

ANALYTICAL CAPABILITY IAC

High End Analytics

Update regarding to dioxin and PCB regulation

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SGS Belgium NV - Division IAC

Welcome

WHEN YOU NEED TO BE SURE



ABOUT SGS IAC

- Founded in 1992, IAC (Institute for Applied Chromatography), a division of SGS Belgium N.V., is a highly qualified Chromatographic/Elemental Research Centre, specialised in sophisticated chromatographic/elemental analyses and related services.
- IAC with its skilled staff and its comprehensive high standard chromatographic equipment is a client oriented interface between “academic ↔ “routine” approach
- Quality, speed, versatility and flexibility are key features within the management of the Institute.
- The Institute for Applied Chromatography has proven to be a reference centre for analysis, training, method development & validation, applications.



ABOUT SGS IAC (cont'd)

- Within the global SGS Group, a center of excellence for Dioxin and related Persistent Organic Pollutants testing, providing this service around the globe via SGS network.
- Extended ISO17025 accreditation scope for specialised trace analysis for organics and metals/elements
- Full range of advanced & innovative instrumentation
 - HRGC/HRMS, LC/MS-MS, LC-TOF, GC/MS-MS, GC/MS, HSP-GCMS, PTV-GC, GC/ECD, GC/NPD, GC/FID, ICP/MS, ...
- Testing field covers Environmental, Feed/Food, Petrochemical, Electronic & Electrical, Pharmaceutical, ... Samples
- Innovative group ahead with analytical developments for new “suspect” components in Environment and in the Food Chain.

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ORGANIC COMPOUNDS

- Dioxins & Dioxinlike, marker PCB's
- Brominated compounds: PBDE 's, PBDF/D, PBB's, HBCD, TBBA, ...
- PAH's
- Chlorophenols, Chlorobenzenes
- Pesticides
- PCN
- Perfluoro compounds: PFOS, PFOA, PFSE,...
- Residue analysis
- Screenings o.a. MultiTrace®
- ...

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AVAILABLE TECHNIQUES : Organics

- **High Resolution GC - High Resolution MS** (3 systems)
(Micromass Autospec and two Micromass Autospec Ultima)
Application: Dioxins, WHO-PCB's, PAH's, PBDE's, PCN's, PCIDE's, PBDD/F, PBB's, ...
- **Multi Inlet Quadrupole MS/MS** (3 systems)
Triple Quadrupole Mass Spectrometer, with a wide range of ionisation techniques, for both LC-MS/MS and GC-MS/MS
(Waters Quattro Premier, Waters XEVO TQS and Varian Triple Quad 1200)
Application: Residue analysis, Screenings, Perfluoro compounds (PFOS, PFOA, PFSA, ...)
- **UPLC – TOF (Time of Flight)**
- **Low Resolution Mass Spectrometry** (8 systems)
Agilent Quadrupole HP 5973 (2 systems)
Varian Ion-Trap Saturn 2000 (2 systems)
Shimadzu Quadrupole QP2010 – Ultra (4 systems)
Application : Screenings, Organic pollutants : PAH's, chlorophenols, chlorobenzenes, pesticides, PCB's, PBB's, PBDE's, ...



AVAILABLE TECHNIQUES (cont'd)

- **Gas Chromatography (Varian, Agilent, Shimadzu)**
 - **Injection Techniques :**
 - Split / Splitless
 - On-Column
 - Programmable Temperature Vapourizer
 - Head-Space
 - Solid Phase Micro Extraction (SPME)
 - **Detection Techniques :**
 - FID : Universal Detector
 - NPD/TSD : Nitrogen & Phosphor Compounds
 - ECD : Halogenated Compounds
 - PFPD : Sulfur or Phosphor Compounds
- **Liquid Chromatography (Varian, Agilent)**
 - Autosampler equipped HPLC with Diode Array Detector

- **ICP-OES (4 systems)**
 - Axial – Radial
 - Perkin Elmer / Shimadzu
 - Metal analysis in diverse matrices for a wide range of elements at ppm – ppb level
- **ICP-MS**
 - High Resolution – ICP/MS (Element II – Thermo)
 - Low level metal analysis: ppt – ppb level
 - Isotopic Ratio's
 - Low Resolution – ICP-MS (Perkin Elmer – Elan DRC)
 - Low level metal analysis : ppb level
 - Variaty of matrices for metals and metal screenings
- **Isotopic Ratio Mass Spectrometry (IRMS – Thermo)**
 - Isotopes : C12/C13 – N14/N15 – O16/O18 – H1/H2
 - Coupled to Gaschromatography (Agilent)
 - Coupled to Elemental Analyser (C/H/N/O/S)
 - Authencity Analyses – Forensics - Biomarker Analyses

- **Ion Chromatography (2 systems):**
 - Cations - Anions
 - Conductivity – UV/VIS detection
- **Elemental Analyser:**
 - C/H/N/O/S
 - Liquid samples
 - Solid samples
- **Metal Speciation:**
 - IC/LC – ICP/HRMS
 - GC – ICP/HRMS
- **Mercury Analyser:**
 - ppt level Hg
- **UV/VIS Spectrometer:**
 - Cr VI+

SGS IAC...

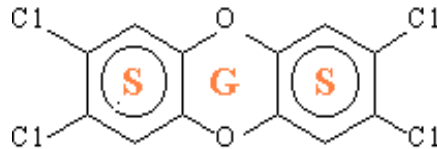
Competence Centre for Dioxin and
Dioxinlike PCB's and High End Analytics
for the Global SGS Group

WHAT ARE DIOXINS?

- Group of polychlorinated aromatic compounds
 - Dioxins : 2 benzene rings connected to each other by 2 oxygen atoms.
PCDD = PolyChlorinated DibenzoDioxins.
 - Furans : 2 benzene rings connected to each other by 1 oxygen atom.
PCDF = PolyChlorinated DibenzoFurans.
- Number of chlorine atoms can vary between 1 and 8.
- In total 210 combinations (« congeners ») possible (75 dioxins and 135 furans).

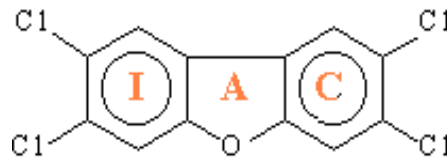
WHAT ARE DIOXINS? (cont'd)

PolyChlorinated Dibenzo-p-Dioxin (PCDD)



2,3,7,8 TCDD

PolyChlorinated DibenzoFuran (PCDF)



2,3,7,8 TCDF

WHAT ARE PCB'S?

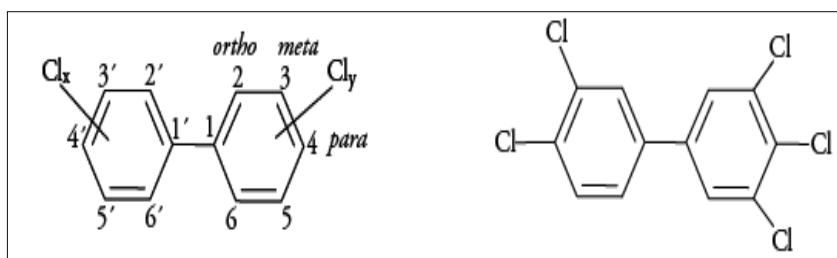
- Group of polychlorinated aromatic compounds : 2 benzene rings connected to each other on a carbon atom of each ring.
- All other carbon atoms can have chlorine substitution. The number of chlorine atoms can vary between 1 and 10
- In total 209 combinations possible (209 « congeners »).
- PCBs with 4 chlorine atoms on the two extremities of the molecule, have a very similar, « planar » structure like the « dirty 17 » dioxins.

These are called : coplanar PCBs or dioxin-like PCBs or WHO-PCBs.

WHAT ARE PCB'S? (cont'd)

- The most toxic PCB is
3,3',4,4',5-PentaChloroBiphenyl (CoPCB 126)
- Dioxin-like PCBs : N° 77, 81, 105, 114, 118, 123, 126, 156, 157, 167, 169, 189
- Non dioxin-like PCBs : N° 28, 52, 101, 138, 153, 180 (also called marker or indicator PCBs)
- Unlike dioxins, PCBs are a group of chemicals which are intentionally synthesised for widespread use in transformers, building materials, lubricants, coatings, plasticizers, inks...

STRUCTURE OF PCB#126
(most toxic non-ortho)



3,3',4,4',5-PentaCB (=126)



PHYSICO-CHEMICAL PROPERTIES OF DIOXINS AND PCBs

- High melting and boiling point
- Low vapour pressure
- Extremely low water solubilities
- Highly soluble in oil, fat
- Strongly adsorbed on surfaces of particulate matter
- Very persistent and not biodegradable

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SAMPLING FEED SAMPLES

- COMMISSION DIRECTIVE EC/152/2009 is establishing requirements for the determination of levels of dioxins and dioxin-like PCBs in feedingstuffs
- The samples must be stored and transported in glass, aluminium, polypropylene or polyethylene containers. Traces of paper dust must be removed from the sample container. Glassware should be rinsed with solvents previously controlled for the presence of dioxins.
- perform a blank analysis by carrying out the entire analytical procedure omitting only the sample.
- sample weight used for the extraction must be sufficient to fulfil the requirements with respect to sensitivity.

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SAMPLING FOOD SAMPLES

- COMMISSION REGULATION (EC) No 1883/2006 of 19 December 2006 is laying down methods of sampling and analysis for the official control of levels of dioxins and dioxin-like PCBs in certain foodstuffs
- As far as possible incremental samples shall be taken at various places distributed throughout the lot or subplot.
- The aggregate sample shall be made up by combining the incremental samples. It shall be at least 1 kg unless not practical, e.g. when a single package has been sampled.
- The replicate samples for enforcement, defence and reference purposes shall be taken from the homogenised aggregate sample.
- Each sample shall be placed in a clean, inert container offering adequate protection from contamination, from loss of analytes by adsorption to the internal wall of the container and against damage in transit. All necessary precautions shall be taken to avoid any change in composition of the sample, which might arise during transportation or storage.

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SAMPLING FOOD SAMPLES (cont'd)

- Each sample taken for official use shall be sealed at the place of sampling and identified following the rules of the Member States.

Minimum number of incremental samples to be taken from the lot or subplot	
Weight or volume of lot/sublot (in kg or litre)	Minimum number of incremental samples to be taken
< 50	3
350 to 500	5
> 500	10

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- Very complicated due to :
 - The amount of different compounds : PCDD/F's consist of 210 different compounds.
 - The difference in toxicity between the different PCDD/F congeners.
 - Presence at low levels in complex matrices, containing similar chlorine substituted compounds in much higher concentrations.
- Need for highly sophisticated analytical instrumentation, i.e. Gaschromatography coupled to High Resolution Mass Spectrometry.
- Set-up of analytical methodology, i.e. extraction, purification and analysis is complex : determination at the parts per trillion/parts per quadrillion level.

- ¹³C-labelled dioxins (extraction standards) are added to the sample before starting the sample preparation.
- These "labelled" dioxins behave in the same way as the dioxins that are actually in the sample itself.
- Any losses that occur during the sample preparation will occur to the same extent for the dioxins in the sample (= native dioxins) as for the labelled (added by the lab) dioxins.
- The ratio native dioxins/labelled dioxins remains constant during the sample preparation process and as we exactly know the amount of labelled dioxins added, this ratio in fact is used to calculate the concentration (this is the principle of isotope dilution).



WHY HIGH RESOLUTION MASS SPECTROMETRY?

- Unequaled sensitivity of HRMS: femtogram-level (10^{-15} gram).
- High sensitivity both based on signal (detector sensitivity) and reduction of noise yielding high signal to noise ratios.
- High selectivity (HRMS) versus low selectivity (LRMS)
- Example of selectivity: MS-measurement of $m/z = 200$
 - LRMS measures mass window 199.5 to 200.5
 - HRMS measures mass window 199.99 to 200.01
- Combination of sensitivity and selectivity gives HRMS the greatest degree of confidence in identification of dioxins and other POPs

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WHY NOT OTHER TECHNIQUES?

- GC/ECD (Electron Capture Detection)
 - Very sensitive detection technique for halogenated compounds.
 - Isotope dilution not possible (only with Mass Spectrometry).
 - No distinction between dioxins and PCBs or other halogenated.
 - Limited range of linearity
- GC/LRMS (Low Resolution Mass Spectrometry)
 - Selectivity lower than HRMS (confidence ↓)
 - Lower sensitivity (due to higher noise)

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SAMPLING**SAMPLE PREPARATION****ANALYSIS****REPORTING**

- Addition of C13-labeled dioxin standards.
- extraction (24 hours).
- Sample purification (multi-column clean-up).
- Final concentration to 25 µl.

- Separation via GC coupled to High Resolution Mass Spectrometry at resolution 10 000.
- Determination of 17 toxic congeners.

- Reporting per component (17).
- Calculation of total toxicity equivalents (TEQ).

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TOXICITY EQUIVALENCE FACTORS - TOXIC EQUIVALENTS

- 2,3,7,8-TCDD is considered to be the most toxic dioxin congener
- 2,3,7,8-TCDD has thus become the model congener for most toxicity studies
- In the early 1980s there was a need to quantify the toxicological potential of mixtures of PCDDs and PCDFs
- The toxic effect of each PCDD/F congener is different
- The « Toxicity Equivalence Factor » or TEF relates the toxic potency of a given congener to the toxic potency of 2,3,7,8-TCDD (TEF=1) as a reference
- The « Toxic equivalent » = TEQ of each of the (dirty 17) congeners is the absolute amount/concentration multiplied by its Toxicity Equivalence Factor

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TOXICITY EQUIVALENCE FACTORS - TOXIC EQUIVALENT

Compound	I-TEF (=NATO)	WHO1998 TEF	WHO2005 TEF
	Environmental	Food / Feed	Food / Feed
2,3,7,8-TCDF	0,1	0,1	0,1
2,3,7,8-TCDD	1	1	1
1,2,3,7,8-PeCDF	0,05	0,05	0,03
2,3,4,7,8-PeCDF	0,5	0,5	0,3
1,2,3,7,8-PeCDD	0,5	1	1
1,2,3,4,7,8-HxCDF	0,1	0,1	0,1
1,2,3,6,7,8-HxCDF	0,1	0,1	0,1
2,3,4,6,7,8-HxCDF	0,1	0,1	0,1
1,2,3,7,8,9-HxCDF	0,1	0,1	0,1
1,2,3,4,7,8-HxCDD	0,1	0,1	0,1
1,2,3,6,7,8-HxCDD	0,1	0,1	0,1
1,2,3,7,8,9-HxCDD	0,1	0,1	0,1
1,2,3,4,6,7,8-HpCDF	0,01	0,01	0,01
1,2,3,4,7,8,9-HpCDF	0,01	0,01	0,01
1,2,3,4,6,7,8-HpCDD	0,01	0,01	0,01
OCDF	0,001	0,0001	0,0003
OCDD	0,001	0,0001	0,0003

- Summation of all 17 individual TEQ gives the « Total TEQ » value
- All national and international regulations always refer to the total TEQ value
- Two different TEF systems are used :
 - NATO : mainly for environmental (emission, soil, etc...)
 - WHO : mainly for feed/food (WHO1998)

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Compliance with regulations Feed

- COMMISSION DIRECTIVE 2006/13/EC sets maximum levels for dioxins (and DL-PCBs).
 - Maximum content relative to a feedingstuff with a moisture content of 12 %

- COMMISSION DIRECTIVE EC/152/2009 establishing requirements for the determination of levels of dioxins and dioxin-like PCBs in feedingstuffs
 - The control laboratory shall analyse the laboratory sample for enforcement in duplicate analysis in case the obtained result of the first analysis is less than 20 % below or above the maximum level, and calculate the mean of the results.
 - The lot is accepted if the result of the first analysis is more than 20 % below the maximum level or where duplicate analysis is necessary if the mean conforms to the respective maximum level as laid down in Directive 1999/29/EC.

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Compliance with regulations Food

- Food
 - Food: COMMISSION REGULATION (EC) No 1881/2006 of 19 December 2006 setting maximum levels for certain contaminants in foodstuffs.

- maximum levels are set for dioxins and for the sum of dioxins and dioxin-like PCBs.

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FIELDS OF EXPERTISE IN DIOXIN TESTING

- Kind of Matrices already analysed :
 - Stack emission : non-continuous and continuous (sampling and analysis).
 - Soil and sediment.
 - Fly ash.
 - Bottom ash from incinerators.
 - Food : fish, milk, eggs, meat,
 - Animal feedingstuff.
 - Additives for animal feedingstuff.
 - Waste water.
 - Chemicals.
 - Deposition (immission).
 - Blood.
 - ...
- Build-up of knowledge for sampling stack emissions for PCDD/F's .

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QUALITY CREDENTIALS AND FEATURES

- IAC is a **Belac accredited** laboratory infrastructure.
 - Certificate 005-Test.
 - Conform ISO 17025 standards
 - Successful participation in Interlab Studies
- GMP certified by Agency Animal Feeding stuff Holland.
- Q&S Anerkennung für Lebensmittel Germany

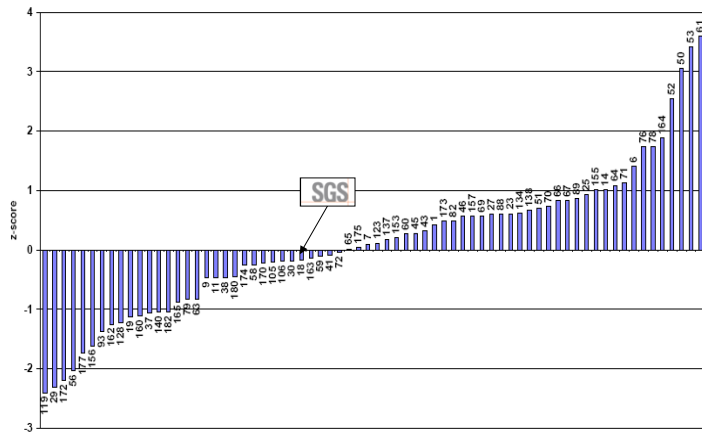
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RESULTS 11TH ROUND INTERNATIONAL INTERCALIBRATION

Ash C TEQ PCDD/DF z-scores
Mean 0.19, RSD 20%

70 labs



Update with respect to Maximum Levels – Action
Thresholds for Dioxins – Dioxinlike PCB’s –
non Dioxinlike PCB’s



MAXIMUM CONTENT

In ng WHO-PCDD/F-TEQ/kg (ppt) ⁽¹⁾ relative to a Feed with a moisture content of 12%

Undesirable substances	Products intended for animal feed	Maximum content SANCO/11515/2011 –Rev 1- 28-06-2011	Maximum content Feed 2006_13_EC
1. Dioxins (sum of polychlorinated dibenzo- <i>para</i> -dioxins (PCDDs), polychlorinated dibenzofurans (PCDFs) expressed in World Health Organisation (WHO) toxic equivalents, using the WHO-TEFs (toxic equivalency factors, 2005 ⁽¹⁾)	Feed materials of plant origin with the exception of: - vegetable oils and their by-products	0,75	0,75
	Feed materials of mineral origin	0,75	0,75
	Feed materials of animal origin: - Animal fat, including milk fat and egg fat	0,75	1,0
	- Other land animal products including milk and milk products and eggs and egg products.	1,50	2,0
	- Fish oil	0,75	0,75
	- Fish, other aquatic animals and products derived with the exception of fish oil and fish protein hydrolysed containing more than 20 % fat ⁽³⁾ - Fish protein hydrolysed containing more than 20 % fat	5,0	6,0
		1,25	1,25
		1,75	2,25

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MAXIMUM CONTENT

In ng WHO-PCDD/F-TEQ/kg (ppt) ⁽¹⁾ relative to a Feed with a moisture content of 12%

Undesirable substances	Products intended for animal feed	Maximum content SANCO/11515/2011 –Rev 1- 28-06-2011	Maximum content Feed 2006_13_EC
1. Dioxins (sum of polychlorinated dibenzo- <i>para</i> -dioxins (PCDDs), polychlorinated dibenzofurans (PCDFs) expressed in World Health Organisation (WHO) toxic equivalents, using the WHO-TEFs (toxic equivalency factors, 2005 ⁽¹⁾)	-Feed additives belonging to the functional groups of binders and anti-caking agents	1,0	0,75
	- Feed additives belonging to the functional group of compounds of trace elements	1,0	1,0
	- Premixtures	1,0	1,0
	- Compound feed with the exception of: - compound feed for pet animals and fish	0,75	0,75
	- compound feed for fur animals	1,75	2,25
			—

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MAXIMUM CONTENT

In ng WHO-PCDD/F-PCB-TEQ/kg (ppt) ⁽¹⁾ relative to a Feed with a moisture content of 12%

Undesirable substances	Products intended for animal feed	Maximum content SANCO/11515/2011 –Rev 1-28-06-2011	Maximum content Feed 2006_13_EC
2. Sum of dioxins and dioxin-like PCBs (sum of polychlorinated dibenzo- <i>para</i> -dioxins (PCDDs), polychlorinated dibenzofurans (PCDFs) and polychlorinated biphenyls (PCBs) expressed in World Health Organisation (WHO) toxic equivalents, using the WHO-TEFs (toxic equivalency factors, 2005 ⁽²⁾)	Feed materials of plant origin with the exception of: - vegetable oils and their by-products	1,25	1,25
	Feed materials of mineral origin	1,5	1,5
	Feed materials of animal origin: - Animal fat, including milk fat and egg fat	1,0	1,5
	- Other land animal products including milk and milk products and eggs and egg products.	2,0	3,0
	- Fish oil	1,25	1,25
	- Fish, other aquatic animals and products derived thereof with the exception of fish oil and fish protein hydrolysed containing more than 20 % fat ⁽³⁾	20,0	24,0
	- Fish protein hydrolysed containing more than 20 % fat	4,0	4,5
		9,0	11,0

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MAXIMUM CONTENT

In ng WHO-PCDD/F-PCB-TEQ/kg(ppt) ⁽¹⁾ relative to a Feed with a moisture content of 12%

Undesirable substances	Products intended for animal feed	Maximum content SANCO/11515/2011 –Rev 1-28-06-2011	Maximum content Feed 2006_13_EC
2. Sum of dioxins and dioxin-like PCBs (sum of polychlorinated dibenzo- <i>para</i> -dioxins (PCDDs), polychlorinated dibenzofurans (PCDFs) and polychlorinated biphenyls (PCBs) expressed in World Health Organisation (WHO) toxic equivalents, using the WHO-TEFs (toxic equivalency factors, 2005 ⁽²⁾)	Feed additives belonging to the functional groups of binders and anti-caking agents	1,5	1,5
	Feed additives belonging to the functional group of compounds of trace elements	1,5	1,5
	Premixtures	1,5	1,5
	Compound feed with the exception of: - compound feed for pet animals and fish	1,5	1,5
	- compound feed for fur animals	5,5	7,0
		—	—

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Non Dioxinlike PCB's

- Present National maximum levels of non-dioxinlikePCBs for animal feed are (sum of the 7 congeners) :
 - 200 µg/kg fat for mixedfeed
 - 250 µg/kg fat for feed with >2% fat
 - 50 µg/kg product for feed with <2% fat



Europe wants a general norm (sum of 6 congeners: not PCB 118)

- New limits will request higher sensitivity of the instrumental technique → IAC already accredited – analysis done via HRMS.

MAXIMUM CONTENT

In µg/kg (ppb) relative to a Feed with a moisture content of 12%

Undesirable substances	Products intended for animal feed	Maximum content SANCO/11515/ 2011 –Rev 1- 28-06-2011
3. Non dioxin-like PCBs (Sum of PCB 28, PCB 52, PCB 101, PCB 138, PCB 153 and PCB 180 (ICES – 6) (1))	Feed materials of plant origin	10
	Feed materials of mineral origin	10
	Feed materials of animal origin:	
	- Animal fat, including milk fat and egg fat	10
	- Other land animal products including milk and milk products and eggs and egg products.	10
	- Fish oil	175
	- Fish, other aquatic animals and products derived thereof with the exception of fish oil and fish protein hydrolysed containing more than 20 % fat	30
	- Fish protein, hydrolysed containing more than 20 % fat	50



MAXIMUM CONTENT (cont'd)

In µg/kg (ppb) relative to a Feed with a moisture content of 12%

Undesirable substances	Products intended for animal feed	Maximum content SANCO/11515/ 2011 –Rev 1- 28-06-2011
3. Non dioxin-like PCBs (Sum of PCB 28, PCB 52, PCB 101, PCB 138, PCB 153 and PCB 180 (ICES – 6) (1))	The feed additives kaolinitic clay, calcium sulphate dihydrate, vermiculite, natrolite-phonolite, synthetic calcium aluminates and clinoptilolite of sedimentary origin belonging to the functional groups of binders and anti-caking agents	10
	Feed additives belonging to the functional group of compounds of trace elements	10
	Premixtures	10
	Compound feed with the exception of: - compound feed for pet animals and fish - compound feed for fur animals	10 40 –

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ACTION THRESHOLD

in ng WHO-PCDD/F TEQ/kg (ppt) ⁽²⁾ relative to a feedingstuff with a moisture content of 12%

Undesirable substances	Products intended for animal feed	Action threshold SANCO/11515/ /2011 –Rev 1- 28-06-2011	Action threshold Feed 2006_13_EC
1. Dioxins (sum of polychlorinated dibenzo- <i>para</i> -dioxins (PCDDs), polychlorinated dibenzofurans (PCDFs) expressed in World Health Organisation (WHO) toxic equivalents, using the WHO-TEFs (toxic equivalency factors, 2005 ⁽¹⁾)	Feed materials of plant origin with the exception of: - vegetable oils and their by-products	0,5	0,5
	Feed materials of mineral origin	0,5	0,5
	Feed materials of animal origin: - Animal fat, including milk fat and egg fat	0,75	1,0
	- Other land animal products including milk and milk products and eggs and egg products.	0,5	0,5
	- Fish oil	4,0	5,0
	- Fish, other aquatic animals and products derived with the exception of fish oil and fish protein hydrolysed containing more than 20 % fat ⁽³⁾	0,75	1,0
	- Fish protein hydrolysed containing more than 20 % fat	1,25	1,75

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ACTION THRESHOLD (cont'd)

in ng WHO-PCDD/F TEQ/kg (ppt) ⁽²⁾ relative to a feedingstuff with a moisture content of 12%

Undesirable substances	Products intended for animal feed	Action threshold SANCO/11515 /2011 –Rev 1- 28-06-2011	Action threshold Feed 2006_13_EC
1. Dioxins (sum of polychlorinated dibenzo- <i>para</i> -dioxins (PCDDs), polychlorinated dibenzofurans (PCDFs) expressed in World Health Organisation (WHO) toxic equivalents, using the WHO-TEFs (toxic equivalency factors, 2005 ⁽¹⁾)	Feed additives belonging to the functional groups of binders and anti-caking agents	0,5	0,5
	Feed additives belonging to the functional group of compounds of trace elements	0,5	0,5
	Premixtures	0,5	0,5
	Compound feed	0,5	0,5
	with the exception of: - compound feed for pet animals and fish - compound feed for fur animals	1,25 —	1,75 —

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ACTION THRESHOLD (cont'd)

in ng WHO-PCDD/F TEQ/kg (ppt) ⁽²⁾ relative to a feedingstuff with a moisture content of 12%

Undesirable substances	Products intended for animal feed	Action threshold SANCO/11515 /2011 –Rev 1- 28-06-2011	Action threshold Feed 2006_13_EC
2. Dioxin-like PCBs (sum of polychlorinated biphenyls (PCBs) expressed in World Health Organisation (WHO) toxic equivalents, using the WHO-TEFs (toxic equivalency factors, 2005 ⁽¹⁾)	Feed materials of plant origin with the exception of: - vegetable oils and their by-products	0,35 0,5	0,35 0,5
	Feed materials of mineral origin	0,35	0,35
	Feed materials of animal origin: - Animal fat, including milk fat and egg fat	0,75	0,75
	- Other land animal products including milk and milk products and eggs and egg products.	0,35	0,35
	- Fish oil	11,0	14,0
	- Fish, other aquatic animals and products derived thereof with the exception of fish oil and fish protein hydrolysed containing more than 20 % fat ⁽³⁾	2,0	2,5
	- Fish protein hydrolysed containing more than 20 % fat	5,0	7,0

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ACTION THRESHOLD (cont'd)

in ng WHO-PCDD/F TEQ/kg (ppt) ⁽²⁾ relative to a feedingstuff with a moisture content of 12%

Undesirable substances	Products intended for animal feed	Action threshold SANCO/11515/2011 –Rev 1- 28-06-2011	Action threshold Feed 2006_13_EC
2.. Dioxinlike PCBs (sum of polychlorinated biphenyls (PCBs) expressed in World Health Organisation (WHO) toxic equivalents, using the WHO-TEFs (toxic equivalency factors, 2005 (1)	Feed additives belonging to the functional groups of binders and anti-caking agents	0,5	0,5
	Feed additives belonging to the functional group of compounds of trace elements	0,35	0,35
	Premixtures	0,35	0,35
	Compound feed	0,5	0,5
	with the exception of: - compound feed for pet animals and fish - compound feed for fur animals	2,5	3,5
		–	–

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WHY SGS IAC?

- Your concern: our challenge
- Full range of advanced and innovative high tech instrumentation
- Fast and flexible service policy
- Value for money strategy
- Extensive back-up equipment to guarantee ultimate continuity
- Highly educated & experienced staff
- Short delivery times/possibility for emergency services
- Full customer satisfaction through an extensive client oriented service approach
- ISO17025 accreditation & recognitions by local authorities
- Reliability of a worldwide leading testing & inspection organization

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- Mr. Geert De Smet, Operations Manager
- Mrs. Stefanie Heyvaert, Sales Representative
- Mr. Chris Lenaerts, Sample Logistics
- Mrs. Nathalie Van Riel, Customer Care