels for Lead*) summarizes proposals submitted to date and includes a section providing the background for each proposal with appropriate references as requested by the 31st CCFAC. The Codex Secretariat has also inserted Table 1 to this paper concerning *Maximum Levels for Lead in Codex Commodity Standards*. As these levels have been extracted from final Codex Standards, they should also be considered by the CCFAC when elaborating proposals for maximum levels for lead.

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[1] ALINORM 99/12A, paras. 121-126.

TABLE 1

MAXIMUM LEVELS FOR LEAD IN CODEX COMMODITY STANDARDS

REFERENCE	DATE	STANDARD TITLE	MAX. LEVEL
Salt			
CX-STAN 150	1997	Food grade salt	2 mg/kg
Foods for special dietary use			
No specific limits given.			
Processed and quick-frozen fruits and vegetables			
CX-STAN 013	1981	Canned tomatoes	1 mg/kg
CX-STAN 014	1981	Canned peaches	1 mg/kg
CX-STAN 015	1981	Canned grapefruit	1 mg/kg
CX-STAN 016	1981	Canned green beans and canned wax beans	1 mg/kg
CX-STAN 017	1981	Canned applesauce	1 mg/kg
CX-STAN 018	1981	Canned sweet corn	1 mg/kg
CX-STAN 042	1987	Canned pineapples	1 mg/kg
CX-STAN 055	1981	Canned mushrooms	1 mg/kg
CX-STAN 056	1981	Canned Asparagus	1 mg/kg
CX-STAN 057	1981	Preserved tomato concentrates	1.5 mg/kg
CX-STAN 058	1981	Canned green beans	1 mg/kg
CX-STAN 059	1981	Canned plums	1 mg/kg
CX-STAN 060	1981	Canned raspberries	1 mg/kg
CX-STAN 061	1981	Canned pears	1 mg/kg
CX-STAN 062	1981	Canned strawberries	1 mg/kg
CX-STAN 066	1987	Table olives	1 mg/kg
CX-STAN 068	1981	Canned mandarin oranges	1 mg/kg
CX-STAN 078	1981	Canned fruit cocktail	1 mg/kg
CX-STAN 079	1981	Jams (fruit preserves) and jellies	1 mg/kg
CX-STAN 081	1981	Canned mature processed peas	1 mg/kg
CX-STAN 099	1981	Canned tropical fruit salad	1 mg/kg
CX-STAN 115	1981	Pickled cucumbers	1 mg/kg
CX-STAN 116	1981	Canned carrots	1 mg/kg
CX-STAN 129	1981	Canned apricots	1 mg/kg
CX-STAN 144	1985	Canned palmito	1 mg/kg
CX-STAN 145	1985	Canned chestnuts and chestnut puree	1 mg/kg
CX-STAN 159	1987	Canned mangoes	1 mg/kg
CX-STAN 160	1987	Mango chutney	1 mg/kg
Fresh fruits and vegetables			
No specific limits given.			
Fruit juices			
CX-STAN 044	1981	Apricot, peach and pear nectars	0.3 mg/kg (under review)
CX-STAN 045	1981	Orange juice	0.3 mg/kg (under review)
CX-STAN 046	1981	Grapefruit juice	0.3 mg/kg (under review)
CX-STAN 047	1981	Lemon juice	1 mg/kg (under

			review)
CX-STAN 048	1981	Apple juice	0.3 mg/kg (under review)
CX-STAN 049	1981	Tomato juice	0.3 mg/kg (under review)
CX-STAN 063	1981	Concentrated apple juice	0.3 mg/kg (under review)
CX-STAN 064	1981	Concentrated orange juice	0.3 mg/kg (under review)
CX-STAN 082	1981	Grape juice	0.3 mg/kg (under review)
CX-STAN 083	1981	Concentrated grape juice	0.3 mg/kg (under review)
CX-STAN 084	1981	Sweetened concentrated Labrusca type grape juice	0.3 mg/kg (under review)
CX-STAN 085	1981	Pineapple juice	0.3 mg/kg (under review)
CX-STAN 101	1981	Non-pulpy blackcurrant nectar	0.3 mg/kg (under review)
CX-STAN 120	1981	Blackcurrant juice	0.3 mg/kg (under review)
CX-STAN 121	1981	Concentrated blackcurrant juice	0.3 mg/kg (under review)
CX-STAN 122	1981	Pulpy nectars of certain small fruits	0.3 mg/kg (under review)
CX-STAN 134	1981	Nectars of certain citrus fruits	0.3 mg/kg (under review)
CX-STAN 138	1983	Concentrated pineapple juice	0.3 mg/kg (under review)
CX-STAN 139	1983	Concentrated pineapple juice with preservatives for manufacturing	0.3 mg/kg (under review)
CX-STAN 148	1985	Guava nectar	0.3 mg/kg (under review)
CX-STAN 149	1985	Liquid pulpy mango products	0.3 mg/kg (under review)
CX-STAN 161	1989	General standard for fruit nectars	0.3 mg/kg (under review)
CX-STAN 164	1989	General standard for fruit juices	0.3 mg/kg (under review)
CX-STAN 179	1991	Vegetable juices	0.3 mg/kg (under review)
CAC/GL 011	1991	Mixed fruit juices	0.3 mg/kg (under review)
CAC/GL 012	1991	Mixed fruit nectars	0.3 mg/kg (under review)
Cereals, pulses (legumes) and derived products and vegetable proteins			
No specific limits given.			
Fats and oils and related products			
CX-STAN 019	1999	Edible fats and oils not covered by individual standards	0.1 mg/kg
CX-STAN 032	1989	Margarine	0.1 mg/kg

CX-STAN 135	1981	Minerine	0.1 mg/kg
Draft step 5	-	Olive oil – revison	0.1 mg/kg
CX-STAN 210	1999	Named vegetable oils	0.1 mg/kg
CX-STAN 211	1999	Named animal fats	0.1 mg/kg
Fish and fishery products			
No specific limits given.			
Meat and meat products, soups and broths			
CX-STAN 088	1991	Corned beef	1 mg/kg (TE)
CX-STAN 089	1991	Luncheon meat	0.5 mg/kg(TE)
CX-STAN 096	1991	Cooked cured ham	0.5 mg/kg (TE)
CX-STAN 097	1991	Cooked cured pork shoulder	0.5 mg/kg (TE)
CX-STAN 098	1991	Cooked cured chopped meat	0.5 mg/kg (TE)
CX-STAN 117	1995	Bouillons and consommés	1 mg/kg – dry products (TE); 0.5 mg/kg – canned products (TE)
Sugars, cocoa products and chocolate and miscellaneous products			
CX-STAN 086	1981	Cocoa butters	0.5 mg/kg
CX-STAN 087	1981	Chocolate	2 mg/kg for unsweetened choc: 1mg/kg for other products
CX-STAN 105	1981	Cocoa powders (cocoa) and dry cocoa sugar mixtures	2 mg/kg (TE)
CX-STAN 108	1997	Natural mineral waters	0.01 mg/kg (NE by CCFAC)
CX-STAN 141	1983	Cocoa nib, mass, press cake, dust	2 mg/kg (TE)
CX-STAN 142	1983	Composite and filled chocolate	1 mg/kg
CX-STAN 147	1985	Cocoa butter confectionery	1 mg/kg – subject to endorsement
CX-STAN 162	1987	Vinegar	1 mg/kg
CX-STAN 168	1987	Mayonnaise	0.3 mg/kg
Sugars, cocoa products and chocolate and miscellaneous products			
No specific limits given.			
Milk and milk products			
CX-STAN A-01	1999	Butter	0.05 mg/kg
CX-STAN A-15	1995	Whey powders	1 mg/kg
CX-STAN A-18	1995	Edible casein products	1 mg/kg

TABLE 2

DRAFT MAXIMUM LEVELS FOR LEAD
(At Step 6)

Code No.	Food	ML (mg/kg)	Step	Remarks
FC1 FP9 FS12 FB18 FT26 FI30	Fruit [Small fruit and berries]	0.1 [0.3]	6 6	
VA35 VO50 VC45 VR75	Vegetables Except brassica (VB), leafy vegetables (VL), and mushrooms	0.1	6	
VB40 VL53	Brassica Except kale (480) Leafy vegetables (except spinach)	0.3	6	
C81 VD70 VP60	Cereal products except bran Pulses Legume vegetables	0.2	6	
MM97 PM100	Meat of cattle, sheep and pig Poultry meat	0.05	6	
MF97 PF111 FM183 OC172 OR172	Fat from meat Fat from poultry Milk fat Vegetable oils	0.05	6	
MO97	Edible offal of cattle, pig and poultry	0.5	6	
ML107	Milk[1]	0.02[2]	6	Also secondary (82) milk products (as consumed)
WF115, VD120 WS125	Fish	0.2	6	Fish muscle
WC143	Crustaceans	0.5	6	
IM151	Bivalve Molluscs	1.0	6	
JF175	Fruit juices	0.05	6	Also nectars
FF269	Wine	0.20	6	
LM (unspecified)	Infant formulae	0.02[2]	6	Ready to use

[1]For dairy products an appropriate concentration factor applies, e.g. for cheese a factor of 10 as approximately 10 kg milk is used for 1 kg cheese.
[2]Provided appropriate methods of analysis are developed.

BACKGROUND FOR PROPOSALS IN TABLE 2

Fruit

For fruit a ML of 0.1 mg/kg is proposed. Fruit, as leafy vegetables, may be contaminated mainly from atmospheric lead deposition. Lead is not absorbed to any major extent through the roots. Recent surveys with appropriate quality assurance show no difficulties in respecting this ML.

In the 30th CCFAC, a special ML for small fruit and berries (with edible peel) of 0.3 mg/kg was proposed, and this ML is included in Table 1. As no supporting evidence was presented, this ML is noted in square brackets. Subsequently Germany has supplemented their data made available for the 31st CCFAC (CX/FAC 99/19), showing that a lower level of 0.05 mg/kg could not be met (BUNR, letter of 3 May 1999).
For raisins, being dried grapes with water content reduced to approximately 15 %, a converting factor of 5 could be applied to the ML of 0.1 mg/kg. Consequently, it should be considered whether the proposal of 0.1 mg/kg should satisfactorily cover also small fruit and berries.

Fruit (ML 0.1 mg/kg; lead range 0-0.05 mg/kg; Intake range 100-300 g/day):				
Foodstuff	**Concentration (mg/kg)**	**Intake (g/day)**	**Country**	**Reference**
Fruit	0.047 (mean) 90% < 0.39	143 (mean)	Republic of Croatia	Sapunar-Postruznik (1996)
Fruit	0.0006-0.027 (mean) 90% < 0.015-0.043	109 (excl fruit juice)	Denmark	National Food Agency (1995) Andersen et al. (1996)
Fruit	< 0.01	65	UK	Ysart et al. (1999)
Stone fruit Pome fruit	0.020 (mean) 0.025 (mean)	66 (mean) 271 (high) male adults	Germany	Written comments (1999)
Fruit	0.005-0.015 (mean)		Germany	Müller and Anke (1995)
Fruit	usually < 0.02		The Netherlands	Written comments (1998)
Fruit	0.015	377 (mean)	Spain	Urieta et al. (1996)

Small fruit and berries (ML 0.3 mg/kg; lead range 0-0.3 mg/kg; Intake range 0-50 g/day):				
Foodstuff	**Concentration (mg/kg)**	**Intake (g/day)**	**Country**	**Reference**
Berries	<0.007-0.024 (mean) 90% < 0.009-0.042		Denmark	National Food Agency (1995)
Berries	0.021 (mean) 95% <0.069		Germany	Written comments (1999)
Grape berries	0.3		France	Teissedre et al. (1994)

Vegetables

For vegetables, except brassica, leafy vegetables and mushrooms, the proposal is 0.1 mg/kg. A proposal of 0.3 mg/kg stands for brassica, except kale, and for leafy vegetables, except spinach. There is no ML proposed for kale, spinach and for mushrooms as they are considered of minor importance for the overall intake and for international trade. Recent surveys with appropriate quality assurance show no difficulties in respecting this ML.

For potatoes, industry has declared that there would be difficulties in meeting a level of 0.1 mg/kg (Written comments 1999). However, results from recent monitoring programs with appropriate quality assurance show that potatoes do not exceed this limit provided that soil is appropriately removed before analysis as it is before consumption. Consequently, it should be considered to provide potatoes with a separate entry, with the remark "Brushed and washed", as it is done in the case of cadmium.

Vegetables (ML 0.1 mg/kg; lead range 0-0.05 mg/kg; Intake range 50-500 g/day):				
Foodstuff	**Concentration (mg/kg)**	**Intake (g/day)**	**Country**	**Reference**
Vegetables	0.29 (median) 90% < 0.286	416	China	Yang et al. (1994)
Vegetables	0.094 90% < 0.573	283	Republic of Croatia	Sapunar-Postruznik et al. (1996)
Vegetables	<0.004-0.014 (mean) 90% < 0.005-0.036	247 (mean of total vegetables)	Denmark	National Food Agency (1995) Andersen et al. (1996)
Vegetables	0.022 (mean) 95% < 0.070	197 (mean) 451 (high) male adults	Germany	Written comments (1999)
Vegetables	0.022-0.032 (mean)		Germany	Müller and Anke (1995)
Vegetables	0.02	243	UK	Ysart et al. (1999)
Vegetables	0.036-0.068 (median) 90% < 0.12-0.28		Poland	Karlowski and Wojciechowska-Mazurek (1991)
Vegetables	0.023	159 (mean)	Spain	Urieta et al. (1996)
Vegetables	0.099-0.358	219-499	Spain	Cuadrado et al. (1995)
Vegetables	0.004-0.014 (mean) 90% < 0.005-0.027		Denmark	VFD (1997)
Fruiting vegetables	0.01 or lower		The Netherlands	Written comments (1998)
Root vegetables	0.01-0.04 (mean)		The Netherlands	Written comments (1998)
Root vegetables	0.028 (mean) 95% <0.08		Germany	Written comments (1999)
Potatoes	<0.1		The Netherlands	Written comments (1998)
Potatoes	0.046 (mean)		France	DGS (1994)
Potatoes	0.01	133	UK	Ysart et al.(1999)
Potatoes	0.004 (mean) <0.039	143	Denmark	National Food Agency (1995)

Brassica (ML 0.3 mg/kg; lead range 0-0.5 mg/kg; Intake range 10-100 g/day):				
Foodstuff	**Concentration (mg/kg)**	**Intake (g/day)**	**Country**	**Reference**
Brassica	0.005-0.016 (mean) 90% < 0.007-0.021		Denmark	VFD (1997)
Brassica	0.004-0.013 (mean)		Germany	Müller and Anke (1995)
Cabbage	0.008-0.050 (median) 90% < 0.25-0.32		Poland	Karlowski and Wojciechowska-Mazurek (1991)
Cabbage		6-29	Spain	Cuadrado et al. (1995)
Cauliflower		4.7-5.2	Spain	Cuadrado et al. (1995)
Brassica and leafy vegetables	0.036 (mean) 95% < 0.112	27	Germany	Written comments (1999)

Leafy vegetables (ML 0.3 mg/kg; lead range 0-0.5 mg/kg; Intake range 0-100 g/day):				
Foodstuff	**Concentration (mg/kg)**	**Intake (g/day)**	**Country**	**Reference**
Leafy vegetables	0.003-0.032 (mean) 90% < 0.005-0.042		Denmark	VFD (1997)
Leafy vegetables		30 (mean) 107 (high) male adults	Germany	Written comments (1999)
Lettuce	0.031 (mean)		Germany	Müller and Anke (1995)
Lettuce	0.01-0.05 (mean)		The Netherlands	Written comments (1998)
Lettuce	0.047-0.150 (median) 90% < 0.23-0.38		Poland	Karlowski and Wojciechowska-Mazurek (1991)
Lettuce		12-29	Spain	Cuadrado et al. (1995)
Spinach	0.04 or higher		The Netherlands	Written comments (1998)
Spinach		1-3	Spain	Cuadrado et al. (1995)

Cereal products, pulses and legume vegetables

For cereal products, except bran, for pulses and for legume vegetables, the proposal is 0.2 mg/kg. There is no ML proposal for bran, as bran is considered of minor importance as a source of lead in the diet and also as a commodity in international trade.

It is argued that international trade is mainly in cereals as such, whereas consumers are mainly concerned with processed cereal products, for which large parts of any lead contamination will be removed through processing. Consequently, it should be considered to change the heading to “cereals, subject to primary processing”.

Moreover, as is seen from the data presented, the content of lead in pulses and in legumes vegetables is generally lower than 0.05 mg/kg, and a ML of 0.1 mg/kg for those products should be considered.

Cereal products (ML 0.2 mg/kg; lead range 0-0.1 mg/kg; Intake range 50-500 g/day):				
Foodstuff	**Concentration (mg/kg)**	**Intake (g/day)**	**Country**	**Reference**
Cereals	0.063 (median) 90% < 0.316	498	China	Yang et al. (1994)
Cereals	0.017-0.085 (mean) 90% < 0.033-0.192	217 (mean of total cereal)	Denmark	National Food Agency (1995) Andersen et al. (1996)
Cereals	0.033	62 (mean)	Spain	Urieta et al. (1996)
Cereals and cereal products	0.02	210	UK	Ysart et al. (1999)
Cereals Wheat Rye	0.047 (mean) 95% < 0.150 0.046 (mean) 0.057 (mean)	142 (male adults)	Germany	Written comments (1999)
Breakfast cereals	0.011-0.022 (mean)		Finland	Tahvonen and Kumpulainen (1993)
Breads and breakfast cereals		90% <100 (children < 2 years)	USA	USDA (1989-1992) Written comments (1998)
Cereals and cereal products	0.039-3.04	196-322	Spain	Cuadrado et al. (1995)
Wheat	around 0.05 or lower		The Netherlands	Written comments (1998)
Wheat grain	0.034 (mg/kg dry weight)		Germany	Brüggemann and Kumpulainen (1995)
Barley groats	0.067 (mean)		Poland	Krelowska-Kulas (1991)
Barley flakes	0.17 (mean)		Poland	Krelowska-Kulas (1991)
Rice	around 0.05 or less		The Netherlands	Written comments (1998)
Rice	0.076 (mean) 90% < 0.404	8.9	Republic of Croatia	Sapunar-Postruznik et al. (1996)
Rice	0.098 (mean)		Germany	Müller and Anke (1995)
Rice	0.205 (mean)	316-534	India	Srikanth et al. (1995)

	0.156-0.208 (range)			
Rice	0.002-0.039 (mean)		Japan	Zhang et al. (1996)
Rice	0.099		Spain	Santos et al. (1992)
Wild rice	<0.0001-0.007		Canada	Pip (1993)
Bread	0.041	122 (mean)	Spain	Urieta et al. (1996)
Bread	0.014 (mean) 0.008 (median)		Finland	Tahvonen and Kumpulainen (1994)
Rye bread	0.016		Finland	Tahvonen and Kumpulainen (1994)

From the data presented, the mean content of lead in pulses and legumes is generally lower than 0.05 mg/kg, and a ML of 0.1 mg/kg for those products should be considered.

Pulses (ML 0.2 mg/kg)				
Foodstuff	**Concentration (mg/kg)**	**Intake (g/day)**	**Country**	**Reference**
Pulses and nuts	0.01	27 (mean)	Spain	Urieta et al. (1996)
White beans	0.022 (mean)		Germany	Müller and Anke (1995)
Pulses	0.026 (mean)		China	Zhang et al. (1998)
Kidney bean	0.025 (mean)		China	Zhang et al. (1998)
Soybean	0.031 (mean)		China	Zhang et al. (1998)

Legume vegetables (ML 0.2 mg/kg; lead range mg/kg; Intake range g/day):				
Foodstuff	**Concentration (mg/kg)**	**Intake (g/day)**	**Country**	**Reference**
Legume vegetables	0.022 (mean) 95% <0.073		Germany	Written comments (1999)
Green Bean		8-18	Spain	Cuadrado et al. (1995)
Peas, peeled	0.016 (mean)		Germany	Müller and Anke (1995)
Green peas	0.006 (mean)		Germany	Müller and Anke (1995)
Peas	0.003-0.032 (mean) 90% < 0.005-0.042		Denmark	VFD (1997)

Meat of cattle, sheep and pig, poultry meat

For meat of cattle, sheep and pig, and for poultry meat the ML proposal is 0.05 mg/kg. Whereas most of the analytical data, with appropriate quality assurance, indicate that a ML of 0.05 mg/kg should be appropriate, there are reports that call for a higher ML. To some extent, different standards in analytical quality control may be the reason for the variation in lead found in different studies.

Meat of cattle, sheep, pig and poultry (ML 0.05 mg/kg; lead range 0-0.1 mg/kg; Intake range 0-500 g/day):				
Foodstuff	**Concentration (mg/kg)**	**Intake (g/day)**	**Country**	**Reference**
Meat	0.037 (median) 90% < 0.129	42.3	China	Yang et al. (1994)
Meat	<0.008-0.017 (mean) 90% < 0.008-0.046	136 (mean)	Denmark	National Food Agency (1995) Andersen et al. (1996)
Meat	0.0616 (mean)		France	DGS (1994)
Meat of cattle Pork	0.021 (mean) 95% < 0.09 0.023 (mean) 95% < 0.140	Intake meat: 72 (mean) 191 (high) male adults	Germany	Written comments (1999)
Meat and meat products	0.01	70	UK	Ysart et al.(1999)
Meat	0.008-0.011 (mean)		Finland	Tahvonen and Kumpulainen (1994)
Meat (muscle)	0.01		The Netherlands	Written comments (1998)
Meat	0.073-0.107 (mean) 90% < 0.468-0.590	122	Republic of Croatia	Sapunar-Postruznik et al. (1996)
Meat	0.017	118 (mean)	Spain	Urieta et al. (1996)
Pork	0.068 (mean)		Poland	Krelowska-Kulas (1991)
Pork chop	0.058 (mg/kg dry weight)		Germany	Brüggemann and Kumpulainen (1995)
Beef	0.118 (mean)		Poland	Krelowska-Kulas (1991)
Meat	0.082-0.356	97-140	Spain	Cuadrado et al. (1995)
Meat (bovine muscle)	<0.007		Sweden (imported from six countries)	Jorhem et al. (1996)
Meat from horse, lamb, sheep reindeer	< 0.002-0.020, <0.002-0.008 <0.002-0.004 <0.002-0.014		Sweden	Jorhem (1999)
Meat	0.008-0.026 (mean)		Germany	Müller and Anke (1995)
Meat products	0.078	45 (mean)	Spain	Urieta et al. (1996)

Fat from meat and poultry, vegetable oils

The proposal is 0.05 mg/kg. There appear to be no problems to trade with this ML, except possibly for cocoa butter, where it is claimed that the content of lead may well exceed the ML. There are few data on cocoa products, and they indicate that there may be reason to expect levels higher than the proposed ML in cocoa products. However, whether the content of lead in cocoa butter is higher than 0.05 mg/kg, or, as is the case for other metals, lead will follow the more protein-rich fractions rather than the cocoa butter, remains to be shown. Provided appropriate data becomes available it could be considered to introduce a separate entry for cocoa butter, with a higher ML.

Fat from meat, poultry, vegetable oils (ML 0.05 mg/kg; lead range 0-0.02 mg/kg; Intake range 0-100 g/day):				
Foodstuff	**Concentration (mg/kg)**	**Intake (g/day)**	**Country**	**Reference**
Fats and oils	0.005	45 (mean)	Spain	Urieta et al. (1996)
Fats and oils	0.02	29	UK	Ysart et al. (1999)
Oils		69-83	Spain	Cuadrado et al. (1995)
Butter	0.014 (mean)		Germany	Müller and Anke (1995)

Edible offal of cattle, pig and poultry

The proposal is 0.5 mg/kg. The data show that the levels of lead found in liver and kidney are generally only slightly higher than those found in muscle.

Edible offal of cattle, pig and poultry (ML 0.5 mg/kg; lead range 0-0.5 mg/kg; Intake range 0-10 g/day):				
Foodstuff	**Concentration (mg/kg)**	**Intake (g/day)**	**Country**	**Reference**
Liver		0.92-1.46	Spain	Cuadrado et al. (1995)
Liver	0.027-0-038 (mean) 90% < 0.046-0.067	4 (mean)	Denmark	National Food Agency (1995) Andersen et al. (1996)
Kidney	0.025-0.095 (mean) 90% < 0.047-0.091	<1 (mean)	Denmark	National Food Agency (1995) Andersen et al. (1996)
Offal	0.11	1	UK	Ysart et al. (1999)
Pork liver	0.171 (mean)		Poland	Krelowska-Kulas (1991)
Beef liver	0.153 (mean)		Poland	Krelowska-Kulas (1991)
Liver, porcine, Bovine	0.139 (mean);90%<0.812 0.208 (mean);90%<0.867	3.7 (liver+kidney)	Republic of Croatia	Sapunar-Postruznik et al. (1996)
Kidney,porcine Bovine	0.183 (mean); 90%<0.980 0.137(mean); 90%<0.807	3.7 (liver+kidney)	Republic of Croatia	Sapunar-Postruznik et al. (1996)
Cattle liver	0.037 (mean)		Finland	Tahvonen and Kumpulainen (1994)
Swine liver	0.011 (mean)		Finland	Tahvonen and Kumpulainen (1994)
Liver of	Edible offal:	15 (mean)	Germany	Written comments

cattle, pig and sheep	0.072 (mean) 95% < 0.220	45 (high) male adults		(1999)
Kidney of cattle and pig	Edible offal: 0.072 (mean) 95% < 0.220	8 (mean) 36 (high) male adults	Germany	Written comments (1999)
Liver	0.035 (mean)		Germany	Müller and Anke (1995)
Kidney	0.077 (mean)		Germany	Müller and Anke (1995)
Liver and kidney from pigs	0.007		Denmark	VFD (1997b)
Liver from horse Lamb Reindeer Kidney from Horse Lamb Sheep Reindeer	 0.13 (mean) 0.031 (mean) 0.13(mean) 0.047(mean) 0.053(mean) 0.046(mean) 0.13(mean)		Sweden	Jorhem (1999)

Milk

The proposal is 0.02 mg/kg, as is the International Dairy Federation (IDF) standard. For milk products such as butter and cheese an appropriate concentration factor should be applied. There appear to be no particular problems with milk and milk products exceeding this low level. Methods of analysis are available, though it may be a challenge to apply them on the levels usually found in milk. Appropriate analytical technique could be Zeeman graphite furnace AAS (Larsen and Rasmussen, 1991), or in future ICP-MS. Consequently, the "Remark" in Table 1 is superfluous and it should be considered to delete this remark.

Following a serious intoxication of cattle, caused by extremely high concentrations of lead in a concentrate feed, the content of lead in milk had dropped to the level of 0.02 mg/kg within two weeks (Baars, 1992)

Milk (ML 0.02 mg/kg; lead range 0-0.01 mg/kg; Intake range 0-550 ml/day):				
Foodstuff	**Concentration (mg/kg)**	**Intake (g/day)**	**Country**	**Reference**
Milk	0.01 (median) 90% < 0.134	9	China	Yang et al. (1994)
Milk	< 0.01	284	UK	Ysart et al. (1999)
Milk	0.076 (mean) 90% < 0.3	279	Republic of Croatia	Sapunar-Postruznik et al. (1996)
Milk	0.0009 (mean) 0.001	 393 (mean for 1-6 year olds)	Denmark	Larsen and Rasmussen (1991) National Food Agency (1990) Andersen et al. (1996)
Milk Cheese	0.002 (mean) 0.017-0.060(means for cheese imported from ten countries)		Finland (Cheese imported from ten countries)	Tahvonen and Kumpulainen (1995).
Milk	0.007 (mean)		Germany	Müller and Anke

				(1995)
Milk	0.073 (mg/kg dry weight)		Germany	Brüggemann and Kumpulainen (1995)
Milk	a few µg/kg		The Netherlands	Written comments (1998)
Milk	0.098 (mean)		Poland	Krelowska-Kulas (1991)
Milk	<0.005	294 (mean)	Spain	Urieta et al. (1996)
Milk	0.013 (mean)		France	DGS (1994)
Milk		229-395	Spain	Cuadrado et al. (1995)
Milk	<0.005	468 (mean) 90% < 1052 (children < 1 year)	USA	Written comments (1998)
Cheese	0.015 (mean) 95% <0.032		Germany	Written comments (1999)
Dairy products	0.006	58 (mean)	Spain	Urieta et al. (1996)
Dairy prods	0.01	57	UK	Ysart et al. (1999)

Fish

The proposal is 0.2 mg/kg. In general, fish are not much influenced by lead contamination of the waters in which they live. The bulk of data, with appropriate quality assurance, indicate that a ML at 0.2 mg/kg should cause no problems for worldwide trade in most fish species. However, there may be certain fish species, or fish from certain waters, that for natural causes need a higher limit, as is the case for mercury, and this problem should be considered, provided supportive quality data is made available.

Fish (ML 0.2 mg/kg; lead range 0-0.5 mg/kg; Intake range 0-100 g/day):				
Foodstuff	**Concentration (mg/kg)**	**Intake (g/day)**	**Country**	**Reference**
Fish	<0.7		Australia	Denton and Burdon-Jones (1986)
Fish	0.02	13	UK	Ysart et al. (1999)
Fish	0.035-0.09		Belgium	Guns et al. (1988)
Fish	0.0778 (mean)		France	DGS (1994)
Fish	0.02 (median) 90% < 0.13	11.8	China	Yang et al. (1994)
Fish	0.324 (mean) 90% < 1.21	19	Republic of Croatia	Sapunar-Postruznik et al. (1996)
Fish	<0.075 (mean) 90% < 0.075-0.127	24 (mean)	Denmark	National Food Agency (1995) Andersen et al. (1996)
Fish	<0.009		Finland	Tahvonen and Kumpulainen (1996)
Fish	<0.061		Germany	Oehlenschlaeger (1988)
Fish	0.008-0.015 (mean) 0.014 (mean) 95% <0.056	 16	Germany Germany	Müller and Anke (1995) Written comments (1999)
Fish	0.019-0.194		Morocco	El-Hraik et al. (1992)

Fish	0.043	89 (mean)	Spain	Urieta et al. (1996)
Fish	0.105-0.345	22-63	Spain	Cuadrado et al. (1995)
Fish	0.015-0.303		Spain	Cabera et al. (1991)
Fish	<0.004-0.009 (mean)		Sweden	Engman and Jorhem (1998)
Fish	0.026±0.119	6.5 (general population) 30 (sport fishermen) 140 (subsistence fishermen)	USA	Tchounwou et al. (1996)
Freshwater fish	<0.02		France	Written comments (1998)
Cod and Plaice	0.0005-0.004		Germany	Harms (1985)
Freshwater fish	0.14-0.22		Italy	Giani et al. (1989)
Canned tuna		14 (mean) 90% < 20 g (1-2 year old children)	USA	Written comments (1998)

Crustaceans

Following the outcome of the discussion in the 31st CCFAC, the proposal is now 0.5 mg/kg. There may be reason to consider lower ML for specific crustaceans.

Crustaceans (ML 0.5 mg/kg; lead range 0-0.5 mg/kg; Intake range 0-5 g/day):				
Foodstuff	**Concentration (mg/kg)**	**Intake (g/day)**	**Country**	**Reference**
Crustaceans		1 (mean)	Denmark	Andersen et al. (1996)
Shrimps	0.040 95% < 0.155	12 (mean) 43 (high) male adults	Germany	Written comments (1999)
Crab Lobster Shrimp	<0.2 (mean) <0.2 (mean) <0.3 (mean)		UK	MAFF (1982)
Crabs	96% < 0.1 mg		France	Written comments (1998)
Shellfish		0.14-0.51	Spain	Cuadrado et al. (1995)

Bivalve molluscs

Following the outcome of the discussion in the 31st CCFAC, the proposal is now 1 mg/kg.

Bivalve molluscs (ML 1.0 mg/kg; lead range 0-1 mg/kg; Intake range 0-5 g/day):				
Foodstuff	**Concentration (mg/kg)**	**Intake (g/day)**	**Country**	**Reference**
Molluscs		<0.1	Denmark	Andersen et al. (1996)
Molluscs		15 (mean) 81 (high) male adults	Germany	Written comments (1999)
Mussel		0.21-0.8	Spain	Cuadrado et al. (1995)
Oysters		139 (max)	Taiwan	Han et al. (1998)

Molluscs	0.06-0.3 (mean)		USA	Capar and Yess (1996)
Clams Mussels	0.123 0.100		Canada	Forsyth et al.(1991)
Mussels Oysters	0.264 (mean) 0.127 (mean)		France	DGS (1994)

Fruit juices

Following the 31st CCFAC, the proposal is now 0.05 mg/kg. The data appear to allow a lower level, e.g. 0.02 mg/kg, in accordance with the data for lead in fruit.

Concerning juice from small fruit and berries, there have been requests for a separate ML (to keep 0.05 mg/kg), similarly to that a separate ML is discussed for the small fruit and berries, as such. There does not, however, appear to be data available to argue the need for a higher ML for juice from small fruit and berries.

Fruit juices (ML 0.05 mg/kg; lead range mg/kg; Intake range g/day):				
Foodstuff	**Concentration (mg/kg)**	**Intake (g/day)**	**Country**	**Reference**
Fruit juice	<0.007 (mean) 90% < 0.013	56 (mean)	Denmark	National Food Agency (1995) Andersen et al. (1996)
Fruit juice	0.009 (mean)		Finland	Tahvonen (1998)
Fruit juice		3-10	Spain	Cuadrado et al. (1995)
Fruit juice	0.008-0.013	154 (mean) 90 % < 288 (<1 year old children) 190 (mean) 90% < 361 (1-2 year old children)	USA	USDA Survey (1989-1991) Written comments (1998)
Fruit juices	0.011 95% < 0.033	166	Germany	Written comments (1999)
Fruit juices	0.01	43	UK	Ysart et al. (1999)
Fruit Juice	0.0292		France	DGS (1994)

Wine

The proposal is 0.2 mg/kg, in accordance with the limit laid down by the OIV, the Organisation Internationale des Vignes et du Vin. It is the intention that this ML, which according to the data could be lower for wine that has been produced in recent years, will be lowered in future, in agreement with the OIV.

Wine (ML 0.2 mg/kg; lead range 0-0.1 mg/kg; Intake range 0-500 g/day):				
Foodstuff	**Concentration (mg/kg)**	**Intake (g/day)**	**Country**	**Reference**
Wine	0.02-0.06		Australia	Gulson et al. (1992)
Wine	0.04 (mean)		Australia	Lee et al. (1991)
Wine	0.099 (mean) 90% < 0.43	75	Republic of Croatia	Sapunar-Postruznik et al. (1996)
Wine	0.053-0.066 (mean) 90% < 0.076-0.143	73 (mean)	Denmark	National Food Agency (1995) Andersen et al. (1996)
Wine	0.009-0.034 (mean)		Finland	Tahvonen (1998)
White wine	0.009 (mean)		Germany	Müller and Anke

				(1995)
Wine		53-360	Spain	Cuadrado et al. (1995)
Wine	0.069 (mean)		France	DGS (1994)
Alcoholic beverages	0.031	243 (mean)	Spain	Urieta et al. (1996)

Infant formulae

The proposal is 0.02 mg/kg, as for milk. There have been raised doubt concerning the definition of the product, and whether it is traded internationally. If these doubts are sustained, it may be discussed not to set a ML for infant formulae.

Infant formulae (ML 0.02 mg/kg; lead range 0-0.01 mg/kg; Intake range 0-1300 g/day):				
Foodstuff	**Concentration (mg/kg)**	**Intake (g/day)**	**Country**	**Reference**
Infant formulae	<0.005	820 (mean) 90% < 1286 (children < 1 year)	USA	Written comments (1996)
Infant formulae	0.01		USA	Bolger et al. (1996)

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