EURL Proficiency Test on the Determination of PCDD/Fs, PCBs, PBDEs, HBCDDs and PFASs in Fish Meal 2022

EURL-PT-POP_2203-FM

FEED

Report

PCDD/Fs and PCBs

(Report Version 1.0)

12 June 2023

EURL POPs

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Summary

Test sample	**FEED:** Fish Meal [2203-FM]
Analytes of interest **Mandatory** for NRLs:	**PCDD/Fs** (17 2,3,7,8-substituted PCDD/Fs) **PCBs** (12 DL-PCBs, 6 NDL-PCBs)
Methods	**PCDD/Fs, DL-PCBs:** GC-HRMS, GC-MS/MS and alternative methods; Bioanalytical screening methods **NDL-PCBs:** Any kind of method
Participants	NRLs, OFLs, other official laboratories, commercial laboratories performing the analysis of samples taken by feed business operators
Statistical evaluation	ISO 13528:2022 [1], IUPAC Protocol [2]
Report of final results	12 June 2023 (Version 1.0)
Publication	EURL POPs reserves all rights to publish and present the anonymised results of the interlaboratory study in scientific journals and/or during conferences.

1. Structure of the ILS, test material and analytes

This proficiency test (PT) on the determination of **PCDD/Fs, PCBs, PBDEs, HBCDDs** and **PFASs** in **fish meal** was organized by European Union Reference Laboratory (EURL) for halogenated persistent organic pollutants (POPs) in Feed and Food to be performed between September and November 2022. The objective was to assess analytical performance of laboratories and interlaboratory comparability of results from analyses of PCDD/Fs, PCBs, PBDEs, HBCDDs and PFASs in one sample of **fish meal**.

National Reference Laboratories (NRLs) for halogenated POPs in Feed and Food from EU member states were requested to participate as part of their work programme for 2022. NRLs were invited to encourage the participation of Official Laboratories (OFLs) from their member states as part of their duties following Article 101 of regulation (EU) 2017/625 of the European Parliament and of the Council of 15 March 2017. Furthermore, participation of OFLs allowed the extension of the data basis for calculation of assigned values and evaluation of results. **Other official laboratories** and **commercial laboratories** performing the analysis of samples taken by feed business operators were invited to participate in this proficiency test.

The evaluated results were discussed by representatives of European Commission, NRLs and the EURL at the EURL/NRL workshop on 29 and 30 November 2022.

1.1. Samples and coding

The test sample was prepared from commercially available feed, naturally contaminated with PCDD/Fs, PCBs and PFASs and fortified with analytes of interest using technical mixtures of PBDEs and HBCDDs. Each participant received about **90 g** of the test sample in a HDPE bottle.

Fish Meal	**Sample no. 2203-FM-xxx**

1.2. Analytes of interest

NRLs for halogenated POPs in feed and food were requested to determine the following parameters:

- 17 2,3,7,8-substituted PCDD/Fs
- WHO-PCDD/F-TEQ (using WHO_{2005}-TEF)
- 12 dioxin-like PCBs
- WHO-PCB-TEQ (using WHO_{2005}-TEF)
- WHO-PCDD/F-PCB-TEQ (using WHO_{2005}-TEF)
- Six non-dioxin-like PCBs (indicator PCBs): PCB 28, 52, 101, 138, 153, 180
- Sum of six non-dioxin-like PCBs (indicator PCBs)
- PCDD/F-PCB-BEQ, PCDD/F-BEQ and/or PCB-BEQ, if applicable (using bioanalytical screening methods)

1.3. Methods

One or more of the following **detection methods** could be applied:

- GC-HRMS-, GC-MS/MS-methods or other alternative methods for PCDD/Fs and dioxin-like PCBs
- Bioanalytical screening methods for PCDD/Fs and dioxin-like PCBs
- Any kind of method for non-dioxin-like PCBs

1.4. Coding of laboratories and confidentiality

The identity of participating laboratories will be kept confidential and will not be revealed to other participants.
For NRLs of EU member states, the suggested “protocol for management of underperformance in comparative testing or lack of collaboration of National Reference Laboratories (NRLs)” will be followed. The confidentiality of NRLs will be kept according to this protocol.
For OFLs of EU member states cooperating with NRL, the respective NRLs will inform the EURL for halogenated POPs about the participating OFLs and will receive the respective laboratory codes, invoices for participation fee and certificates of participation of the OFLs.

1.5. Results of PCDD/Fs and PCBs

1.5.1. Results of PCDD/Fs and PCBs determined by physico-chemical methods (GC-HRMS, GC-MS/MS, GC-LRMS, GC-ECD, …)

Laboratories should

- use their own reference standards for identification and quantification,
- report results for each analyte,
- report the limit of quantification (LOQ), at least for each non-quantified analyte,
- report upper, middle and lower bound results for WHO-PCDD/F-PCB-TEQ, WHO-PCDD/F-TEQ, WHO-PCB-TEQ and sum of six indicator PCBs,
- report if sample exceeds respective EU maximum levels or action thresholds for WHO-PCDD/F-PCB-TEQ, WHO-PCDD/F-TEQ and/or WHO-PCB-TEQ or the maximum level for the sum of six non-dioxin-like PCBs beyond reasonable doubt taking into account the measurement uncertainty,
- report the measurement uncertainty, applied for checking of compliance, for WHO-PCDD/F-PCB-TEQ, WHO-PCDD/F-TEQ, WHO-PCB-TEQ and the sum of six indicator PCBs,
- give method information and
- give information about the accreditation of the laboratory according to ISO/IEC 17025 *(for metrological traceability of consensus values of participants used as assigned values).*

Results had to be reported in **ng/kg product, relative to a feed with a moisture content of 12 %**, for PCDD/Fs and dioxin-like PCBs, and in **µg/kg product, relative to a feed with a moisture content of 12 %**, for indicator PCBs. TEQ-based results had to be calculated using the WHO-TEFs of 2005 [3].

1.5.2. Results of PCDD/Fs, PCBs, PBDEs and HBCDDs determined by physico-chemical methods (GC-HRMS, GC-MS/MS, GC-LRMS, GC-ECD, …)

Laboratories should

- use their own reference standards,
- report if the samples are suspected to be noncompliant with EU legal limits and confirmation is required,
- report PCDD/F and/or PCB results in BEQ, if applicable,
- report the reporting limit, maximum level / action threshold, which the evaluation is based on, and the bioassay cut-off, if applicable,
- give method information
- and give information about the accreditation of the laboratory according to ISO/IEC 17025.

Results had to be reported in **ng BEQ/kg, relative to a feed with a moisture content of 12 %**, for PCDD/Fs and dioxin-like PCBs.

2. Participating laboratories

This proficiency test was open for participation of:

- National Reference Laboratories (NRLs) of EU member states
- National Reference Laboratories of other European countries
- Official laboratories
- Commercial laboratories

113 laboratories registered for this proficiency test, reporting 99 sets of results for at least one parameter.

Table 1: Participating laboratories

Participating laboratories	Region	No. of participants
National Reference Laboratories	European Union Other Countries	25 3
Official Laboratories	European Union Other European Countries Africa Americas Asia Oceania	60 0 0 3 1 1
Commercial Laboratories	European Union Other European Countries Africa Americas Asia Oceania	13 1 0 5 1 0
	Total	**113**

2.1. Number of reported results

Table 2: Reported results for PCDD/F and PCB sum parameters and moisture content

Reported results	WHO-PCDD/F-PCB-TEQ	WHO-PCDD/F-TEQ	WHO-PCB-TEQ	Sum of six indicator PCBs	PCDD/F-PCB-BEQ [Bioanalytical screening methods]	Moisture content
All laboratories	74	75	74	88	8	89
NRLs	19	19	19	23	3	23

Table 3: Reported accreditation according to ISO/IEC 17025 by participants for PCDD/Fs and PCBs

Fish meal	PCDD/Fs, PCBs [Physico-chemical methods]	PCDD/Fs, PCBs [Bioanalytical screening methods]
yes	80	11
no	6	1

2.2. Detection methods

The following detection methods were applied:

- GC-HRMS-, GC-MS/MS-, GC-LRMS-methods for PCDD/Fs and non- ortho PCBs
- GC-HRMS-, GC-MS/MS-, GC-LRMS-, GC-ECD-methods for mono-ortho-PCBs and indicator PCBs
- Bioanalytical screening methods for PCDD/Fs and dioxin-like PCBs

Table 4: Overview of physico-chemical detection methods for PCDD/Fs and PCBs applied by participants

Detection methods	PCDD/Fs	non-ortho-PCBs	mono-ortho-PCBs	Indicator PCBs
HRMS	57	56	51	42
MS/MS	11	12	12	26
LRMS	3	3	3	12
ECD	-	-	-	4

3. Test for sufficient homogeneity

The test for sufficient homogeneity was performed according to ISO 13528:2022 [1] and the International Harmonized Protocol for the Proficiency Testing of Analytical Chemistry Laboratories [2].

Therefore, 10 portions of the test samples 2203-FM were analyzed in duplicate for PCDD/Fs and PCBs. The test for sufficient homogeneity was performed for the sum parameters WHO-PCDD/F-PCB-TEQ, WHO-PCDD/F-TEQ, WHO-PCB-TEQ, the sum of six non-dioxin-like PCBs and individual congeners. The test materials showed sufficient homogeneity for this proficiency test. The stability check of the analytes of interest applying room temperature storage was performed according to ISO 13528:2022 [1]. The test material showed sufficient stability for this proficiency test.

4. Determination of the assigned value

Statistical evaluation of the PT results was performed by the EURL for halogenated POPs in feed and food according to DIN ISO 13528:2022 [1] and the International Harmonized Protocol for the Proficiency Testing of Analytical Chemistry Laboratories [2].

The determination of the assigned value was performed according [1] by estimating of the assigned value as the consensus of participants' results (using only results of physico-chemical methods). The Huber robust mean was taken as assigned value after excluding extreme outliers (outside the range of ± 50% of the median of all reported results) and examination of the distribution of the remaining results using histogram and Kernel density estimation, if necessary.

Assigned values were calculated for WHO-PCDD/F-PCB-TEQ, WHO-PCDD/F-TEQ, WHO-PCB-TEQ, the sum of six non-dioxin-like PCBs and individual PCDD/F and PCB congeners (including limits of quantification (LOQs)), if possible. Additionally the median of all values is calculated.

For individual congeners (including LOQs) assigned values were only calculated according to the above mentioned procedure, if more than 2/3 of all results are above the LOQ and less than 1/3 of all results (including LOQs) are outside the range of ± 50% of the median of all reported results. Levels for individual congeners are only used for evaluation and calculation if these levels are equal to or above the LOQ; otherwise the LOQ is used instead.

Due to high variation of participants' results or the limited number of reported results above the LOQ, no assigned values could be calculated for:

- 1,2,3,4,7,8-HxCDD, 1,2,3,7,8,9-HxCDD
- 1,2,3,7,8,9-HxCDF, 1,2,3,4,6,7,8-HpCDF, 1,2,3,4,7,8,9-HpCDF, 1,2,3,4,6,7,8,9-OCDF
- PCB 123

Since there are no traceable reference values available, the assigned values in this PT were calculated based on the Huber robust mean of the participants' results. Therefore, the assigned values are only traceable to these submitted results. Additionally the results of all participants reporting results and the results of participants having accreditation according ISO/IEC 17025 were compared for PCDD/F and PCB sum parameters. No significant differences between the assigned values calculated for both data sets were observed (Table 5).

Table 5: Comparison of assigned values for all participants and participants with reported accreditation according to ISO/IEC 17025 for PCDD/F and PCB sum parameters in fish meal 2203-FM

Sum parameters	Assigned value All participants	Assigned value ISO/IEC 17025 accreditation	Deviation
	ng/kg, µg/kg product (12 % moisture content)	ng/kg, µg/kg product (12 % moisture content)	%
WHO-PCDD/F-PCB-TEQ ub rep	1.85	1.85	-
WHO-PCDD/F-TEQ ub rep	1.12	1.11	<1
WHO-PCB-TEQ ub rep	0.736	0.737	<1
Sum Indicator PCBs ub rep	8.66	8.61	<1

4.1. PCDD/Fs and PCBs – Sum parameters

The assigned values for the test sample 2203-FM were calculated as consensus of participants' results for the PCDD/F and PCB sum parameters, taking into account the calculation criteria described above.

Table 6: Assigned values for physico-chemical methods for PCDD/Fs and PCBs (rounded to three significant figures)

Test sample	WHO-PCDD/F-PCB-TEQ (ub)	WHO-PCDD/F-TEQ (ub)	WHO-PCB-TEQ (ub)	Sum Indicator PCBs (ub)
	ng/kg product (12 % moisture content)			µg/kg product (12 % moisture content)
Fish Meal (2203-FM)	1.85	1.12	0.736	8.66

Table 7: Assigned values for PCDD/Fs and DL-PCBs for comparison with BEQ results of bioanalytical screening methods (rounded to two significant figures)

Test sample	WHO-PCDD/F-PCB-TEQ (ub)	WHO-PCDD/F-TEQ (ub)	WHO-PCB-TEQ (ub)
	ng/kg product (12 % moisture content)		
Fish Meal (2203-FM)	1.9	1.1	0.74

4.2. PCDD/Fs and PCBs – Individual congeners

The assigned values for the test sample 2203-FM for individual congeners were calculated as a consensus of the participants' results, taking into account the calculation criteria described above (Figure 1; tabular summary see annex 1).

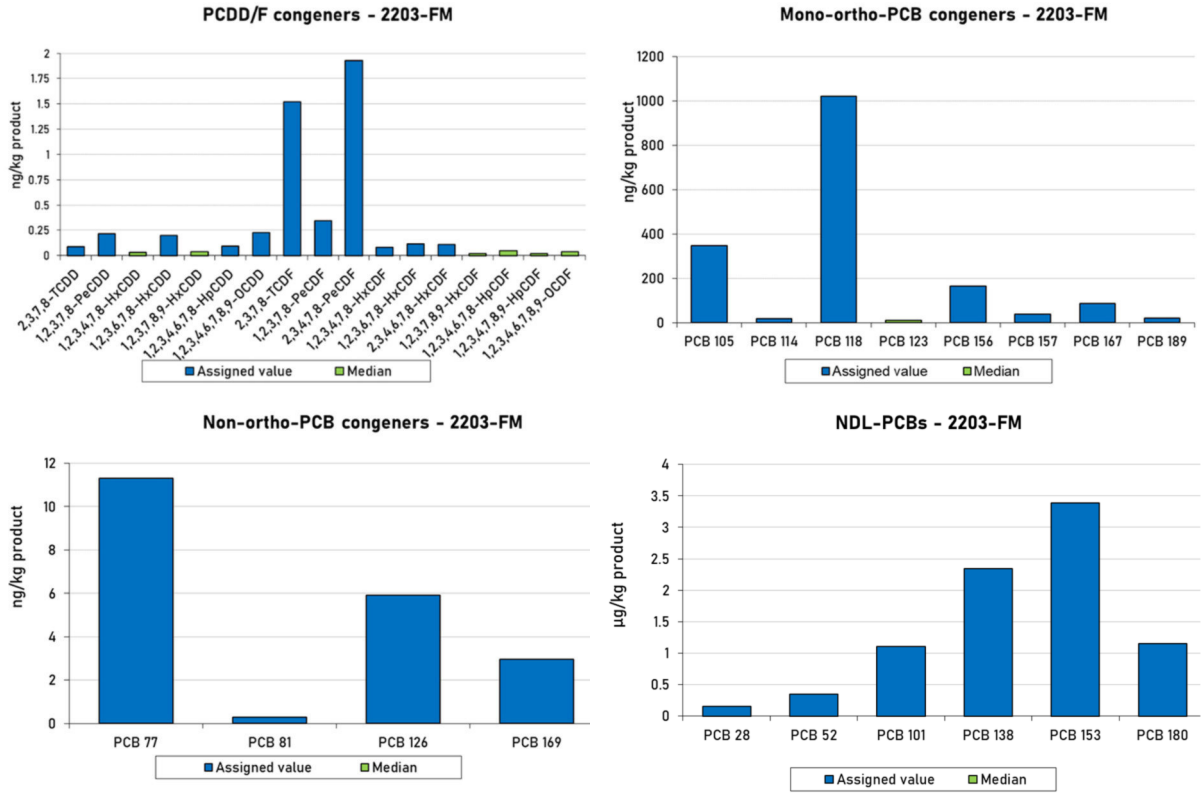

Figure 1: Assigned values (blue) and median values (green) for PCDD/F and PCB congeners for fish meal (2203-FM) [ng/kg or µg/g product (12% moisture content)]

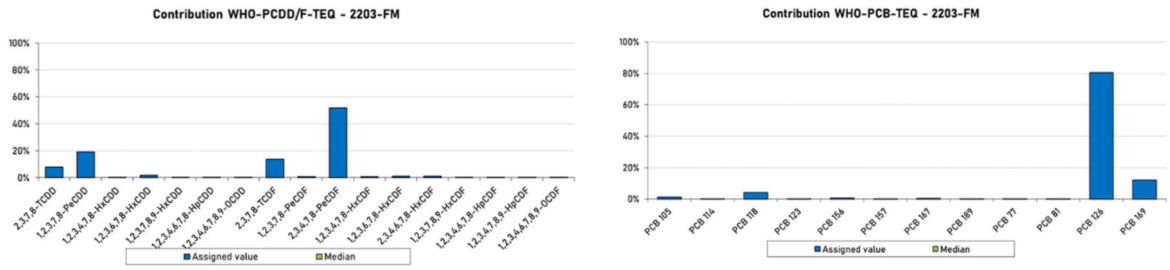

Figure 2: Contributions in % to WHO-PCDD/F-TEQ and WHO-PCB-TEQ for PCDD/F and PCB assigned (blue) and median (green) values for fish meal (2203-FM)

4.3. Moisture content

For the moisture content an assigned value of 10.7 % for the test sample 2203-FM was calculated as a consensus of the participants' results, taking into account the calculation criteria described above.

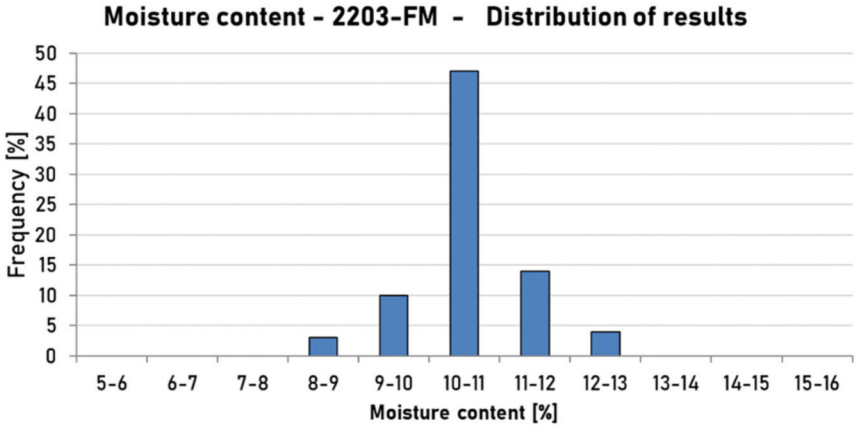

Figure 3: Frequency of participant's results for the moisture content in % for fish meal (2203-FM)

4.4. Comparison of assigned values with legal limits

Maximum levels and action thresholds for feed are defined in the Directive 2002/32/EC of the European Parliament and of the Council of 7 May 2002 on undesirable substances in animal feed (Annex I Section V and Annex II).

Table 8: Maximum levels and action thresholds for feed materials of animal origin:

Undesirable Substances **Feed materials of animal origin**		**Maximum level**	**Action threshold**
WHO-PCDD/F-PCB-TEQ	ng/kg product*	**4**	
WHO-PCDD/F-TEQ	ng/kg product*	**1.25**	**0.75**
WHO-PCB-TEQ	ng/kg product*		**2**
Sum of 6 NDL PCBs (sum of PCB 28, 52, 101, 138, 153, 180)	µg/kg product*	**30**	

* *relative to a feed with a moisture content of 12%*

For the fish meal test sample 2203-FM the assigned values for the sum parameters WHO-PCDD/F-PCB-TEQ (rounded to one significant digit for comparison with the ML) and WHO-PCDD/F-TEQ were in the range of 0.5 to 4 of the respective maximum levels and action thresholds (Figure 4).

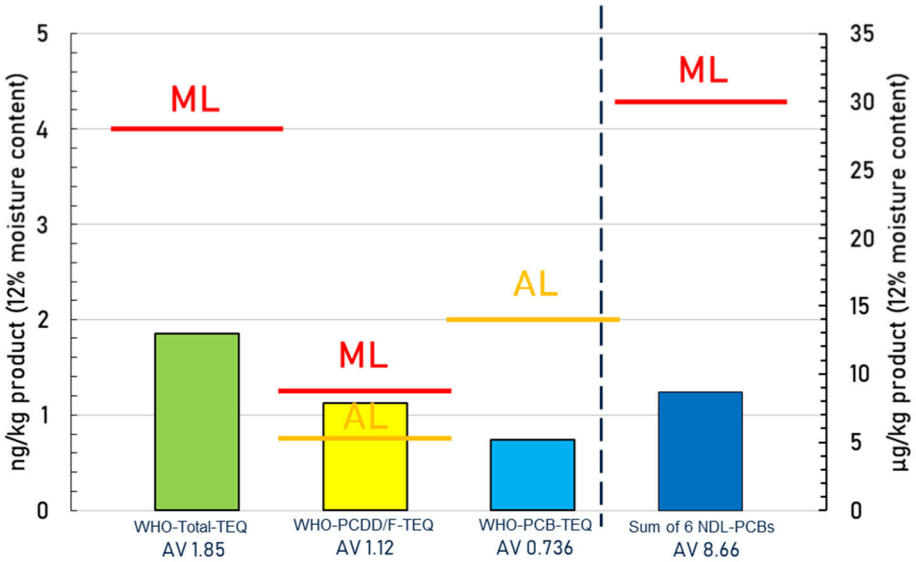

Figure 4: Comparison of the assigned values for sum parameters for fish meal (2203-FM) with maximum levels (red lines) and action thresholds (yellow line) [ng/kg and µg/kg product (12% moisture content)]

5. Scoring of results – Z-scores

5.1. Participants' results for physico-chemical methods

5.1.1 Z-scores

Criteria for successful participation of laboratories using physico-chemical methods were based on the evaluation of the results of the sum parameters WHO-PCDD/F-TEQ, WHO-PCB-TEQ, WHO-PCDD/F-PCB-TEQ and the sum of six non-dioxin-like PCBs and evaluated individual congeners. The criteria will be applicable for sum parameter concentrations in the range (about 0.5 to 4 times) of the level of interest (maximum or action level).

For evaluation of results of physico-chemical methods the z-scores were calculated according to the following formula:

$$z = \frac{(x - x_a)}{\sigma_p}$$

x: *participant's result*
x_a: *assigned value*
σ_p: *fitness-for-purpose-based standard deviation for proficiency assessment*

For WHO-PCDD/F-TEQ, WHO-PCB-TEQ and WHO-PCDD/F-PCB-TEQ the standard deviation for proficiency assessment σ_p was defined as 10 %, for the sum of six non-dioxin-like PCBs (PCB 28, 52, 101, 138, 153, 180) as 15 % and for evaluated individual PCDD/F, PCB congeners as 20 %.

Z-scores for individual congeners were only calculated and reported if levels for these congeners are equal to or above the LOQ. Otherwise no z-scores will be given.

Interpretation of z-scores:

$\lvert z\text{-score}\rvert \leq 2$	*satisfactory performance*
$2 < \lvert z\text{-score}\rvert < 3$	*questionable performance (warning signal)*
$\lvert z\text{-score}\rvert \geq 3$	*unsatisfactory performance (action signal)*

5.1.2 PCDD/Fs and PCBs - Participants' z-scores

Tabular summaries of participants' results and z-scores can be found in annex 2 and 3.

Table 9: Distribution of all participants' and NRLs only z-scores for sum parameters

Fish meal (2203-FM)	WHO-PCDD/F-PCB-TEQ	WHO-PCDD/F-TEQ	WHO-PCB-TEQ	Sum of six indicator PCBs
all Participants				
|z-score| ≤ 2	86 %	88 %	85 %	92 %
2 < |z-score| < 3	7 %	4 %	11 %	3 %
|z-score| ≥ 3	7 %	8 %	4 %	5 %
NRLs				
|z-score| ≤ 2	90 %	90 %	90 %	87 %
2 < |z-score| < 3	5 %	5 %	10 %	4 %
|z-score| ≥ 3	5 %	5 %	-	9 %

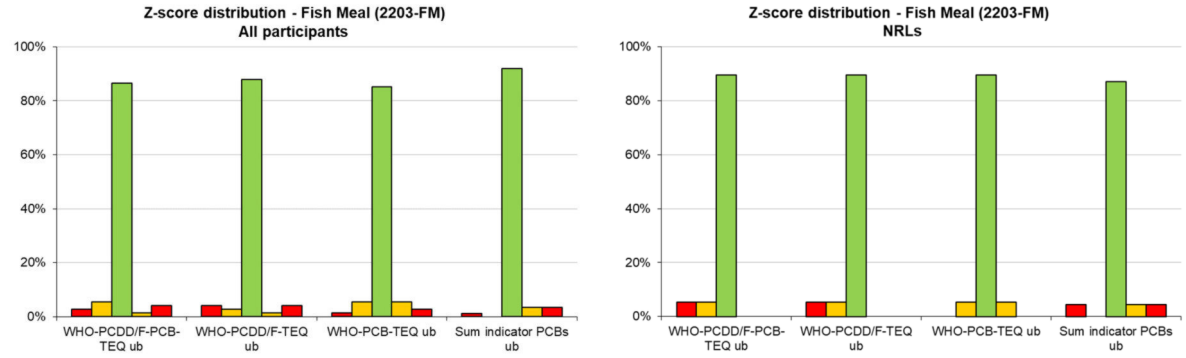

Figure 5: Distribution of all participants' z-scores and NRLs only for sum parameters for fish meal (2203-FM) [Green bars: -2 ≤ z-score ≤ 2, orange bars: -3 < z-score < -2, 2 < z-score < 3, red bars: z-score ≤ -3, z-score ≥ 3]

5.1.3 Comparison of reported and calculated sum parameters

In addition to the calculation of the sum parameters for reported individual PCDD/F and PCB congener values, the calculated sum parameters for PCDD/Fs and PCBs by the EURL were compared with the ones reported by each participant. As the reported sum parameters are decisive to compare the results with the legal limits, an incorrect calculation might lead to a wrong assessment of a sample. In case of a significant deviation of the reported sum parameter value from the (EURL) calculated one (deviation >10 %) the laboratory has therefore not successfully participated in the PT according to the positive scoring system (see 5.1.5).

Table 10: Difference between reported and calculated sum parameters for PCDD/Fs and PCBs for fish meal (2203-FM) given in percentage of participants' results

Fish meal (2203-FM)	WHO-PCDD/F-PCB-TEQ	WHO-PCDD/F-TEQ	WHO-PCB-TEQ	Sum of six indicator PCBs
Deviation ≤ 10 %	99%	99%	100%	99%
Deviation > 10 %	1%	1%	-	1%

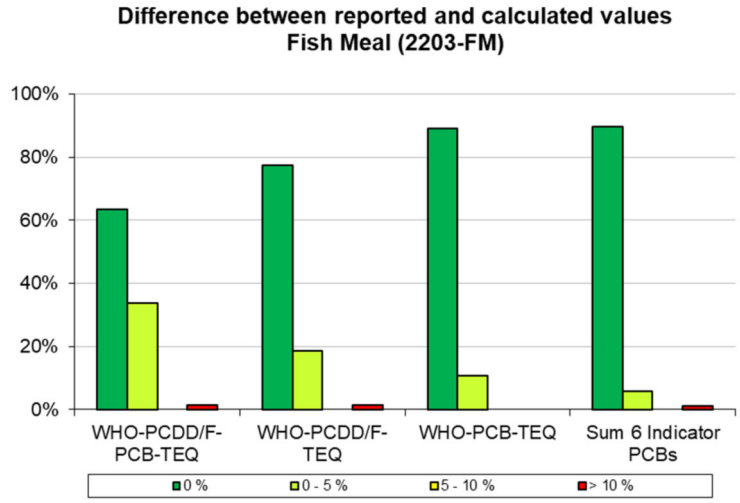

Figure 6: Difference between reported and calculated sum parameters for PCDD/Fs and PCBs [Green bars: 0 %, light green bars: 0-5 %, yellow bars: 5-10 %, red bars: > 10 %] for fish meal (2203-FM) given in percentage of participants' results

5.1.4 Difference between upper and lower bound calculation

According to Commission Regulation (EC) No 152/2009 the difference between upper bound level and lower bound level shall not exceed 20 % for confirmation of exceedance of maximum level or in case of need of action thresholds for PCDD/Fs and DL-PCBs. For indicator PCBs the difference between upper bound and lower bound levels for the sum of six indicator PCBs shall be ≤ 20 % at the level of interest. Participants with a larger deviation should review their analytical methods, especially with regard to sensitivity and limit of quantification.

For the test samples 2203-FM the assigned values for all sum parameters were below the respective maximum levels.

Table 11: Difference between upper and lower bound calculation for fish meal (2203-FM) given in percentage of participants' results

Fish meal (2203-FM)	WHO-PCDD/F-PCB-TEQ	WHO-PCDD/F-TEQ	WHO-PCB-TEQ	Sum of six indicator PCBs
0 – 10 %*	97%	93%	100%	87%
10 – 20 %*	1%	4%	-	13%
20 – 50 %*	1%	3%	-	-
> 50 %*	-	-	-	-

* Difference between upper and lower bound calculation

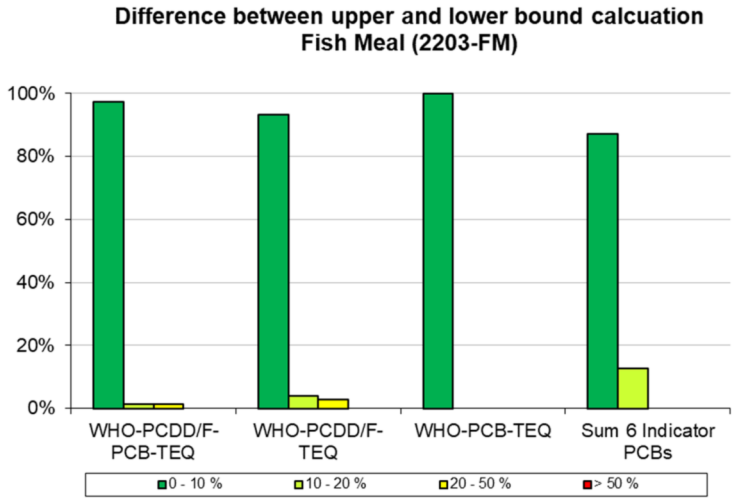

Figure 7: Difference between upper and lower bound calculation for fish meal (2203-FM) given in percentage of participants' results [Green bars: 0 – 10 %, light green bars: 10 – 20 %, yellow bars: 20 – 50 %, red bars: > 50 %]

5.1.5 Positive scoring system

The "positive scoring system" gives one assessment for each PT sample covering all relevant PCDD/F and PCB sum parameters and congeners.

The total score for the positive scoring system was calculated according to the following general principles:

- Calculation of z-scores for sum parameters and evaluated individual congeners
- Calculation of the positive scores according to the following table:

Positive scoring system	| z-score | ≤ 2	2 < | z-score | < 3	| z-score | ≥ 3
Individual congeners	**Positive score**	**Positive score**	**Positive score**
Contribution to sum parameter* > 10 %	12	6	0
Contribution to sum parameter* 3-10 %	8	4	0
Contribution to sum parameter* < 3 %	6	3	0
Not evaluated congeners	0	0	0

* separately for the respective sum parameters WHO-PCDD/F-TEQ, WHO-PCB-TEQ and the sum of six non-dioxin-like PCBs

- Calculation of maximum achievable scores (| z-score | ≤ 2) for PCDD/F and DL-PCB and non-dioxin-like PCB congeners separately:

$$Maximum\ Score = \sum_{i=1}^{n} Max.Score_{(>10\%)i} + \sum_{i=1}^{m} Max.Score_{(3-10\%)i} + \sum_{i=1}^{p} Max.Score_{(<3\ \%)i}$$

- Calculation of the participant's scores for PCDD/F and DL-PCB and non-dioxin-like PCB congeners separately:

$$Participant's\ Score = \sum_{i=1}^{n} Score_{(>10\%)i} + \sum_{i=1}^{m} Score_{(3-10\%)i} + \sum_{i=1}^{p} Score_{(<3\ \%)i}$$

- Calculation of achieved scoring percentage for each participant:

$$Participant's\ Scoring\ Percentage = \frac{Participant's\ score}{Maximum\ score} \cdot 100$$

- Criteria for successful participation:

Sum parameters:	≤ 1 parameter with | z-score | > 2, no parameter with | z-score | ≥ 3
PCDD/F congeners:	≥ 75 % of maximum score
DL-PCB congeners:	≥ 75 % of maximum score
Non-dioxin-like PCB congeners:	≥ 75 % of maximum score
Difference between reported and calculated results for sum parameters	≤ 10 %

The assessment based on the positive scoring system is performed for each PT test sample. A laboratory participates successfully in a PT for PCDD/Fs and PCBs, if all above mentioned criteria for the reported analytes are met for each PT test sample.

5.2 Participants' results for bioanalytical screening methods

According to Commission Regulation (EC) No 152/2009, "a screening method in principle classifies a sample as compliant or suspected to be non-compliant. For this, the calculated BEQ level is compared to the cut-off value […]. Samples below the cut-off value are declared compliant, samples equal or above the cut-off value as suspected to be non-compliant, requiring analysis by a confirmatory method".

Therefore, the main criterion for evaluation of results from bioanalytical screening methods is their ability to reliably identify compliant samples and samples suspected to be non-compliant with established legal limits.

For further evaluation of the performance of bioanalytical screening methods, bioassay-scores are applied: The reported BEQ-values derived from bioanalytical screening methods are compared with the WHO-TEQ assigned values calculated on basis of the results of physical-chemical methods for the concentration range of 0.5 to 2 times the level of interest.

Because bioanalytical screening methods focus mainly on distinguishing between compliant and potentially non-compliant samples, a direct comparison of bioassay-scores and z-scores is not possible. However, bioassay scores may serve as a tool to assess method performance within the scope of external quality control measures of the respective laboratory.

Bioassay-scores are calculated according to the following formula:

$$bioassay - score = \frac{(x - x_a)}{\sigma_{bioassay}}$$

x: *participant's result (BEQ from bioanalytical screening method)*
x_a: *assigned value (physical-chemical methods)*
$\sigma_{bioassay}$: *bioassay target deviation*

For PCDD/F-BEQ, PCB-BEQ and PCDD/F-PCB-BEQ the bioassay target deviation $\sigma_{Bioassay}$ was defined as 20%.

5.2.1 Assessment of analytical results

As a consequence of the comparison of the assigned values of the test sample 2203-FM with legal limits, the assessment of the analytical results using bioanalytical screening methods should read "compliant with the maximum level for WHO-PCDD/F-PCB-TEQ and WHO-PCDD/F-TEQ", "suspected to be non-compliant with the action threshold for WHO-PCB-TEQ" and "compliant with the action threshold for WHO-PCDD/F-TEQ".

Table 12: Evaluation of assigned values for fish meal

	WHO-PCDD/F-PCB-TEQ	WHO-PCDD/F-TEQ	WHO-PCDD/F-TEQ	WHO-PCB-TEQ
2203-FM	< ML	< ML	> AL	< AL

Eight laboratories reported results using CALUX bioassay for Total-BEQ and hereof five also for PCDD/F-BEQ and/or PCB-BEQ.

Table 13: Participants' assessment of analytical results using bioanalytical screening methods for 2203-FM

Laboratories' assessment of analytical results	WHO-PCDD/F-PCB-TEQ Maximum level	WHO-PCDD/F-TEQ Maximum level	WHO-PCDD/F-TEQ Action threshold	WHO-PCB-TEQ Action threshold
Suspected to be non-compliant	2	3	4	1
Compliant	6	3	-	2

5.2.2 Participants' bioassay-scores

Concentrations for WHO-PCDD/F-PCB-TEQ and WHO-PCDD/F-TEQ in the test sample 2203-FM are in the range (about 0.5 to 2 times) of the respective maximum levels.

Table 14: Distribution of participants' bioassay-scores for BEQ parameters for fish meal (2203-FM)

Percentage of participants' results	PCDD/F-PCB-BEQ	PCDD/F-BEQ	PCB-BEQ
| **bioassay-score** | ≤ 2	67 %	100 %	100 %
2 < | **bioassay-score** | < 3	-	-	-
| **bioassay-score** | ≥ 3	33 %	-	-

6. Participants' feedback

A questionnaire for feedback from participants of this EURL proficiency test was available as online survey between 28 November 2022 and 23 January 2023. The survey was anonymous, but participants could also give their laboratory name. The identity of the laboratories is kept confidential. The survey included several questions related to different topics (participants' information, organization of the proficiency test, PT test samples and evaluation of results and summary of data) and a possibility to include comments and further suggestions.

In total, 9 laboratories (8 % of all PT participants) replied to this survey.

Table 15: Participating laboratories in the feedback survey

Type of laboratory	Answers
National Reference Laboratory (NRL)	2
Official Laboratory (OFL)	5
Commercial laboratory	2
Other (e.g. research and development)	0
No Answer	0

General aspect

How satisfied are you with the organization of this proficiency test in general? Please rate the parts below according to your experience, with 0 stars meaning "no opinion" and 5 stars meaning "full satisfaction".

Announcement	
Instructions	
Sample shipment	
Reporting of results	
Preliminary report	

Did the proficiency test meet expectations?

Specific aspects of this proficiency test

We would like to know a bit more about specific aspects of this proficiency test. Please rate the aspects below according to your experience, with 0 stars meaning "no opinion" and 5 stars meaning "full satisfaction".

Was all necessary information for participation and performance of the PT provided in an understandable way?	
Was the time frame acceptable?	
Was the handling of EUSurvey as webtool for reporting and source of instructions manageable?	
Was the evaluation of participant's results and the information in the preliminary report clear and comprehensible?	

Was the selected sample adequate for the goal to assess analytical performance of laboratories in relevant matrices?

Choice of matrix	
Level of contamination	

The following comments or suggestions for improvements were submitted:
"To the EUSurvey webtool: the person-related application is impractical; it would be better to create an access option for several people in a laboratory."; "timing to perform test was very good (enough time); timing to send the preliminary results was very good (short)"

7. Quality control

The Deutsche Akkreditierungsstelle GmbH attests that the provider of proficiency testing Chemisches und Veterinäruntersuchungsamt Freiburg, EU Reference Laboratory (EURL) for halogenated persistent organic pollutants (POPs) in feed and food is competent under the terms of DIN EN ISO/IEC 17043:2010 to carry out proficiency testing in the testing field of determination of halogenated persistent organic pollutants (POPs) in food and feed (Accreditation number: D-EP-18625-01-00).

8. Results of participants

An overview of the PCDD/F and PCB results for the PT test sample fish meal (2203-FM) are given in the following annexes. Laboratories are coded according to the laboratory codes sent after registration.

9. References

[1] ISO 13528:2022, Statistical methods for use in proficiency testing by interlaboratory comparisons, International Organization for Standardization

[2] M. Thompson, S.L.R. Ellison, R. Wood: The International Harmonized Protocol For The Proficiency Testing Of Analytical Chemistry Laboratories, Pure Appl. Chem., Vol. 78, No. 1, pp. 145-196, 2006.

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

10. Annex

Fish meal – 2203-FM	
Annex-1	Assigned values – PCDD/F, PCB
Annex-2	Participants' results – Tables – PCDD/F, PCB
Annex-3	Participants' z-scores / bioassay-scores – Tables – PCDD/F, PCB
Annex-4	Participants' z-scores – Charts – PCDD/F, PCB
Annex-5	Scoring system – PCDD/F, PCB
Annex-6	Test for sufficient homogeneity – PCDD/F and PCB
Annex-7	Participants' methods for PCDD/Fs and PCBs

EURL for halogenated POPs in Feed and Food
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Annex 1: Assigned values of PCDD/Fs and PCBs

Test sample - Fish Meal (2203-FM)

Assigned values of sum parameters and individual congeners

Estimation of the assigned value as the consensus of participants' results
Assigned value = Huber robust mean after exlusion of extreme outliers

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Fish Meal (2203-FM)
Sum parameters - Results

Analyte	Result ng/kg 12% moisture content	**Assigned value** [outliers removed]	**Robust standard deviation** [outliers removed]	**Standard uncertainty** [outliers removed]	**No. of results contributing to assigned value**	**Median** [all values]
WHO-PCDD/F-PCB-TEQ upper bound rep		1.85	0.145	0.021	72	1.85
WHO-PCDD/F-PCB-TEQ lower bound rep		1.83	0.161	0.024	71	1.82
WHO-PCDD/F-PCB-TEQ upper bound cal		1.86	0.148	0.022	71	1.85
WHO-PCDD/F-PCB-TEQ lower bound cal		1.82	0.167	0.025	72	1.83

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Fish Meal (2203-FM)
PCDD/F - Assigned values

Analyte	Result ng/kg 12% moisture content	**Assigned value** [outliers removed]	**Robust standard deviation** [outliers removed]	**Standard uncertainty** [outliers removed]	**No. of results contributing to assigned value**	**Median** [all values]
WHO-PCDD/F-TEQ upper bound rep		1.12	0.0931	0.014	73	1.12
WHO-PCDD/F-TEQ lower bound rep		1.09	0.103	0.015	72	1.09
WHO-PCDD/F-TEQ upper bound cal		1.12	0.103	0.015	72	1.12
WHO-PCDD/F-TEQ lower bound cal		1.09	0.108	0.016	73	1.09
2,3,7,8-TCDD		0.0881	0.0166	0.0025	68	0.0892
1,2,3,7,8-PeCDD		0.215	0.0335	0.0050	69	0.216
1,2,3,4,7,8-HxCDD						0.0335
1,2,3,6,7,8-HxCDD		0.200	0.0293	0.0044	70	0.197
1,2,3,7,8,9-HxCDD						0.0378
1,2,3,4,6,7,8-HpCDD		0.0940	0.0159	0.0026	58	0.0995
1,2,3,4,6,7,8,9-OCDD		0.227	0.0521	0.0086	58	0.240
2,3,7,8-TCDF		1.52	0.190	0.028	71	1.51
1,2,3,7,8-PeCDF		0.342	0.0467	0.0070	70	0.343
2,3,4,7,8-PeCDF		1.93	0.189	0.028	73	1.92
1,2,3,4,7,8-HxCDF		0.0814	0.0141	0.0022	63	0.0820
1,2,3,6,7,8-HxCDF		0.113	0.0199	0.0030	67	0.114
2,3,4,6,7,8-HxCDF		0.112	0.0208	0.0032	67	0.111
1,2,3,7,8,9-HxCDF						0.0225
1,2,3,4,6,7,8-HpCDF						0.0471
1,2,3,4,7,8,9-HpCDF						0.0210
1,2,3,4,6,7,8,9-OCDF						0.0385

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Fish Meal (2203-FM)
Dioxin-like PCB - Assigned values

Analyte	Result ng/kg 12% moisture content	**Assigned value** [outliers removed]	**Robust standard deviation** [outliers removed]	**Standard uncertainty** [outliers removed]	**No. of results contributing to assigned value**	**Median** [all values]
WHO-PCB-TEQ upper bound rep		0.736	0.0982	0.014	73	0.730
WHO-PCB-TEQ lower bound rep		0.736	0.100	0.015	71	0.730
WHO-PCB-TEQ upper bound cal		0.735	0.0969	0.014	73	0.729
WHO-PCB-TEQ lower bound cal		0.735	0.0969	0.014	73	0.729
PCB 105		346	39.9	5.8	73	348
PCB 114		18.5	2.82	0.44	65	19.2
PCB 118		1020	121	18	73	1050
PCB 123						11.0
PCB 156		165	17.6	2.6	72	167
PCB 157		39.4	4.73	0.70	72	39.8
PCB 167		85.3	10.2	1.5	72	86.4
PCB 189		21.2	2.21	0.33	71	21.1
PCB 77		11.3	1.47	0.22	71	11.5
PCB 81		0.298	0.0473	0.0084	50	0.319
PCB 126		5.92	0.789	0.12	72	5.93
PCB 169		2.96	0.391	0.058	72	2.98

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Fish Meal (2203-FM)
Non dioxin-like PCB - Assigned values

Analyte	Result µg/kg 12% moisture content	**Assigned value** [outliers removed]	**Robust standard deviation** [outliers removed]	**Standard uncertainty** [outliers removed]	**No. of results contributing to assigned value**	**Median** [all values]
Sum Indicator PCBs upper bound rep		8.66	0.884	0.12	83	8.63
Sum Indicator PCBs lower bound rep		8.54	0.729	0.10	81	8.63
Sum Indicator PCBs upper bound cal		8.67	0.902	0.12	83	8.63
Sum Indicator PCBs lower bound cal		8.51	0.773	0.11	83	8.62
PCB 28		0.156	0.0388	0.0061	63	0.170
PCB 52		0.348	0.0778	0.011	81	0.340
PCB 101		1.11	0.146	0.020	83	1.11
PCB 138		2.34	0.340	0.048	80	2.33
PCB 153		3.39	0.449	0.061	84	3.43
PCB 180		1.15	0.131	0.018	83	1.16

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Fish Meal (2203-FM)
WHO-TEQ - Assigned values - Bioanalytical screening methods

Analyte	Result ng BEQ/kg 12% moisture content	**Assigned value** [outliers removed]	**Robust standard deviation** [outliers removed]	**Standard uncertainty** [outliers removed]	**No. of results contributing to assigned value**	**Median** [all values]
WHO-PCDD/F-PCB-TEQ		1.9	0.15	0.021	72	1.9
WHO-PCDD/F-TEQ		1.1	0.093	0.014	73	1.1
WHO-PCB-TEQ		0.74	0.098	0.014	73	0.73

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Fish Meal (2203-FM)
Moisture content (PCDD/F, PCB) - Assigned value

Analyte	Result %	**Assigned value** [outliers removed]	**Robust standard deviation** [outliers removed]	**Standard uncertainty** [outliers removed]	**No. of results contributing to assigned value**	**Median** [all values]
Moisture content		10.7	0.554	0.076	82	10.8

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Annex 2: Participants' results of PCDD/Fs and PCBs

Test sample - Fish Meal (2203-FM)

* Modified/additional results reported after distribution of preliminary results to all participating laboratories

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Fish Meal (2203-FM)
Sum parameters - Results

LC	Sample	Result ng/kg 12% moisture content	WHO-PCDD/F-PCB-TEQ reported upper bound	WHO-PCDD/F-PCB-TEQ reported lower bound	WHO-PCDD/F-PCB-TEQ calculated upper bound	WHO-PCDD/F-PCB-TEQ calculated lower bound	WHO-PCDD/F-TEQ reported upper bound	WHO-PCDD/F-TEQ reported lower bound	WHO-PCDD/F-TEQ calculated upper bound	WHO-PCDD/F-TEQ calculated lower bound	WHO-PCB-TEQ reported upper bound	WHO-PCB-TEQ reported lower bound	WHO-PCB-TEQ calculated upper bound	WHO-PCB-TEQ calculated lower bound	Result µg/kg 12% moisture content	Sum 6 Indicator PCBs reported upper bound	Sum 6 Indicator PCBs reported lower bound	Sum 6 Indicator PCBs calculated upper bound	Sum 6 Indicator PCBs calculated lower bound
1	2203-FM																		
2	2203-FM															3.64	3.44	3.64	3.44
3	2203-FM		1.8	1.8	1.8	1.79	1.1	1.1	1.15	1.14	0.65	0.65	0.65	0.65		9.2	9.2	9.29	9.29
4	2203-FM		1.98	1.98	1.98	1.98	1.2	1.2	1.2	1.2	0.776	0.776	0.776	0.776		8.55	8.55	8.55	8.55
5	2203-FM		1.32	1.32	1.32	1.32	0.736	0.735	0.736	0.735	0.58	0.58	0.58	0.58		8.1	8.1	8.1	8.1
6	2203-FM		1.88	1.88	1.89	1.89	1.09	1.09	1.09	1.09	0.797	0.797	0.797	0.797		8.6	8.6	8.6	8.6
7	2203-FM		1.9	1.9	1.9	1.9	1.13	1.13	1.13	1.13	0.77	0.77	0.77	0.77		8.63	8.63	8.63	8.63
8	2203-FM																		
9	2203-FM		2.01	1.6	2.01	1.61	1.3	0.9	1.3	0.913	0.71	0.7	0.709	0.698		8.79	8.79	8.78	8.78
10	2203-FM		1.84	1.79	1.84	1.79	1.09	1.04	1.09	1.04	0.745	0.745	0.745	0.745		7.35	7.35	7.35	7.35
11	2203-FM		1.85	1.82	2.89	1.5	1.06	1.04	2.1	0.717	0.785	0.784	0.785	0.784		8.93	8.93	8.93	8.93
12	2203-FM		1.4	1.4	1.45	1.45	0.841	0.839	0.839	0.838	0.61	0.61	0.608	0.608		8.4	8.4	8.36	8.36
13	2203-FM		1.81	1.63	1.82	1.63	0.988	0.804	0.989	0.804	0.826	0.826	0.826	0.826		8.65	8.65	8.64	8.64
14	2203-FM																		
15	2203-FM		1.81	1.81	1.81	1.81	1.08	1.08	1.08	1.08	0.728	0.728	0.728	0.728		8.39	8.39	8.39	8.39
16	2203-FM															7.94	6.96	7.94	6.96
17	2203-FM		1.97	1.97	1.97	1.97	1.22	1.22	1.22	1.22	0.746	0.746	0.746	0.746		8.08	8.08	8.08	8.08
18	2203-FM																		
19	2203-FM																		
20	2203-FM																		
21	2203-FM		1.84	1.84	1.84	1.84	1.02	1.02	1.02	1.02	0.821	0.821	0.82	0.82		8.27	8.27	8.26	8.26
22	2203-FM		1.77	1.75	1.77	1.75	1.06	1.05	1.06	1.04	0.708	0.708	0.709	0.709		6.52	6.52	6.51	6.51
23	2203-FM		1.87	1.86	1.86	1.84	1.1	1.09	1.08	1.07	0.771		0.775	0.774		8.59	8.59	8.59	8.59
24	2203-FM															18.8	18.8	18.8	18.8
25	2203-FM		1.22	1.21	1.23	1.21	0.684	0.673	0.685	0.672	0.54	0.54	0.54	0.54		9.81	9.81	9.81	9.81
26	2203-FM															8.24	8.24	8.23	8.23
27	2203-FM		1.73	1.73	1.73	1.73	1.03	1.03	1.03	1.03	0.698	0.698	0.698	0.698					
28	2203-FM		1.79	1.79	1.8	1.8	1.16	1.16	1.16	1.16	0.638	0.638	0.639	0.639		8.94	8.94	8.94	8.94
29	2203-FM		1.85	1.85	1.85	1.85	1.15	1.15	1.15	1.15	0.698	0.698	0.698	0.698		7.6	7.6	7.61	7.61
30	2203-FM															17.5	16	17.5	16
31	2203-FM		1.83	1.81	1.83	1.81	1.05	1.03	1.05	1.03	0.778	0.778	0.778	0.778		8.94	8.94	8.94	8.94
32	2203-FM		1.78	1.64	1.79	1.64	1.1	0.96	1.1	0.957	0.69	0.69	0.685	0.685		8.65	8.65	8.66	8.66
33	2203-FM		1.9	1.89	1.9	1.89	1.12	1.11	1.12	1.11	0.785	0.784	0.782	0.781		9.6	9.5	9.66	9.66
34	2203-FM															7.29		7.29	7.29
35	2203-FM																		
36	2203-FM		1.63	1.63	1.62	1.62	1.09	1.09	1.09	1.09	0.534	0.534	0.534	0.534		7.73	7.73	7.72	7.72
37	2203-FM		1.78	1.78	1.77	1.77	1.1	1.1	1.1	1.1	0.674	0.673	0.673	0.673		8.75	8.75	8.75	8.75
38	2203-FM																		
39	2203-FM		1.79	1.73	1.74	1.72	1.06	0.994	1.01	0.994	0.73	0.73	0.73	0.73		8.15	8.15	8.15	8.15
41	2203-FM																		
42	2203-FM																		
43	2203-FM		2.52	2.23	2.52	2.23	1.53	1.24	1.53	1.24	0.99	0.99	0.99	0.99		9.27	9.27	9.27	9.27
44	2203-FM		1.93		1.93	1.89	1.24		1.24	1.2	0.693		0.694	0.694		7.93		8.54	7.54
45	2203-FM																		
46	2203-FM		2.07	2.07	2.08	2.07	1.27	1.26	1.27	1.26	0.807	0.807	0.807	0.807		8.86	8.86	8.86	8.86
47	2203-FM		1.7	1.69	1.7	1.69	1.09	1.08	1.09	1.08	0.614	0.614	0.614	0.614		11.6	10.6	11.6	10.6
48	2203-FM		1.72	1.7	1.71	1.7	1.01	0.998	1.01	0.998	0.703	0.703	0.703	0.703		8.57	8.57	8.57	8.57
49	2203-FM		1.67	1.67	1.67	1.67	1.08	1.08	1.08	1.08	0.59	0.59	0.589	0.589		7.93	7.93	7.94	7.94
50	2203-FM		1.7	1.7	1.69	1.67	1.1	1	1.07	1.05	0.61	0.61	0.615	0.615		9.2	9.2	9.24	9.24
51	2203-FM																		
52	2203-FM		1.88	1.85	1.88	1.85	1.12	1.09	1.12	1.09	0.763	0.763	0.763	0.763		9.1	8.9	9.13	8.93
53	2203-FM		4.69	4.69	4.7	4.7	3.9	3.9	3.9	3.9	0.797	0.797	0.797	0.797		9.38	9.38	9.38	9.38
54	2203-FM																		
55	2203-FM		1.94	1.94	1.94	1.94	1.12	1.12	1.12	1.12	0.82	0.82	0.818	0.818		7.74	7.74	7.73	7.73
56	2203-FM		2.1	2.07	2.09	2.08	1.28	1.25	1.27	1.26	0.82	0.82	0.818	0.818					
57	2203-FM		1.82	1.72	1.82	1.72	1.15	1.05	1.15	1.05	0.671	0.67	0.671	0.67					
58	2203-FM		2.04	2.03	2.04	2.04	1.32	1.32	1.32	1.32	0.716	0.716	0.717	0.717		8.99	8.99	8.99	8.99
59	2203-FM		1.96	1.96	1.96	1.96	1.19	1.19	1.19	1.19	0.771	0.771	0.771	0.771		8.37	8.37	8.38	8.38
60	2203-FM															8.62	8.62	8.62	8.62
61	2203-FM		1.82	1.77	1.83	1.77	1.06	1.01	1.07	1.01	0.76	0.76	0.76	0.76		7.7	7.7	7.7	7.7
62	2203-FM		1.98	1.97	1.99	1.97	1.25	1.24	1.26	1.24	0.73	0.73	0.728	0.728		8.52	8.52	8.52	8.52
63	2203-FM		1.84	1.84	1.83	1.83	1.12	1.12	1.12	1.12	0.713	0.713	0.713	0.713		9.15	9.15	9.15	9.15
64	2203-FM		1.87	1.87	1.88	1.88	1.12	1.12	1.12	1.12	0.755	0.755	0.755	0.755		9.22	9.22	9.22	9.22
65	2203-FM		1.7	1.7	1.73	1.7	1.1	1.1	1.09	1.07	0.64	0.63	0.639	0.634		9.2	8.8	9.17	8.77
66	2203-FM		2.16	2.05	2.16	2.05	1.28	1.18	1.28	1.18	0.876	0.874	0.876	0.874		9.42	9.23	9.41	9.21
67	2203-FM															6.07	5.07	6.07	5.07
68	2203-FM																		
69	2203-FM		1.95	1.95	1.95	1.95	1.18	1.18	1.18	1.18	0.77	0.77	0.769	0.769					
70	2203-FM		1.79	1.79	1.78	1.78	1.03	1.03	1.02	1.02	0.763	0.763	0.759	0.759		7.64	7.64	7.64	7.64
71	2203-FM															9.69	8.69	9.7	8.7
72	2203-FM																		
73	2203-FM															10	9	10	9
74	2203-FM		1.85	1.85	1.85	1.85	1.04	1.04	1.04	1.04	0.814	0.814	0.814	0.814		9.2	9.2	9.2	9.2
75	2203-FM															9.2	9.2	9.19	9.19
76	2203-FM															7.76	7.26	8.26	7.26
77	2203-FM		1.8	1.8	1.81	1.81	1.07	1.07	1.08	1.08	0.73	0.73	0.728	0.728		6.24	6.24	6.24	6.24
78	2203-FM																		
79	2203-FM		1.95	1.92	1.95	1.93	1.15	1.12	1.15	1.13	0.801	0.801	0.801	0.801		8.17	7.98	8.18	7.98

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Fish Meal (2203-FM)
Sum parameters - Results

LC	Sample	Result ng/kg 12% moisture content	WHO-PCDD/F-PCB-TEQ reported upper bound	WHO-PCDD/F-PCB-TEQ reported lower bound	WHO-PCDD/F-PCB-TEQ calculated upper bound	WHO-PCDD/F-PCB-TEQ calculated lower bound	WHO-PCDD/F-TEQ reported upper bound	WHO-PCDD/F-TEQ reported lower bound	WHO-PCDD/F-TEQ calculated upper bound	WHO-PCDD/F-TEQ calculated lower bound	WHO-PCB-TEQ reported upper bound	WHO-PCB-TEQ reported lower bound	WHO-PCB-TEQ calculated upper bound	WHO-PCB-TEQ calculated lower bound	Result µg/kg 12% moisture content	Sum 6 Indicator PCBs reported upper bound	Sum 6 Indicator PCBs reported lower bound	Sum 6 Indicator PCBs calculated upper bound	Sum 6 Indicator PCBs calculated lower bound
80	2203-FM															11.7	10.7	11.7	10.7
81	2203-FM		1.82	1.82	1.94	1.72	1.15	1.15	1.27	1.05	0.672	0.672	0.672	0.672					
82	2203-FM															10.3	9.25	10.3	9.25
83	2203-FM		1.85	1.85	1.85	1.85	1.12	1.12	1.12	1.12	0.727	0.727	0.727	0.727		8.19	8.19	8.19	8.19
84	2203-FM																		
85	2203-FM		1.77	1.77	1.77	1.77	1.06	1.06	1.06	1.06	0.71	0.71	0.707	0.707		7.6	7.6	7.56	7.56
86	2203-FM		1.73	1.73	1.73	1.73	1.09	1.09	1.09	1.09	0.639	0.639	0.639	0.639		11.3	11.3	11.3	11.3
87	2203-FM		1.77	1.71	1.78	1.72	1.07	1	1.07	1.01	0.71	0.71	0.708	0.707		7.65	7.65	7.64	7.64
88	2203-FM		1.45	1.45	1.45	1.45	0.847	0.847	0.846	0.845	0.607	0.607	0.607	0.607		7.93	7.93	6.46	6.46
89	2203-FM		2.39	2.39	2.38	2.38	1.51	1.51	1.5	1.5	0.89	0.89	0.881	0.881		7.92	7.92	7.88	7.88
90	2203-FM		2.03	2.03	1.99	1.99	1.14	1.14	1.14	1.14	0.891	0.891	0.853	0.853		9.09	9.09	9.09	9.09
91	2203-FM		2.45	2.45	2.45	2.45	1.41	1.41	1.41	1.41	1.04	1.04	1.04	1.04		7.91	7.91	7.91	7.91
92	2203-FM															8.9	8.9	8.9	8.9
93	2203-FM																		
94	2203-FM		1.86	1.8	1.84	1.83	1.03	0.967	1	0.994	0.836	0.833	0.835	0.832		8.24	7.24	7.73	7.73
95	2203-FM		1.92	1.92	1.92	1.92	1.19	1.19	1.19	1.19	0.729	0.729	0.729	0.729		8.15	8.15	8.16	8.16
96	2203-FM																		
97	2203-FM		1.91	1.89	1.91	1.89	1.11	1.09	1.11	1.09	0.798	0.797	0.798	0.796		11.4	9.26	11.4	9.26
98	2203-FM															10.2	9.24	10.2	9.24
99	2203-FM		1.29	1.27	1.29	1.27	0.914	0.893	0.915	0.893	0.378	0.375	0.378	0.374		7.62	7.62	7.62	7.62
100	2203-FM		1.95	1.96	1.96	1.96	1.06	1.06	1.06	1.06	0.899	0.899	0.899	0.899		9.06	9.06	9.06	9.06
101	2203-FM		1.73	1.72	1.75	1.74	1.17	1.17	1.2	1.19	0.554	0.554	0.551	0.551					
102	2203-FM		1.31	1.3	1.31	1.3	0.7	0.68	0.696	0.682	0.62	0.62	0.616	0.616		8.5	8.5	8.44	8.44
103	2203-FM																		
104	2203-FM		1.86	1.81	1.86	1.81	1.14	1.1	1.14	1.1	0.719	0.714	0.717	0.712		9.52	8.34	9.52	8.34
105	2203-FM		2.12	2.12	2.14	2.12	1.25	1.24	1.26	1.24	0.877	0.877	0.877	0.876		8.97	8.97	8.96	8.96
106	2203-FM		1.99	1.99	1.99	1.99	1.12	1.12	1.12	1.12	0.865	0.865	0.865	0.865		9.61	9.61	9.61	9.61
107	2203-FM															17.6	14.6	17.6	14.6
108	2203-FM																		
109	2203-FM		1.87	1.87	1.87	1.87	1.2	1.2	1.2	1.2	0.671	0.671	0.671	0.671		8.01	8.01	8.02	8.02
110	2203-FM		1.66	1.65	1.66	1.65	0.986	0.98	0.986	0.981	0.672	0.672	0.672	0.672		8.35	8.35	8.36	8.36
111	2203-FM															9.46	9.46	9.46	9.46
112	2203-FM															8.38	8.18	8.38	8.18
113	2203-FM		2.1	2.1	2.1	2.1	1.17	1.17	1.17	1.17	0.93	0.93	0.93	0.93		9.51	9.51	9.51	9.51
114	2203-FM															9.86	8.86	9.86	8.86
27A	2203-FM		1.71	1.71	1.71	1.71	1.12	1.12	1.12	1.12	0.592	0.592	0.592	0.592					
37A	2203-FM															10.0	9.0	10.0	9
57A	2203-FM						1.22	0.745	1.22	0.746									
69A	2203-FM		1.93	1.93	1.93	1.93	1.15	1.15	1.15	1.15	0.78	0.78	0.778	0.778					
75A	2203-FM															9.0	8.9	9.02	8.86
11*	2203-FM		1.85	1.82	1.85	1.83	1.06	1.04	1.06	1.05	0.785	0.784	0.785	0.784		8.93	8.93	8.93	8.93
13*	2203-FM		1.76	1.57	1.76	1.58	0.934	0.749	0.934	0.75	0.826	0.826	0.826	0.826		8.65	8.65	8.64	8.64
81*	2203-FM		1.82	1.82	1.82	1.82	1.15	1.15	1.15	1.15	0.672	0.672	0.672	0.672					

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Fish Meal (2203-FM)
Assessment of analytical results, Measurement uncertainty

		Assessment of analytical results					**Measurement uncertainty [%]**			
LC	Sample	Exceeds maximum level for **WHO-PCDD/F-PCB-TEQ**	Exceeds maximum level for **WHO-PCDD/F-TEQ**	Exceeds action level for **WHO-PCDD/F-TEQ**	Exceeds action level for **WHO-PCB-TEQ**	Exceeds maximum level for **Sum 6 Indicator PCBs**	WHO-PCDD/F-PCB-TEQ	WHO-PCDD/F-TEQ	WHO-PCB-TEQ	Sum 6 Indicator PCBs
1	2203-FM									
2	2203-FM									13
3	2203-FM						20	20	20	20
4	2203-FM			x			18	18	18	16
5	2203-FM						8	11	13	6
6	2203-FM			X			20	20	22	20
7	2203-FM			x			29	26	34	22
8	2203-FM									
9	2203-FM						15	15	15	20
10	2203-FM						37	37	37	37
11	2203-FM			x						
12	2203-FM						21	24	31	21
13	2203-FM			X			20	20	20	20
14	2203-FM									
15	2203-FM			X			30	30	30	30
16	2203-FM									20
17	2203-FM			X			21	21	21	30
18	2203-FM									
19	2203-FM									
20	2203-FM									
21	2203-FM			X			17	25	17	6
22	2203-FM	-	-	-	-	-	25	25	25	25
23	2203-FM						25	25	30	30
24	2203-FM									24
25	2203-FM						20	16	17	20
26	2203-FM									45
27	2203-FM						38	38	38	
28	2203-FM			x			30	30	30	30
29	2203-FM						19	17	22	25
30	2203-FM									28
31	2203-FM						41	31	26	31
32	2203-FM			x			15	15	16	11
33	2203-FM			x			16	16	20	20
34	2203-FM									18
35	2203-FM									
36	2203-FM			X			19	25	30	30
37	2203-FM			X			26	19	33	34
38	2203-FM									
39	2203-FM			x			20	20	20	20
41	2203-FM									
42	2203-FM									
43	2203-FM		X	X			32	22	32	34
44	2203-FM			X			28	25	28	13
45	2203-FM									
46	2203-FM			X			22	14	17	17
47	2203-FM			X			1	0	0	5
48	2203-FM			X			0	0	0	1
49	2203-FM						24	22	10	10
50	2203-FM			X			23	24	24	25
51	2203-FM									
52	2203-FM						38	25	30	53
53	2203-FM						5	5	5	5
54	2203-FM									
55	2203-FM						8	9	7	
56	2203-FM			x			±15	±15	±15	
57	2203-FM			X			8	9	16	
58	2203-FM		x	x			27	27	21	8
59	2203-FM	No	No	X	No	No	15	15	15	15
60	2203-FM									17
61	2203-FM						30	30	30	25
62	2203-FM			X			35	35		
63	2203-FM			x			20	20	20	25
64	2203-FM			X			14	15	20	16
65	2203-FM			x			25	35	30	20
66	2203-FM			X			20	20	20	20
67	2203-FM									20
68	2203-FM									
69	2203-FM			x			25	25	25	
70	2203-FM			x			30	30	30	30
71	2203-FM									88
72	2203-FM									
73	2203-FM									50
74	2203-FM			x			20	20	20	20
75	2203-FM									20

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Fish Meal (2203-FM)
Assessment of analytical results, Measurement uncertainty

LC	Sample	Assessment of analytical results					Measurement uncertainty [%]			
		Exceeds maximum level for **WHO-PCDD/F-PCB-TEQ**	Exceeds maximum level for **WHO-PCDD/F-TEQ**	Exceeds action level for **WHO-PCDD/F-TEQ**	Exceeds action level for **WHO-PCB-TEQ**	Exceeds maximum level for **Sum 6 Indicator PCBs**	WHO-PCDD/F-PCB-TEQ	WHO-PCDD/F-TEQ	WHO-PCB-TEQ	Sum 6 Indicator PCBs
76	2203-FM									50
77	2203-FM						30	30	30	30
78	2203-FM									
79	2203-FM			x			20	20	20	30
80	2203-FM									55
81	2203-FM			x			30	30	30	
82	2203-FM									50
83	2203-FM			x			20	23	20	20
84	2203-FM									
85	2203-FM			X			22	22	23	20
86	2203-FM			X			18	21	35	10
87	2203-FM			X			28	27	29	23
88	2203-FM			x			9	8	10	11
89	2203-FM		X				44	44	44	44
90	2203-FM						30	30	20	20
91	2203-FM						22	25	38	23
92	2203-FM									17
93	2203-FM									
94	2203-FM			X			43	27	26	37
95	2203-FM						24	42	36	20
96	2203-FM									
97	2203-FM						21	20	24	11
98	2203-FM									26
99	2203-FM						20	15	15	15
100	2203-FM						50	31	40	32
101	2203-FM						29	29	29	
102	2203-FM						15	15	15	20
103	2203-FM									
104	2203-FM			x			30	30	30	30
105	2203-FM						30	26	29	25
106	2203-FM						18	19	18	18
107	2203-FM									43
108	2203-FM									
109	2203-FM			X			20	20	20	20
110	2203-FM						27	32	18	31
111	2203-FM									30
112	2203-FM									
113	2203-FM						25	25	25	25
114	2203-FM									
27A	2203-FM						38	38	38	
37A	2203-FM									40
57A	2203-FM			X				8		
69A	2203-FM			x				25	25	
75A	2203-FM									20

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EURL for halogenated Persistent Organic Pollutants (POPs) in Feed and Food

Fish Meal (2203-FM)

Difference between upper bound (ub) - lower bound (lb) calculation, Comparison of reported and calculated sum parameters

LC	Sample	Difference between upper and lower bound calculation for reported sum parameters [%]				Difference between reported and calculated upper bound sum parameters [%]				Correct calculation	Difference between reported and calculated lower bound sum parameters [%]				Correct calculation
		WHO-PCDD/F-PCB-TEQ	WHO-PCDD/F-TEQ	WHO-PCB-TEQ	Sum 6 Indicator PCBs	WHO-PCDD/F-PCB-TEQ	WHO-PCDD/F-TEQ	WHO-PCB-TEQ	Sum 6 Indicator PCBs	(deviation ≤ 10 %)	WHO-PCDD/F-PCB-TEQ	WHO-PCDD/F-TEQ	WHO-PCB-TEQ	Sum 6 Indicator PCBs	(deviation ≤ 10 %)
1	2203-FM														
2	2203-FM				5.5				0.0	yes				0.0	yes
3	2203-FM	0.0	0.0	0.0	0.0	0.0	4.0	0.0	1.0	yes	1.0	4.0	0.0	1.0	yes
4	2203-FM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	yes	0.0	0.0	0.0	0.0	yes
5	2203-FM	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	yes	0.0	0.0	0.0	0.0	yes
6	2203-FM	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	yes	1.0	0.0	0.0	0.0	yes
7	2203-FM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	yes	0.0	0.0	0.0	0.0	yes
8	2203-FM														
9	2203-FM	20	31	1.4	0.0	0.0	0.0	0.0	0.0	yes	1.0	1.0	0.0	0.0	yes
10	2203-FM	2.7	4.6	0.0	0.0	0.0	0.0	0.0	0.0	yes	0.0	0.0	0.0	0.0	yes
11	2203-FM	1.6	1.9	0.1	0.0	36	50	0.0	0.0	no	21	45	0.0	0.0	no
12	2203-FM	0.0	0.2	0.0	0.0	3.0	0.0	0.0	0.0	yes	3.0	0.0	0.0	0.0	yes
13	2203-FM	9.9	19	0.0	0.0	1.0	0.0	0.0	0.0	yes	0.0	0.0	0.0	0.0	yes
14	2203-FM														
15	2203-FM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	yes	0.0	0.0	0.0	0.0	yes
16	2203-FM				12.3				0.0	yes				0.0	yes
17	2203-FM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	yes	0.0	0.0	0.0	0.0	yes
18	2203-FM														
19	2203-FM														
20	2203-FM														
21	2203-FM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	yes	0.0	0.0	0.0	0.0	yes
22	2203-FM	1.1	0.9	0.0	0.0	0.0	0.0	0.0	0.0	yes	0.0	1.0	0.0	0.0	yes
23	2203-FM	0.5	0.9		0.0	1.0	2.0	1.0	0.0	yes	1.0	2.0		0.0	yes
24	2203-FM				0.0				0.0	yes				0.0	yes
25	2203-FM	0.8	1.6	0.0	0.0	1.0	0.0	0.0	0.0	yes	0.0	0.0	0.0	0.0	yes
26	2203-FM				0.0				0.0	yes				0.0	yes
27	2203-FM	0.0	0.0	0.0		0.0	0.0	0.0		yes	0.0	0.0	0.0		yes
28	2203-FM	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	yes	1.0	0.0	0.0	0.0	yes
29	2203-FM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	yes	0.0	0.0	0.0	0.0	yes
30	2203-FM				8.6				0.0	yes				0.0	yes
31	2203-FM	1.1	1.9	0.0	0.0	0.0	0.0	0.0	0.0	yes	0.0	0.0	0.0	0.0	yes
32	2203-FM	7.9	13	0.0	0.0	1.0	0.0	1.0	0.0	yes	0.0	0.0	1.0	0.0	yes
33	2203-FM	0.5	0.9	0.1	1.0	0.0	0.0	0.0	1.0	yes	0.0	0.0	0.0	2.0	yes
34	2203-FM								0.0	yes					
35	2203-FM														
36	2203-FM	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	yes	1.0	0.0	0.0	0.0	yes
37	2203-FM	0.0	0.0	0.1	0.0	1.0	0.0	0.0	0.0	yes	1.0	0.0	0.0	0.0	yes
38	2203-FM														
39	2203-FM	3.4	6.2	0.0	0.0	3.0	5.0	0.0	0.0	yes	1.0	0.0	0.0	0.0	yes
41	2203-FM														
42	2203-FM														
43	2203-FM	12	19	0.0	0.0	0.0	0.0	0.0	0.0	yes	0.0	0.0	0.0	0.0	yes
44	2203-FM					0.0	0.0	0.0	7.0	yes					
45	2203-FM														
46	2203-FM	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	yes	0.0	0.0	0.0	0.0	yes
47	2203-FM	0.6	0.9	0.0	8.6	0.0	0.0	0.0	0.0	yes	0.0	0.0	0.0	0.0	yes
48	2203-FM	1.2	1.2	0.0	0.0	1.0	0.0	0.0	0.0	yes	0.0	0.0	0.0	0.0	yes
49	2203-FM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	yes	0.0	0.0	0.0	0.0	yes
50	2203-FM	0.0	9.1	0.0	0.0	1.0	3.0	1.0	0.0	yes	2.0	5.0	1.0	0.0	yes
51	2203-FM														
52	2203-FM	1.6	2.7	0.0	2.2	0.0	0.0	0.0	0.0	yes	0.0	0.0	0.0	0.0	yes
53	2203-FM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	yes	0.0	0.0	0.0	0.0	yes
54	2203-FM														
55	2203-FM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	yes	0.0	0.0	0.0	0.0	yes
56	2203-FM	1.4	2.3	0.0		0.0	1.0	0.0		yes	0.0	1.0	0.0		yes
57	2203-FM	5.5	8.7	0.1		0.0	0.0	0.0		yes	0.0	0.0	0.0		yes
58	2203-FM	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	yes	0.0	0.0	0.0	0.0	yes
59	2203-FM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	yes	0.0	0.0	0.0	0.0	yes
60	2203-FM				0.0				0.0	yes				0.0	yes
61	2203-FM	2.7	4.7	0.0	0.0	1.0	1.0	0.0	0.0	yes	0.0	0.0	0.0	0.0	yes
62	2203-FM	0.5	0.8	0.0	0.0	1.0	1.0	0.0	0.0	yes	0.0	0.0	0.0	0.0	yes
63	2203-FM	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	yes	1.0	0.0	0.0	0.0	yes
64	2203-FM	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	yes	1.0	0.0	0.0	0.0	yes
65	2203-FM	0.0	0.0	1.6	4.3	2.0	1.0	0.0	0.0	yes	0.0	3.0	1.0	0.0	yes
66	2203-FM	5.1	7.8	0.2	2.0	0.0	0.0	0.0	0.0	yes	0.0	0.0	0.0	0.0	yes
67	2203-FM				16				0.0	yes				0.0	yes
68	2203-FM														
69	2203-FM	0.0	0.0	0.0		0.0	0.0	0.0		yes	0.0	0.0	0.0		yes
70	2203-FM	0.0	0.0	0.0	0.0	1.0	1.0	1.0	0.0	yes	1.0	1.0	1.0	0.0	yes
71	2203-FM				10				0.0	yes				0.0	yes
72	2203-FM														
73	2203-FM				10.0				0.0	yes				0.0	yes
74	2203-FM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	yes	0.0	0.0	0.0	0.0	yes
75	2203-FM				0.0				0.0	yes				0.0	yes
76	2203-FM				6.4				6.0	yes				0.0	yes
77	2203-FM	0.0	0.0	0.0	0.0	1.0	1.0	0.0	0.0	yes	1.0	1.0	0.0	0.0	yes
78	2203-FM														
79	2203-FM	1.5	2.6	0.0	2.3	0.0	0.0	0.0	0.0	yes	1.0	1.0	0.0	0.0	yes

Fish Meal (2203-FM)

Difference between upper bound (ub) - lower bound (lb) calculation, Comparison of reported and calculated sum parameters

LC	Sample	Difference between upper and lower bound calculation for reported sum parameters [%]				Difference between reported and calculated upper bound sum parameters [%]				Correct calculation	Difference between reported and calculated lower bound sum parameters [%]				Correct calculation
		WHO-PCDD/F-PCB-TEQ	WHO-PCDD/F-TEQ	WHO-PCB-TEQ	Sum 6 Indicator PCBs	WHO-PCDD/F-PCB-TEQ	WHO-PCDD/F-TEQ	WHO-PCB-TEQ	Sum 6 Indicator PCBs	(deviation ≤ 10 %)	WHO-PCDD/F-PCB-TEQ	WHO-PCDD/F-TEQ	WHO-PCB-TEQ	Sum 6 Indicator PCBs	(deviation ≤ 10 %)
80	2203-FM				8.5				0.0	yes				0.0	yes
81	2203-FM	0.0	0.0	0.0		6.0	9.0	0.0		yes	6.0	10.0	0.0		yes
82	2203-FM				10				0.0	yes				0.0	yes
83	2203-FM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	yes	0.0	0.0	0.0	0.0	yes
84	2203-FM														
85	2203-FM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	yes	0.0	0.0	0.0	1.0	yes
86	2203-FM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	yes	0.0	0.0	0.0	0.0	yes
87	2203-FM	3.4	6.5	0.0	0.0	1.0	0.0	0.0	0.0	yes	1.0	1.0	0.0	0.0	yes
88	2203-FM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	23	no	0.0	0.0	0.0	23	no
89	2203-FM	0.0	0.0	0.0	0.0	0.0	1.0	1.0	1.0	yes	0.0	1.0	1.0	1.0	yes
90	2203-FM	0.0	0.0	0.0	0.0	2.0	0.0	4.0	0.0	yes	2.0	0.0	4.0	0.0	yes
91	2203-FM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	yes	0.0	0.0	0.0	0.0	yes
92	2203-FM				0.0				0.0	yes				0.0	yes
93	2203-FM														
94	2203-FM	3.2	6.1	0.4	12.1	1.0	3.0	0.0	7.0	yes	2.0	3.0	0.0	6.0	yes
95	2203-FM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	yes	0.0	0.0	0.0	0.0	yes
96	2203-FM														
97	2203-FM	1.0	1.8	0.1	18.8	0.0	0.0	0.0	0.0	yes	0.0	0.0	0.0	0.0	yes
98	2203-FM				9.4				0.0	yes				0.0	yes
99	2203-FM	1.6	2.3	0.8	0.0	0.0	0.0	0.0	0.0	yes	0.0	0.0	0.0	0.0	yes
100	2203-FM	-0.5	0.0	0.0	0.0	1.0	0.0	0.0	0.0	yes	0.0	0.0	0.0	0.0	yes
101	2203-FM	0.6	0.0	0.0		1.0	3.0	1.0		yes	1.0	2.0	1.0		yes
102	2203-FM	0.8	2.9	0.0	0.0	0.0	1.0	1.0	1.0	yes	0.0	0.0	1.0	1.0	yes
103	2203-FM														
104	2203-FM	2.7	3.5	0.7	12	0.0	0.0	0.0	0.0	yes	0.0	0.0	0.0	0.0	yes
105	2203-FM	0.0	0.8	0.0	0.0	1.0	1.0	0.0	0.0	yes	0.0	0.0	0.0	0.0	yes
106	2203-FM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	yes	0.0	0.0	0.0	0.0	yes
107	2203-FM				17.0				0.0	yes				0.0	yes
108	2203-FM														
109	2203-FM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	yes	0.0	0.0	0.0	0.0	yes
110	2203-FM	0.6	0.6	0.0	0.0	0.0	0.0	0.0	0.0	yes	0.0	0.0	0.0	0.0	yes
111	2203-FM				0.0				0.0	yes				0.0	yes
112	2203-FM				2.4				0.0	yes				0.0	yes
113	2203-FM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	yes	0.0	0.0	0.0	0.0	yes
114	2203-FM				10.1				0.0	yes				0.0	yes
27A	2203-FM	0.0	0.0	0.0		0.0	0.0	0.0		yes	0.0	0.0	0.0		yes
37A	2203-FM				10.0				0.0	yes				0.0	yes
57A	2203-FM		39				0.0			yes		0.0			yes
69A	2203-FM	0.0	0.0	0.0		0.0	0.0	0.0		yes	0.0	0.0	0.0		yes
75A	2203-FM				1.1				0.0	yes				0.0	yes
11*	2203-FM	1.6	1.9	0.1	0.0	0.0	0.0	0.0	0.0	yes	1.0	1.0	0.0	0.0	yes
13*	2203-FM	11	20	0.0	0.0	0.0	0.0	0.0	0.0	yes	1.0	0.0	0.0	0.0	yes
81*	2203-FM	0.0	0.0	0.0		0.0	0.0	0.0		yes	0.0	0.0	0.0		yes

EURL Proficiency Study on the Determination of PCDD/Fs, PCBs, PBDEs, HBCDDs and PFASs in Fish Meal 2022 [EURL-PT-POP_2203-FM]
EURL for halogenated Persistent Organic Pollutants (POPs) in Feed and Food

Fish Meal (2203-FM)
PCDD/F - Results

LC	Sample	Result ng/kg 12% moisture content	WHO-PCDD/F-TEQ reported upper bound	WHO-PCDD/F-TEQ reported lower bound	WHO-PCDD/F-TEQ calculated upper bound	WHO-PCDD/F-TEQ calculated lower bound	2,3,7,8-TCDD	1,2,3,7,8-PeCDD	1,2,3,4,7,8-HxCDD	1,2,3,6,7,8-HxCDD	1,2,3,7,8,9-HxCDD	1,2,3,4,6,7,8-HpCDD	OCDD	2,3,7,8-TCDF	1,2,3,7,8-PeCDF	2,3,4,7,8-PeCDF	1,2,3,4,7,8-HxCDF	1,2,3,6,7,8-HxCDF	2,3,4,6,7,8-HxCDF	1,2,3,7,8,9-HxCDF	1,2,3,4,6,7,8-HpCDF	1,2,3,4,7,8,9-HpCDF	OCDF
1	2203-FM																						
2	2203-FM																						
3	2203-FM		1.1	1.1	1.15	1.14	0.13	0.17	< 0.034	0.23	0.081	< 0.72	< 0.24	1.6	0.34	2	0.095	0.14	0.092	0.051	< 0.049	< 0.014	< 0.25
4	2203-FM		1.2	1.2	1.2	1.2	0.11	0.271	0.0386	0.201	0.029	0.109	0.219	1.62	0.376	1.94	0.0782	0.115	0.118	< 0.008	0.0325	< 0.003	0.0205
5	2203-FM		0.736	0.735	0.736	0.735	0.042	0.148	0.019	0.174	0.016	0.077	0.167	0.786	0.222	1.38	0.063	0.084	0.093	< 0.01	0.029	< 0.01	< 0.023
6	2203-FM		1.09	1.09	1.09	1.09	0.096	0.239	0.022	0.187	0.027	0.089	< 0.23	1.53	0.333	1.78	0.072	0.106	0.096	0.013	0.031	< 0.003	0.012
7	2203-FM		1.13	1.13	1.13	1.13	0.0894	0.202	0.0287	0.21	0.0332	0.0881	0.227	1.56	0.328	2.03	0.0763	0.127	0.115	< 0.0286	0.0382	< 0.0194	< 0.0111
8	2203-FM																						
9	2203-FM		1.3	0.9	1.3	0.913	< 0.1	0.18	< 0.5	< 0.5	< 0.5	< 0.5	< 14	1.51	0.5	1.89	< 0.2	< 0.2	< 0.2	< 0.5	< 0.5	< 0.5	< 14
10	2203-FM		1.09	1.04	1.09	1.04	0.077	0.188	< 0.12	0.26	< 0.12	0.154	0.318	1.35	0.327	1.92	< 0.12	0.154	0.154	< 0.12	< 0.12	< 0.12	< 0.241
11	2203-FM		1.06	1.04	2.1	0.717	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	0.242	1.41	< 0.5	1.92	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.2
12	2203-FM		0.841	0.839	0.839	0.838	0.059	0.191	< 0.006	0.16	0.029	0.132	0.503	0.935	0.242	1.46	0.073	0.093	0.116	< 0.01	0.029	< 0.008	< 0.006
13	2203-FM		0.988	0.804	0.989	0.804	< 0.0353	< 0.0412	< 0.107	< 0.0928	< 0.0907	1.47	2.84	2.45	2.02	1.61	< 0.229	< 0.152	< 0.156	< 0.191	< 0.387	< 0.242	0.529
14	2203-FM																						
15	2203-FM		1.08	1.08	1.08	1.08	0.0874	0.201	0.0171	0.186	0.017	0.0779	0.19	1.49	0.323	1.95	0.065	0.0925	0.104	< 0.02	0.0227	< 0.02	< 0.05
16	2203-FM																						
17	2203-FM		1.22	1.22	1.22	1.22	0.089	0.26	0.024	0.18	0.03	0.1	0.17	1.83	0.42	2.07	0.082	0.12	0.119	< 0.01	0.033	< 0.022	< 0.044
18	2203-FM																						
19	2203-FM																						
20	2203-FM																						
21	2203-FM		1.02	1.02	1.02	1.02	0.0655	0.212	0.0277	0.197	0.0448	0.0922	0.218	1.53	0.36	1.74	0.0789	0.113	0.107	< 0.0107	0.0412	< 0.0166	0.0215
22	2203-FM		1.06	1.05	1.06	1.04	0.0735	0.198	< 0.0497	0.137	< 0.0497	0.0675	0.123	1.62	0.305	1.87	0.0663	0.0866	0.112	< 0.0497	< 0.0497	< 0.0497	< 0.0994
23	2203-FM		1.1	1.09	1.08	1.07	0.06	0.29	0.067	0.19	< 0.046	0.058	0.11	1.4	0.67	1.7	0.09	0.096	0.076	< 0.043	< 0.033	< 0.035	< 0.013
24	2203-FM																						
25	2203-FM		0.684	0.673	0.685	0.672	0.059	0.132	< 0.03	0.114	< 0.03	< 0.033	0.217	0.925	0.187	1.21	0.034	< 0.024	0.05	< 0.032	< 0.033	< 0.043	< 0.077
26	2203-FM																						
27	2203-FM		1.03	1.03	1.03	1.03	0.072	0.226	0.029	0.17	0.032	0.113	0.246	1.31	0.359	1.79	0.079	0.099	0.104	< 0.0096	0.058	0.026	0.072
28	2203-FM		1.16	1.16	1.16	1.16	0.0982	0.211	0.0272	0.205	0.0218	0.0871	0.174	1.66	0.351	2.05	0.0755	0.122	0.0932	0.00527	0.0338	0.00405	0.00752
29	2203-FM		1.15	1.15	1.15	1.15	0.0991	0.215	0.0349	0.197	0.0345	0.122	0.256	1.44	0.343	2.08	0.0895	0.1	0.107	0.023	0.0387	0.0183	0.0371
30	2203-FM																						
31	2203-FM		1.05	1.03	1.05	1.03	0.082	0.164	< 0.0556	0.169	< 0.0637	< 0.0903	< 0.346	1.5	0.351	1.93	0.0782	0.114	0.0956	< 0.032	0.0345	< 0.039	< 0.0387
32	2203-FM		1.1	0.96	1.1	0.957	< 0.0786	0.191	< 0.0885	0.157	< 0.0695	0.11	0.347	1.43	0.299	1.99	< 0.0875	< 0.114	< 0.12	< 0.132	0.0377	< 0.0344	< 0.0826
33	2203-FM		1.12	1.11	1.12	1.11	0.099	0.188	0.079	0.227	< 0.05	0.118	0.415	1.44	0.42	2	0.089	0.128	0.138	< 0.05	0.069	< 0.05	< 0.2
34	2203-FM																						
35	2203-FM																						
36	2203-FM		1.09	1.09	1.09	1.09	0.0669	0.244	0.0232	0.177	0.0271	0.0897	0.178	1.19	0.317	2	0.075	0.103	0.107	0.00752	0.0308	0.00721	< 0.0124
37	2203-FM		1.1	1.1	1.1	1.1	0.099	0.17	0.029	0.22	0.041	0.22	0.58	2.21	0.29	1.77	0.13	0.12	0.16	< 0.016	0.088	< 0.0043	0.044
38	2203-FM																						
39	2203-FM		1.06	0.994	1.01	0.994	0.0507	0.211	< 0.05	0.17	< 0.05	< 0.05	0.253	1.11	0.305	1.89	0.06	0.108	0.114	< 0.05	< 0.05	< 0.05	< 0.1
41	2203-FM																						
42	2203-FM																						
43	2203-FM		1.53	1.24	1.53	1.24	0.0792	< 0.256	< 0.0636	< 0.0632	0.145	0.145	0.272	1.92	4.62	2.16	1.04	0.447	< 0.0827	< 0.0783	1.8	< 0.258	< 0.0528
44	2203-FM		1.24		1.24	1.2	0.09	0.198	< 0.08	0.217	< 0.08	< 0.1	< 0.2	1.65	0.318	2.04	< 0.08	0.943	0.108	< 0.08	0.27	< 0.1	< 0.2
45	2203-FM																						
46	2203-FM		1.27	1.26	1.27	1.26	0.115	0.22	< 0.025	0.217	0.027	0.101	0.201	1.96	0.417	2.2	0.082	0.108	0.132	< 0.025	0.033	< 0.02	< 0.02
47	2203-FM		1.09	1.08	1.09	1.08	0.0837	0.191	< 0.021	0.142	< 0.048	0.0865	< 0.314	2.06	0.34	1.81	0.0715	0.103	0.0969	< 0.048	< 0.048	< 0.075	< 0.029
48	2203-FM		1.01	0.998	1.01	0.998	0.079	0.17	< 0.05	0.2	< 0.05	0.1	0.268	1.34	0.335	1.85	0.071	0.109	0.111	< 0.05	< 0.05	< 0.05	< 0.1
49	2203-FM		1.08	1.08	1.08	1.08	0.079	0.208	0.0296	0.198	0.0395	0.079	0.217	1.42	0.316	1.96	0.0692	0.0889	0.0988	0.00988	0.0198	0.0889	0.0198
50	2203-FM		1.1	1	1.07	1.05	0.073	0.26	< 0.06	0.18	< 0.06	0.092	0.16	1.2	0.19	1.8	0.1	0.13	0.067	< 0.06	< 0.06	< 0.06	< 0.06
51	2203-FM																						
52	2203-FM		1.12	1.09	1.12	1.09	0.09	0.23	< 0.1	0.19	< 0.1	0.11	< 1	1.43	0.32	1.87	0.097	0.13	0.13	< 0.05	< 0.2	< 0.2	< 1
53	2203-FM		3.9	3.9	3.9	3.9	0.694	1.11	0.125	0.293	0.168	0.343	0.26	3.82	2.22	4.43	0.55	0.74	0.985	0.236	0.295	0.0651	0.144
54	2203-FM																						
55	2203-FM		1.12	1.12	1.12	1.12	0.0819	0.208	0.0219	0.182	0.0298	0.0852	0.214	1.52	0.358	2.05	0.0779	0.11	0.115	0.00573	0.0377	0.00657	0.0225
56	2203-FM		1.28	1.25	1.27	1.26	0.099	0.256	< 0.03	0.23	< 0.04	0.111	0.212	1.76	0.414	2.17	0.08	0.135	0.149	< 0.06	0.032	< 0.02	< 0.03
57	2203-FM		1.15	1.05	1.15	1.05	0.115	0.21	< 0.164	0.191	< 0.164	< 0.164	< 0.328	1.4	0.321	1.85	< 0.164	< 0.164	< 0.164	< 0.164	< 0.164	< 0.164	< 0.328
58	2203-FM		1.32	1.32	1.32	1.32	0.106	0.275	< 0.0254	0.243	0.0448	0.116	0.364	1.87	0.467	2.24	0.11	0.0758	0.147	< 0.0147	< 0.0638	< 0.0491	< 0.029
59	2203-FM		1.19	1.19	1.19	1.19	0.091	0.238	0.027	0.19	0.026	0.082	0.235	1.49	0.359	2.14	0.093	0.115	0.116	< 0.0197	0.041	< 0.0106	0.013
60	2203-FM																						
61	2203-FM		1.06	1.01	1.07	1.01	0.0649	0.217	< 0.0592	0.169	< 0.0522	< 0.0795	< 0.153	1.4	0.289	1.88	< 0.128	< 0.116	< 0.114	< 0.0502	< 0.0682	< 0.0566	< 0.161
62	2203-FM		1.25	1.24	1.26	1.24	0.1	0.25	< 0.05	0.22	< 0.05	0.09	0.2	1.64	0.37	2.2	0.08	0.12	0.12	< 0.05	< 0.05	< 0.05	< 0.05
63	2203-FM		1.12	1.12	1.12	1.12	0.087	0.22	0.021	0.189	0.022	0.087	0.194	1.67	0.387	1.94	0.068	0.101	0.101	< 0.0039	0.026	< 0.046	< 0.011
64	2203-FM		1.12	1.12	1.12	1.12	0.105	0.215	0.0319	0.229	0.036	0.0909	0.188	1.53	0.35	1.9	0.0874	0.113	0.114	< 0.0219	0.0336	< 0.0197	< 0.0238
65	2203-FM		1.1	1.1	1.09	1.07	0.08	0.22	< 0.05	0.18	< 0.1	< 0.1	< 1	1.4	0.3	1.9	0.1	0.11	0.13	< 0.05	< 0.1	< 0.1	< 1
66	2203-FM		1.28	1.18	1.28	1.18	0.0861	0.245	< 0.1	< 0.2	< 0.1	< 0.2	< 0.5	1.68	< 0.5	2.27	< 0.1	< 0.1	< 0.14	< 0.035	< 0.5	< 0.1	< 0.2
67	2203-FM																						
68	2203-FM																						
69	2203-FM		1.18	1.18	1.18	1.18	0.09	0.25	0.02	0.2	0.03	0.09	0.21	1.5	0.34	2.1	0.07	0.09	0.09	< 0.01	0.03	0.01	0.01
70	2203-FM		1.03	1.03	1.02	1.02	0.066	0.19	0.024	0.24	0.022	0.016	0.36	1.39	0.38	1.85	0.081	0.12	0.11	0.019	0.069	0.031	< 0.05
71	2203-FM																						
72	2203-FM																						
73	2203-FM																						
74	2203-FM		1.04	1.04	1.04	1.04	0.092	0.21	0.019	0.179	0.024	0.077	0.175	1.42	0.339	1.77	0.078	0.106	0.111	< 0.005	0.03	< 0.005	0.013
75	2203-FM																						
76	2203-FM																						
77	2203-FM		1.07	1.07	1.08	1.08	0.093	0.21	0.018	0.25	0.015	0.18	0.43	1.5	0.29	1.85	0.086	0.11	0.1	0.0017	0.068	0.019	0.035
78	2203-FM																						
79	2203-FM		1.15	1.12	1.15	1.13	0.0963	0.184	< 0.0497	0.19	< 0.0497	0.105	0.32	1.73	0.386	2.05	0.0825	0.139	0.1	< 0.0497	< 0.0497	< 0.0497	< 0.0993

EURL Proficiency Study on the Determination of PCDD/Fs, PCBs, PBDEs, HBCDDs and PFASs in Fish Meal 2022 [EURL-PT-POP_2203-FM]
EURL for halogenated Persistent Organic Pollutants (POPs) in Feed and Food

Fish Meal (2203-FM)
PCDD/F - Results

LC	Sample	Result ng/kg 12% moisture content	WHO-PCDD/F-TEQ reported upper bound	WHO-PCDD/F-TEQ reported lower bound	WHO-PCDD/F-TEQ calculated upper bound	WHO-PCDD/F-TEQ calculated lower bound	2,3,7,8-TCDD	1,2,3,7,8-PeCDD	1,2,3,4,7,8-HxCDD	1,2,3,6,7,8-HxCDD	1,2,3,7,8,9-HxCDD	1,2,3,4,6,7,8-HpCDD	OCDD	2,3,7,8-TCDF	1,2,3,7,8-PeCDF	2,3,4,7,8-PeCDF	1,2,3,4,7,8-HxCDF	1,2,3,6,7,8-HxCDF	2,3,4,6,7,8-HxCDF	1,2,3,7,8,9-HxCDF	1,2,3,4,6,7,8-HpCDF	1,2,3,4,7,8,9-HpCDF	OCDF
80	2203-FM																						
81	2203-FM		1.15	1.15	1.27	1.05	< 0.212	0.225	0.032	0.19	0.033	0.091	0.193	1.51	0.353	2.03	0.088	0.12	0.116	< 0.047	0.038	< 0.02	0.025
82	2203-FM																						
83	2203-FM		1.12	1.12	1.12	1.12	0.083	0.257	0.023	0.182	0.031	0.067	0.232	1.55	0.32	1.86	0.077	0.11	0.14	< 0.013	0.028	< 0.01	0.014
84	2203-FM																						
85	2203-FM		1.06	1.06	1.06	1.06	0.091	0.2	0.026	0.21	0.026	0.077	0.18	1.47	0.32	1.85	0.069	0.099	0.1	0.004	0.026	0.002	0.007
86	2203-FM		1.09	1.09	1.09	1.09	0.0852	0.241	0.0331	0.21	0.0237	0.0955	0.222	1.56	0.321	1.78	0.0897	0.132	0.145	< 0.0159	0.0462	< 0.016	0.0154
87	2203-FM		1.07	1	1.07	1.01	0.07	0.21	< 0.1	0.19	< 0.1	< 0.1	0.24	1.47	0.36	1.84	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.2
88	2203-FM		0.847	0.847	0.846	0.845	0.0655	0.177	0.0236	0.196	0.0232	0.0809	0.182	1.08	0.248	1.46	0.0566	0.0948	0.087	< 0.00394	0.0348	0.00464	0.013
89	2203-FM		1.51	1.51	1.5	1.5	0.11	0.38	0.057	0.21	0.045	0.14	0.29	1.73	0.42	2.48	0.12	0.17	0.19	0.016	0.27	0.018	0.084
90	2203-FM		1.14	1.14	1.14	1.14	0.081	0.189	0.016	0.213	0.017	0.102	0.224	1.51	0.386	2.15	0.099	0.136	0.108	< 0.02	0.034	< 0.02	< 0.02
91	2203-FM		1.41	1.41	1.41	1.41	0.0927	0.42	0.0598	0.222	0.0278	0.109	0.235	1.57	0.356	2.2	0.0775	0.138	0.136	< 0.00541	0.0453	< 0.00295	< 0.000291
92	2203-FM																						
93	2203-FM																						
94	2203-FM		1.03	0.967	1	0.994	0.069	0.131	0.063	0.113	< 0.1	0.083	0.25	1.64	0.324	1.93	0.05	0.059	0.081	0.009	0.265	0.013	0.019
95	2203-FM		1.19	1.19	1.19	1.19	0.0784	0.23	0.0196	0.235	0.0343	0.098	0.255	1.79	0.377	2.12	0.0833	0.103	0.0931	< 0.0049	0.0588	< 0.0049	0.0735
96	2203-FM																						
97	2203-FM		1.11	1.09	1.11	1.09	0.123	0.224	< 0.08	0.257	< 0.03	< 0.2	< 0.5	1.5	0.332	1.74	0.102	0.158	< 0.03	0.1	< 0.2	< 0.03	< 0.2
98	2203-FM																						
99	2203-FM		0.914	0.893	0.915	0.893	0.0708	0.17	< 0.05	0.164	< 0.05	< 0.2	< 2	1.25	0.262	1.56	0.129	0.133	< 0.05	0.087	< 0.2	< 0.2	< 2
100	2203-FM		1.06	1.06	1.06	1.06	0.0774	0.217	0.025	0.188	0.0346	0.0812	0.27	1.6	0.352	1.8	0.0686	0.097	0.0964	< 0.0191	0.0369	< 0.0191	< 0.0382
101	2203-FM		1.17	1.17	1.2	1.19	0.107	0.187	< 0.025	0.24	< 0.025	0.291	0.588	1.709	0.295	2.111	0.158	0.159	0.152	0.094	0.245	< 0.025	< 0.025
102	2203-FM		0.7	0.68	0.696	0.682	0.033	0.15	< 0.044	0.146	< 0.044	0.088	0.251	0.713	0.208	1.28	0.053	0.086	0.079	< 0.044	< 0.044	< 0.044	0.135
103	2203-FM																						
104	2203-FM		1.14	1.1	1.14	1.1	0.115	0.219	< 0.0985	0.241	< 0.0985	< 0.197	< 0.394	1.42	0.333	1.85	< 0.0985	0.176	0.126	< 0.0985	0.201	< 0.0985	< 0.296
105	2203-FM		1.25	1.24	1.26	1.24	0.088	0.184	< 0.05	0.181	< 0.05	0.132	0.324	1.86	0.364	2.39	0.094	0.128	0.116	< 0.05	< 0.05	< 0.05	< 0.2
106	2203-FM		1.12	1.12	1.12	1.12	0.111	0.241	0.0338	0.217	0.0328	0.0852	0.178	1.35	0.343	1.88	0.095	0.116	0.123	< 0.0049	0.0215	< 0.0122	< 0.0245
107	2203-FM																						
108	2203-FM																						
109	2203-FM		1.2	1.2	1.2	1.2	0.0913	0.255	0.0267	0.211	0.0318	0.106	0.285	1.72	0.387	2.04	0.0788	0.119	0.105	< 0.00818	0.0308	< 0.0164	< 0.0327
110	2203-FM		0.986	0.98	0.986	0.981	0.0902	0.22	< 0.018	0.208	< 0.02	0.0973	0.167	1.26	0.269	1.63	0.0796	0.089	0.0914	< 0.0107	< 0.0314	< 0.0126	< 0.0329
111	2203-FM																						
112	2203-FM																						
113	2203-FM		1.17	1.17	1.17	1.17	0.112	0.227	0.061	0.211	0.036	0.085	0.213	1.65	0.347	1.98	0.07	0.098	0.101	0.011	0.033	0.01	< 0.0428
114	2203-FM																						
27A	2203-FM		1.12	1.12	1.12	1.12	0.077	0.255	0.02	0.197	0.032	0.099	0.174	1.44	0.383	1.92	0.08	0.114	0.098	< 0.0099	0.051	0.01	< 0.0053
57A	2203-FM		1.22	0.745	1.22	0.746	0.0935	< 0.274	< 0.274	< 0.274	< 0.274	< 0.274	< 0.547	1.41	0.362	1.67	< 0.274	< 0.274	< 0.274	< 0.274	< 0.274	< 0.274	< 0.547
69A	2203-FM		1.15	1.15	1.15	1.15	0.1	0.22	0.02	0.17	0.03	0.08	0.19	1.4	0.33	2.1	0.06	0.09	0.11	< 0.01	0.03	< 0.01	0.01
11*	2203-FM		1.06	1.04	1.06	1.05	0.0709	0.197	< 0.05	0.175	< 0.05	0.0886	0.242	1.41	0.287	1.92	0.0906	0.11	0.124	< 0.05	0.0591	< 0.05	< 0.2
13*	2203-FM		0.934	0.749	0.934	0.75	< 0.0353	< 0.0412	< 0.107	< 0.0928	< 0.0907	1.47	2.84	2.45	0.202	1.61	< 0.229	< 0.152	< 0.156	< 0.191	< 0.387	< 0.242	0.529
81*	2203-FM		1.15	1.15	1.15	1.15	0.092	0.225	0.032	0.19	0.033	0.091	0.193	1.51	0.353	2.03	0.088	0.12	0.116	< 0.047	0.038	< 0.02	0.025

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EURL for halogenated Persistent Organic Pollutants (POPs) in Feed and Food

Fish Meal (2203-FM)

Dioxin-like PCB - Results

LC	Sample	Result ng/kg 12% moisture content	WHO-PCB-TEQ reported upper bound	WHO-PCB-TEQ reported lower bound	WHO-PCB-TEQ calculated upper bound	WHO-PCB-TEQ calculated lower bound	PCB 105	PCB 114	PCB 118	PCB 123	PCB 156	PCB 157	PCB 167	PCB 189	PCB 77	PCB 81	PCB 126	PCB 169
1	2203-FM																	
2	2203-FM																	
3	2203-FM		0.65	0.65	0.65	0.65	360	17	860	8.4	180	38	92	24	13	0.36	5.2	2.7
4	2203-FM		0.776	0.776	0.776	0.776	380	26.4	1140	10.7	177	41.2	83.8	21.5	11.4	0.331	6.24	3.13
5	2203-FM		0.58	0.58	0.58	0.58	262	12.6	776	144	146	33	71	< 5.2	8.16	0.22	4.58	2.59
6	2203-FM		0.797	0.797	0.797	0.797	361	18.7	1070	8.87	171	41.9	98.1	23.1	10.9	0.297	6.51	3.04
7	2203-FM		0.77	0.77	0.77	0.77	380	20.1	1090	11.2	183	46.5	99.9	25	11.9	0.301	6.14	3.3
8	2203-FM																	
9	2203-FM		0.71	0.7	0.709	0.698	335	< 80	929	< 80	162	< 80	85.9	< 80	11.5	< 5.5	5.63	2.95
10	2203-FM		0.745	0.745	0.745	0.745	291	19.8	855	8.25	151	38	71.6	18.2	9.86	0.866	6.04	3.22
11	2203-FM		0.785	0.784	0.785	0.784	342	19.8	1050	30.7	164	41.2	88	21.2	11.5	< 2	6.4	3.01
12	2203-FM		0.61	0.61	0.608	0.608	309	17.8	877	8.3	155	36.2	83.7	21.8	9.02	4.15	4.81	2.65
13	2203-FM		0.826	0.826	0.826	0.826	389	19.1	1140	24.8	167	46.4	83.8	19.2	13.1	0.367	6.85	2.76
14	2203-FM																	
15	2203-FM		0.728	0.728	0.728	0.728	362	17	987	7.03	161	39.3	84.2	20.9	10.6	0.316	5.87	2.98
16	2203-FM																	
17	2203-FM		0.746	0.746	0.746	0.746	344	21	1110	14	167	39	87	22	13	0.33	6	3
18	2203-FM																	
19	2203-FM																	
20	2203-FM																	
21	2203-FM		0.821	0.821	0.82	0.82	371	21.4	1120	29.5	170	41.1	87.3	23.1	14.9	0.264	6.64	3.3
22	2203-FM		0.708	0.708	0.709	0.709	384	19.3	1190	45.6	187	39.8	93.5	25.4	14.6	0.565	5.99	1.62
23	2203-FM		0.771		0.775	0.774	323	15.8	951	< 27.9	171	39.7	86.5	20.4	11	0.27	6.2	3.5
24	2203-FM																	
25	2203-FM		0.54	0.54	0.54	0.54	260	14.1	708	27.3	121	28.8	66.2	20.6	7.5	< 0.21	4.33	2.28
26	2203-FM																	
27	2203-FM		0.698	0.698	0.698	0.698	289	15	844	104	142	33.9	84.6	19.8	13.2	6.48	5.5	3.3
28	2203-FM		0.638	0.638	0.639	0.639	349	18.5	1070	8.6	164	38	71.8	19.3	10.7	0.37	5.19	2.21
29	2203-FM		0.698	0.698	0.698	0.698	324	16.9	890	9.95	157	29.6	66.3	21.1	10.8	0.319	5.63	2.95
30	2203-FM																	
31	2203-FM		0.778	0.778	0.778	0.778	398	29	1070	81.9	185	41.2	94.6	20.5	11.5	0.284	6.27	3.07
32	2203-FM		0.69	0.69	0.685	0.685	345	15.5	1070	6.96	167	39.1	64.8	22.9	11.3	0.328	5.51	2.69
33	2203-FM		0.785	0.784	0.782	0.781	370	20	1100	20	170	45	89	21	9.5	< 2	6.2	3.5
34	2203-FM																	
35	2203-FM																	
36	2203-FM		0.534	0.534	0.534	0.534	304	16.4	972	9.17	141	34.9	70.7	20	9.29	0.261	4.2	2.2
37	2203-FM		0.674	0.673	0.673	0.673	305	18.2	841	44.1	147	34.6	79.6	19.3	10.8	0.81	5.41	2.87
38	2203-FM																	
39	2203-FM		0.73	0.73	0.73	0.73	311	16.3	968	7.99	161	38.2	91	18.6	9.14	0.267	5.93	2.93
41	2203-FM																	
42	2203-FM																	
43	2203-FM		0.99	0.99	0.99	0.99	334	43.1	957	24.1	167	47.5	71.3	20.6	11.5	4.73	8.6	2.58
44	2203-FM		0.693		0.694	0.694	330	18	978	11	149	36	98	20	10	< 0.8	5.6	2.8
45	2203-FM																	
46	2203-FM		0.807	0.807	0.807	0.807	387	24.3	1070	9.81	167	41.4	81	20.6	12.2	0.352	6.21	4.36
47	2203-FM		0.614	0.614	0.614	0.614	329	14	1050	4.64	132	29.4	63.9	15.5	7.68	< 0.159	4.92	2.41
48	2203-FM		0.703	0.703	0.703	0.703	328	20.9	977	14.3	166	37.6	86.2	21.9	10.3	0.304	5.67	2.85
49	2203-FM		0.59	0.59	0.589	0.589	272	13.5	739	114	123	25.8	55.4	15.3	8.91	0.217	4.79	2.29
50	2203-FM		0.61	0.61	0.615	0.615	340	22	1000	< 3	170	38	87	24	10	0.32	5	2.1
51	2203-FM																	
52	2203-FM		0.763	0.763	0.763	0.763	354	21	1060	10.5	165	40	88	21.8	12	< 1	6.1	3.3
53	2203-FM		0.797	0.797	0.797	0.797	365	18.7	1100	10.1	175	41.9	90.7	23.2	11.8	0.294	6.44	3.22
54	2203-FM																	
55	2203-FM		0.82	0.82	0.818	0.818	394	21	1170	11	178	43	93	21.8	11.7	0.326	6.66	3.09
56	2203-FM		0.82	0.82	0.818	0.818	380	20	1050	8.6	180	45	90	22	12	0.31	6.7	3.1
57	2203-FM		0.671	0.67	0.671	0.67	322	17.1	981	19	160	35.4	78.6	19.5	10.2	< 2.19	5.38	2.74
58	2203-FM		0.716	0.716	0.717	0.717	326	17.8	1020	14.1	152	34.9	76.7	19.6	11.2	0.267	5.81	2.82
59	2203-FM		0.771	0.771	0.771	0.771	348	20	1030	< 17.1	171	42.3	86.4	23	11.7	0.304	6.2	3.26
60	2203-FM																	
61	2203-FM		0.76	0.76	0.76	0.76	347	21.4	1010	9.32	174	41.8	94	22.3	11.3	0.26	6.17	3.01
62	2203-FM		0.73	0.73	0.728	0.728	313	16	943	11	149	37	83	19	12.3	0.35	5.81	3.29
63	2203-FM		0.713	0.713	0.713	0.713	366	15.9	1070	8	172	40	77.1	19.8	11.1	0.26	5.67	3.07
64	2203-FM		0.755	0.755	0.755	0.755	362	19.4	1020	9.99	184	42.8	94.6	23.3	12.9	0.363	5.95	3.52
65	2203-FM		0.64	0.63	0.639	0.634	315	18.4	883	7.9	158	34.7	82	19.6	< 50	0.31	5.1	2.6
66	2203-FM		0.876	0.874	0.876	0.874	395	< 30	1220	< 30	191	42.6	96.5	19	13	< 1	7.14	3.32
67	2203-FM																	
68	2203-FM																	
69	2203-FM		0.77	0.77	0.769	0.769	370	21	1090	20	185	40	108	22	12	0.31	6.1	3.4
70	2203-FM		0.763	0.763	0.759	0.759	391	16.1	1050	9.73	167	38.3	96	21.3	17.2	0.29	5.9	3.8
71	2203-FM																	
72	2203-FM																	
73	2203-FM																	
74	2203-FM		0.814	0.814	0.814	0.814	381	22.3	1140	20.9	190	45	78.2	25	12.6	0.299	6.57	3.3
75	2203-FM																	

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EURL for halogenated Persistent Organic Pollutants (POPs) in Feed and Food

Fish Meal (2203-FM)
Dioxin-like PCB - Results

LC	Sample	Result ng/kg 12% moisture content	WHO-PCB-TEQ reported upper bound	WHO-PCB-TEQ reported lower bound	WHO-PCB-TEQ calculated upper bound	WHO-PCB-TEQ calculated lower bound	PCB 105	PCB 114	PCB 118	PCB 123	PCB 156	PCB 157	PCB 167	PCB 189	PCB 77	PCB 81	PCB 126	PCB 169
76	2203-FM																	
77	2203-FM		0.73	0.73	0.728	0.728	282	19.8	924	9.76	141	38.5	77.7	19.1	11.8	0.31	6.05	2.56
78	2203-FM																	
79	2203-FM		0.801	0.801	0.801	0.801	382	19.2	1110	7.2	181	41.2	95.3	22.8	12.4	0.609	6.53	3.02
80	2203-FM																	
81	2203-FM		0.672	0.672	0.672	0.672	281	16.2	874	10.8	137	32.2	70.9	18	9.68	0.281	5.47	2.7
82	2203-FM																	
83	2203-FM		0.727	0.727	0.727	0.727	338	18.2	691	11.9	173	44.8	107	23.7	11.3	0.309	5.95	2.96
84	2203-FM																	
85	2203-FM		0.71	0.71	0.707	0.707	324	21.2	994	8.49	157	37.4	79.1	20.1	9.87	0.25	5.73	2.79
86	2203-FM		0.639	0.639	0.639	0.639	325	21	1060	9.22	149	35.4	77.9	20.1	11.7	0.31	5.02	2.83
87	2203-FM		0.71	0.71	0.708	0.707	368	15.9	1110	8.14	190	48	88.7	25.8	11	< 1	5.56	3.15
88	2203-FM		0.607	0.607	0.607	0.607	316	14.4	955	107	150	35.9	84.9	19.2	10.2	0.284	4.78	2.58
89	2203-FM		0.89	0.89	0.881	0.881	368	39.1	1070	11.7	176	41.5	89.9	22	11.6	0.52	7.34	3.04
90	2203-FM		0.891	0.891	0.853	0.853	352	19.2	1240	< 0.1	165	38.9	79.4	21.9	12.6	0.222	7	3.15
91	2203-FM		1.04	1.04	1.04	1.04	359	20.5	1090	10.5	171	42.5	88.5	22	12.3	0.35	8.87	3.25
92	2203-FM																	
93	2203-FM																	
94	2203-FM		0.836	0.833	0.835	0.832	287	17.1	1100	21.3	134	28.9	78	17.9	10.3	< 10	5.55	7.53
95	2203-FM		0.729	0.729	0.729	0.729	332	18.6	968	9.49	142	40.1	91.4	19.9	11.7	0.418	5.76	3.44
96	2203-FM																	
97	2203-FM		0.798	0.797	0.798	0.796	469	58.1	1530	18.8	205	44.3	103	22.2	32.4	< 5	6.41	2.61
98	2203-FM																	
99	2203-FM		0.378	0.375	0.378	0.374	302	16.5	847	14.6	< 10	34.3	75.8	19.6	9.9	< 10	2.57	2.57
100	2203-FM		0.899	0.899	0.899	0.899	427	20.5	1300	12.5	162	38	85.5	23.5	10.6	< 0.239	7.64	2.39
101	2203-FM		0.554	0.554	0.551	0.551	402	41.4	1220	1630	167	56.7	119	24.8	9.34	0.271	3.65	2.52
102	2203-FM		0.62	0.62	0.616	0.616	275	17.4	920	15.1	143	34.7	88.4	18	8.25	0.241	4.95	2.48
103	2203-FM																	
104	2203-FM		0.719	0.714	0.717	0.712	352	16.9	954	< 39.4	155	40.6	< 98.5	22.7	12.1	< 0.394	5.76	2.96
105	2203-FM		0.877	0.877	0.877	0.876	433	25.7	1180	14.9	194	47.5	91.9	23.2	11.9	< 2	7.22	3.1
106	2203-FM		0.865	0.865	0.865	0.865	382	23.3	1140	10.4	179	42.9	88.6	24.2	13.4	< 0.196	7.04	3.42
107	2203-FM																	
108	2203-FM																	
109	2203-FM		0.671	0.671	0.671	0.671	351	16.1	1050	9.14	179	40.8	81.8	21	9.84	0.272	5.37	2.68
110	2203-FM		0.672	0.672	0.672	0.672	326	15	955	14.4	152	33.3	75.4	21.1	10.2	0.233	5.4	2.78
111	2203-FM																	
112	2203-FM																	
113	2203-FM		0.93	0.93	0.93	0.93	392	43	1110	9.06	182	50.7	198	25.4	15.5	0.51	7.59	3.64
114	2203-FM																	
27A	2203-FM		0.592	0.592	0.592	0.592	251	13.8	780	92.9	120	28.8	71.9	19	12.9	5.23	4.6	2.93
69A	2203-FM		0.78	0.78	0.778	0.778	367	24	1060	15	201	42	92	21	12	0.31	6.2	3.4

EURL Proficiency Study on the Determination of PCDD/Fs, PCBs, PBDEs, HBCDDs and PFASs in Fish Meal 2022 [EURL-PT-POP_2203-FM]
EURL for halogenated Persistent Organic Pollutants (POPs) in Feed and Food

Fish Meal (2203-FM)
Non dioxin-like PCB - Results

LC	Sample	Result µg/kg 12% moisture content	Sum 6 Indicator PCBs reported upper bound	Sum 6 Indicator PCBs reported lower bound	Sum 6 Indicator PCBs calculated upper bound	Sum 6 Indicator PCBs calculated lower bound	PCB 28	PCB 52	PCB 101	PCB 138	PCB 153	PCB 180
1	2203-FM											
2	2203-FM		3.64	3.44	3.64	3.44	0.28	0.224	0.574	1.86	< 0.2	0.499
3	2203-FM		9.2	9.2	9.29	9.29	0.23	0.46	1.3	2.3	3.9	1.1
4	2203-FM		8.55	8.55	8.55	8.55	0.158	0.334	1.11	2.33	3.4	1.22
5	2203-FM		8.1	8.1	8.1	8.1	0.115	0.276	0.896	2.73	3.11	0.974
6	2203-FM		8.6	8.6	8.6	8.6	0.135	0.342	1.09	2.36	3.48	1.19
7	2203-FM		8.63	8.63	8.63	8.63	0.144	0.356	1.17	2.29	3.54	1.13
8	2203-FM											
9	2203-FM		8.79	8.79	8.78	8.78	0.21	0.29	0.8	4.02	1.94	1.52
10	2203-FM		7.35	7.35	7.35	7.35	0.0965	0.292	0.971	1.74	3.22	1.03
11	2203-FM		8.93	8.93	8.93	8.93	0.178	0.345	1.17	2.47	3.59	1.18
12	2203-FM		8.4	8.4	8.36	8.36	0.17	0.29	1	2.23	3.51	1.16
13	2203-FM		8.65	8.65	8.64	8.64	0.211	0.312	1.17	1.8	4.02	1.13
14	2203-FM											
15	2203-FM		8.39	8.39	8.39	8.39	0.124	0.327	1.1	2.24	3.46	1.14
16	2203-FM		7.94	6.96	7.94	6.96	< 0.49	< 0.49	0.99	2.77	2.25	0.95
17	2203-FM		8.08	8.08	8.08	8.08	0.12	0.32	1.1	2.21	3.24	1.09
18	2203-FM											
19	2203-FM											
20	2203-FM											
21	2203-FM		8.27	8.27	8.26	8.26	0.127	0.364	1.16	2.51	2.89	1.21
22	2203-FM		6.52	6.52	6.51	6.51	0.534	0.354	0.861	1.7	2.36	0.705
23	2203-FM		8.59	8.59	8.59	8.59	0.128	0.331	1.18	2.26	3.48	1.21
24	2203-FM		18.8	18.8	18.8	18.8	0.7	1	2.1	5.7	6.2	3.1
25	2203-FM		9.81	9.81	9.81	9.81	0.23	0.339	1.12	3.34	3.69	1.09
26	2203-FM		8.24	8.24	8.23	8.23	0.189	0.374	1.06	2.58	2.98	1.05
27	2203-FM											
28	2203-FM		8.94	8.94	8.94	8.94	0.132	0.344	1.04	2.67	3.51	1.24
29	2203-FM		7.6	7.6	7.61	7.61	0.131	0.283	0.956	2.02	3.16	1.06
30	2203-FM		17.5	16	17.5	16	< 1.5	1.9	5.3	3.8	3.1	1.9
31	2203-FM		8.94	8.94	8.94	8.94	0.124	0.333	1.14	2.9	3.28	1.16
32	2203-FM		8.65	8.65	8.66	8.66	0.126	0.339	1.25	1.51	4.21	1.22
33	2203-FM		9.6	9.5	9.66	9.66	0.29	0.47	1.2	2.7	3.8	1.2
34	2203-FM		7.29		7.29	7.29	0.116	0.325	1.02	2.01	2.86	0.96
35	2203-FM											
36	2203-FM		7.73	7.73	7.72	7.72	0.128	0.31	1.1	2.05	3.1	1.03
37	2203-FM		8.75	8.75	8.75	8.75	0.2	0.261	1.01	3.3	2.97	1.01
38	2203-FM											
39	2203-FM		8.15	8.15	8.15	8.15	0.17	0.297	1.1	2.2	3.24	1.14
41	2203-FM											
42	2203-FM											
43	2203-FM		9.27	9.27	9.27	9.27	0.233	0.31	1.1	2.15	4.33	1.15
44	2203-FM		7.93		8.54	7.54	< 0.5	< 0.5	1.23	2.06	3.11	1.14
45	2203-FM											
46	2203-FM		8.86	8.86	8.86	8.86	0.175	0.316	1.07	2.29	3.74	1.27
47	2203-FM		11.6	10.6	11.6	10.6	< 0.5	< 0.5	1.42	3.27	4.3	1.62
48	2203-FM		8.57	8.57	8.57	8.57	0.155	0.314	1.06	2.35	3.5	1.19
49	2203-FM		7.93	7.93	7.94	7.94	0.257	0.323	1.24	2.3	2.7	1.12
50	2203-FM		9.2	9.2	9.24	9.24	0.17	0.37	1.3	2.4	3.7	1.3
51	2203-FM											
52	2203-FM		9.1	8.9	9.13	8.93	< 0.2	0.32	1.29	2.6	3.53	1.19
53	2203-FM		9.38	9.38	9.38	9.38	0.15	0.354	1.22	2.63	3.74	1.29
54	2203-FM											
55	2203-FM		7.74	7.74	7.73	7.73	0.109	0.299	1.04	2.04	3.13	1.11
56	2203-FM											
57	2203-FM											
58	2203-FM		8.99	8.99	8.99	8.99	0.163	0.368	1.17	2.41	3.62	1.26
59	2203-FM		8.37	8.37	8.38	8.38	0.144	0.331	1.08	2.26	3.43	1.13
60	2203-FM		8.62	8.62	8.62	8.62	0.15	0.25	0.73	2.9	3.63	0.96
61	2203-FM		7.7	7.7	7.7	7.7	0.217	0.273	0.93	2.24	3.06	0.982
62	2203-FM		8.52	8.52	8.52	8.52	0.11	0.31	1.07	2.39	3.54	1.1
63	2203-FM		9.15	9.15	9.15	9.15	0.17	0.34	1.2	2.6	3.58	1.26
64	2203-FM		9.22	9.22	9.22	9.22	0.155	0.347	1.23	2.5	3.84	1.15
65	2203-FM		9.2	8.8	9.17	8.77	0.27	< 0.4	1.3	2.8	3.2	1.2
66	2203-FM		9.42	9.23	9.41	9.21	< 0.2	0.402	1.3	2.54	3.87	1.1
67	2203-FM		6.07	5.07	6.07	5.07	< 0.5	< 0.5	0.9	1.73	1.92	0.52
68	2203-FM											
69	2203-FM											
70	2203-FM		7.64	7.64	7.64	7.64	0.097	0.28	1.3	2.24	2.82	0.9
71	2203-FM		9.69	8.69	9.7	8.7	< 0.5	< 0.5	0.98	3.27	3.43	1.02
72	2203-FM											
73	2203-FM		10	9	10	9	< 0.5	< 0.5	1.12	3.27	3.56	1.05
74	2203-FM		9.2	9.2	9.2	9.2	0.151	0.37	1.18	2.55	3.71	1.24
75	2203-FM		9.2	9.2	9.19	9.19	0.18	0.37	1.25	2.35	3.89	1.15

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EURL for halogenated Persistent Organic Pollutants (POPs) in Feed and Food

Fish Meal (2203-FM)

Non dioxin-like PCB - Results

LC	Sample	Result µg/kg 12% moisture content	Sum 6 Indicator PCBs reported upper bound	Sum 6 Indicator PCBs reported lower bound	Sum 6 Indicator PCBs calculated upper bound	Sum 6 Indicator PCBs calculated lower bound	PCB 28	PCB 52	PCB 101	PCB 138	PCB 153	PCB 180
76	2203-FM		7.76	7.26	8.26	7.26	< 0.5	< 0.5	0.89	2.65	2.88	0.84
77	2203-FM		6.24	6.24	6.24	6.24	0.083	0.24	0.81	1.56	2.63	0.92
78	2203-FM											
79	2203-FM		8.17	7.98	8.18	7.98	< 0.199	0.248	1.11	2.3	3.04	1.28
80	2203-FM		11.7	10.7	11.7	10.7	< 0.5	< 0.5	1.26	4.02	4.09	1.3
81	2203-FM											
82	2203-FM		10.3	9.25	10.3	9.25	< 0.5	< 0.5	1.31	2.76	3.97	1.21
83	2203-FM		8.19	8.19	8.19	8.19	0.161	0.39	1.21	2.04	3.18	1.21
84	2203-FM											
85	2203-FM		7.6	7.6	7.56	7.56	0.12	0.33	1.07	1.98	3.01	1.05
86	2203-FM		11.3	11.3	11.3	11.3	0.146	0.408	1.27	2.76	5.2	1.56
87	2203-FM		7.65	7.65	7.64	7.64	0.1	0.24	1.02	1.8	3.35	1.13
88	2203-FM		7.93	7.93	6.46	6.46	0.1	0.233	0.839	2.32	2.2	0.772
89	2203-FM		7.92	7.92	7.88	7.88	0.13	0.32	1.02	2.18	3.16	1.07
90	2203-FM		9.09	9.09	9.09	9.09	0.16	0.3	1.09	2.5	3.85	1.19
91	2203-FM		7.91	7.91	7.91	7.91	0.163	0.39	1.03	2.2	3.21	0.917
92	2203-FM		8.9	8.9	8.9	8.9	0.17	0.39	1.14	2.29	3.67	1.24
93	2203-FM											
94	2203-FM		8.24	7.24	7.73	7.73	0.209	0.271	1.24	2.06	2.78	1.17
95	2203-FM		8.15	8.15	8.16	8.16	0.145	0.372	1.09	2.25	3.02	1.28
96	2203-FM											
97	2203-FM		11.4	9.26	11.4	9.26	< 0.5	< 1.6	1.89	2.59	3.46	1.32
98	2203-FM		10.2	9.24	10.2	9.24	< 0.5	< 0.5	1.25	2.79	3.9	1.3
99	2203-FM		7.62	7.62	7.62	7.62	0.2	0.299	1.09	1.87	3.19	0.966
100	2203-FM		9.06	9.06	9.06	9.06	0.16	0.38	1.2	1.94	3.66	1.72
101	2203-FM											
102	2203-FM		8.5	8.5	8.44	8.44	0.147	0.258	0.913	2.13	3.87	1.12
103	2203-FM											
104	2203-FM		9.52	8.34	9.52	8.34	< 0.394	< 0.788	1.26	2.29	3.63	1.16
105	2203-FM		8.97	8.97	8.96	8.96	0.199	0.321	1.3	2.38	3.56	1.2
106	2203-FM		9.61	9.61	9.61	9.61	0.147	0.375	1.21	2.51	4.09	1.28
107	2203-FM		17.6	14.6	17.6	14.6	< 1.5	1.78	4.94	4.94	2.96	< 1.5
108	2203-FM											
109	2203-FM		8.01	8.01	8.02	8.02	0.11	0.296	1.06	2.17	3.35	1.03
110	2203-FM		8.35	8.35	8.36	8.36	0.142	0.293	1.09	2.25	3.39	1.19
111	2203-FM		9.46	9.46	9.46	9.46	0.15	0.36	1.17	3.87	2.68	1.23
112	2203-FM		8.38	8.18	8.38	8.18	< 0.2	0.27	0.98	2.62	3.25	1.06
113	2203-FM		9.51	9.51	9.51	9.51	0.21	0.67	1.43	2.24	3.71	1.25
114	2203-FM		9.86	8.86	9.86	8.86	< 0.5	< 0.5	1.21	2.46	3.83	1.36
37A	2203-FM		10	9	10	9	< 0.5	< 0.5	1	3.7	3.1	1.2
75A	2203-FM		9	8.9	9.02	8.86	< 0.16	0.33	1.24	2.22	3.94	1.13

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Fish Meal (2203-FM)
Bioanalytical screening methods - Results, Assessment of analytical results

LC	Sample	Result ng BEQ/kg 12% moisture content	PCDD/Fs + DL-PCBs	PCDD/Fs	DL-PCBs	Assessment of analytical results: Sample suspected to be noncompliant with … Maximum Level PCDD/Fs+DL-PCBs	Maximum Level PCDD/Fs	Action Threshold PCDD/Fs	Action Threshold DL-PCBs	Reporting Limit PCDD/Fs+ DL-PCBs	Reporting Limit PCDD/Fs	Reporting Limit DL-PCBs	Maximum Level on which evaluation is based on PCDD/Fs+ DL-PCBs	Maximum Level on which evaluation is based on PCDD/Fs	Maximum Level on which evaluation is based on DL-PCBs	Action Level on which evaluation is based on PCDD/Fs+ DL-PCBs	Action Level on which evaluation is based on PCDD/Fs	Action Level on which evaluation is based on DL-PCBs	Bioassay Cut-off Maximum Level PCDD/Fs+ DL-PCBs	Bioassay Cut-off Maximum Level PCDD/Fs	Bioassay Cut-off Action Threshold PCDD/Fs	Bioassay Cut-off Action Threshold DL-PCBs
1	2203-FM																					
2	2203-FM																					
3	2203-FM																					
4	2203-FM																					
5	2203-FM																					
6	2203-FM																					
7	2203-FM																					
8	2203-FM																					
9	2203-FM																					
10	2203-FM																					
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37	2203-FM																					
38	2203-FM																					
39	2203-FM																					
41	2203-FM																					
42	2203-FM																					
43	2203-FM																					
44	2203-FM																					
45	2203-FM																					
46	2203-FM		2.3	1.4	0.91	no	no	yes	yes	0.95	0.31	0.64	4	1.25			0.75	2	2.37	1.26	0.7	1.31
47	2203-FM																					
48	2203-FM																					
49	2203-FM																					
50	2203-FM		3.5	2.3	1.2	yes	yes						4	1.25					2.7	0.83		
51	2203-FM																					
52	2203-FM																					
53	2203-FM																					
54	2203-FM																					
55	2203-FM																					
56	2203-FM																					
57	2203-FM																					
58	2203-FM																					
59	2203-FM		3.4			No	N/A	N/A	N/A	0.3			5.5	1.75			1.25	2.5				
60	2203-FM		2			no				0.17			4			2.75			2.67			
61	2203-FM																					
62	2203-FM																					
63	2203-FM																					
64	2203-FM																					
65	2203-FM																					
66	2203-FM																					
67	2203-FM																					
68	2203-FM																					
69	2203-FM																					
70	2203-FM																					
71	2203-FM																					
72	2203-FM																					
73	2203-FM																					
74	2203-FM																					
75	2203-FM																					

EURL Proficiency Study on the Determination of PCDD/Fs, PCBs, PBDEs, HBCDDs and PFASs in Fish Meal 2022 [EURL-PT-POP_2203-FM]
EURL for halogenated Persistent Organic Pollutants (POPs) in Feed and Food

Fish Meal (2203-FM)
Bioanalytical screening methods - Results, Assessment of analytical results

LC	Sample	Result ng BEQ/kg 12% moisture content	PCDD/Fs + DL-PCBs	PCDD/Fs	DL-PCBs	Assessment of analytical results: Sample suspected to be noncompliant with … Maximum Level PCDD/Fs+DL-PCBs	Maximum Level PCDD/Fs	Action Threshold PCDD/Fs	Action Threshold DL-PCBs	Reporting Limit PCDD/Fs+ DL-PCBs	Reporting Limit PCDD/Fs	Reporting Limit DL-PCBs	Maximum Level on which evaluation is based on PCDD/Fs+ DL-PCBs	Maximum Level on which evaluation is based on PCDD/Fs	Maximum Level on which evaluation is based on DL-PCBs	Action Level on which evaluation is based on PCDD/Fs+ DL-PCBs	Action Level on which evaluation is based on PCDD/Fs	Action Level on which evaluation is based on DL-PCBs	Bioassay Cut-off Maximum Level PCDD/Fs+ DL-PCBs	Bioassay Cut-off Maximum Level PCDD/Fs	Bioassay Cut-off Action Threshold PCDD/Fs	Bioassay Cut-off Action Threshold DL-PCBs
76	2203-FM																					
77	2203-FM																					
78	2203-FM		1.2			no	yes	yes	no	0.7			4	1.25			0.75	2	2.67	0.83	0.5	1.33
79	2203-FM																					
80	2203-FM																					
81	2203-FM																					
82	2203-FM																					
83	2203-FM		0.81			yes	yes												0.5			
84	2203-FM																					
85	2203-FM																					
86	2203-FM																					
87	2203-FM																					
88	2203-FM																					
89	2203-FM																					
90	2203-FM																					
91	2203-FM																					
92	2203-FM																					
93	2203-FM																					
94	2203-FM																					
95	2203-FM																					
96	2203-FM																					
97	2203-FM																					
98	2203-FM																					
99	2203-FM																					
100	2203-FM																					
101	2203-FM		1.3	0.83	0.43	no	no	yes					4	1.25	2		0.75			0.07		
102	2203-FM																					
103	2203-FM																					
104	2203-FM																					
105	2203-FM																					
106	2203-FM																					
107	2203-FM																					
108	2203-FM																					
109	2203-FM																					
110	2203-FM																					
111	2203-FM																					
112	2203-FM																					
113	2203-FM																					
114	2203-FM																					
78A	2203-FM		1.2	0.53		no	no	yes	no	0.7	0.5		4	1.25			0.75	2	2.67	0.83	0.5	1.33

EURL Proficiency Study on the Determination of PCDD/Fs, PCBs, PBDEs, HBCDDs and PFASs in Fish Meal 2022 [EURL-PT-POP_2203-FM]
EURL for halogenated Persistent Organic Pollutants (POPs) in Feed and Food

Fish Meal (2203-FM)
Moisture content - Results

LC	Sample	Result %	Moisture content	Moisture content	Moisture content
			Physico-chemical methods	Bioanalytical methods	Mean
1	2203-FM				
2	2203-FM		11.6		11.6
3	2203-FM		10.7		10.7
4	2203-FM		12.6		12.6
5	2203-FM		10.7		10.7
6	2203-FM		10.8		10.8
7	2203-FM		10.3		10.3
8	2203-FM				
9	2203-FM		9.8		9.8
10	2203-FM		10.2		10.2
11	2203-FM		10.6		10.6
12	2203-FM		11.6		11.6
13	2203-FM		10.0		10.0
14	2203-FM				
15	2203-FM		10.0		10.0
16	2203-FM		9.8	12.0	10.9
17	2203-FM		9.3	9.3	9.3
18	2203-FM				
19	2203-FM				
20	2203-FM				
21	2203-FM		12.3		12.3
22	2203-FM		0.0		0.0
23	2203-FM				
24	2203-FM		10.7		10.7
25	2203-FM		10.6		10.6
26	2203-FM		10.8		10.8
27	2203-FM		11.3		11.3
28	2203-FM		9.6		9.6
29	2203-FM		10.8		10.8
30	2203-FM		10.8		10.8
31	2203-FM		11.3		11.3
32	2203-FM		10.5		10.5
33	2203-FM		10.9		10.9
34	2203-FM		10.6		10.6
35	2203-FM				
36	2203-FM		10.4		10.4
37	2203-FM		11.2		11.2
38	2203-FM				
39	2203-FM		10.3		10.3
41	2203-FM				
42	2203-FM				
43	2203-FM		11.2		11.2
44	2203-FM			10.7	10.7
45	2203-FM				
46	2203-FM		11.2	10.3	10.8
47	2203-FM				
48	2203-FM		11.1		11.1
49	2203-FM		10.9		10.9
50	2203-FM		11.6	11.6	11.6
51	2203-FM				
52	2203-FM		10.8		10.8
53	2203-FM				
54	2203-FM				
55	2203-FM		9.3		9.3
56	2203-FM		10.7		10.7
57	2203-FM		8.7		8.7
58	2203-FM				
59	2203-FM		10.9		10.9
60	2203-FM		10.2	10.2	10.2
61	2203-FM		10.7		10.7
62	2203-FM		11.4		11.4
63	2203-FM		10.5		10.5
64	2203-FM		11.1		11.1
65	2203-FM		10.6		10.6
66	2203-FM		89.3		89.3
67	2203-FM		10.7		10.7
68	2203-FM				
69	2203-FM		10.8		10.8
70	2203-FM		10.5		10.5
71	2203-FM		10.9		10.9
72	2203-FM				
73	2203-FM		10.9		10.9
74	2203-FM		10.9		10.9
75	2203-FM		10.9		10.9

EURL Proficiency Study on the Determination of PCDD/Fs, PCBs, PBDEs, HBCDDs and PFASs in Fish Meal 2022 [EURL-PT-POP_2203-FM]
EURL for halogenated Persistent Organic Pollutants (POPs) in Feed and Food

Fish Meal (2203-FM)
Moisture content - Results

LC	Sample	Result %	Moisture content	Moisture content	Moisture content
			Physico-chemical methods	Bioanalytical methods	Mean
76	2203-FM		88.4	88.4	88.4
77	2203-FM		8.9	8.9	8.9
78	2203-FM			11.0	11.0
79	2203-FM		11.4		11.4
80	2203-FM		10.9	10.9	10.9
81	2203-FM		88.8		88.8
82	2203-FM		11.2		11.2
83	2203-FM		10.9	10.9	10.9
84	2203-FM				
85	2203-FM		89.3		89.3
86	2203-FM		10.5		10.5
87	2203-FM		9.8		9.8
88	2203-FM		10.9		10.9
89	2203-FM		12.5		12.5
90	2203-FM		2.0		2.0
91	2203-FM		11.3		11.3
92	2203-FM		10.8		10.8
93	2203-FM				
94	2203-FM		10.7		10.7
95	2203-FM		12.9		12.9
96	2203-FM				
97	2203-FM		9.6		9.6
98	2203-FM		10.7		10.7
99	2203-FM		10.4		10.4
100	2203-FM		9.0		9.0
101	2203-FM				
102	2203-FM		9.5		9.5
103	2203-FM				
104	2203-FM		10.7		10.7
105	2203-FM		10.8		10.8
106	2203-FM		11.2		11.2
107	2203-FM		10.9		10.9
108	2203-FM				
109	2203-FM		10.7		10.7
110	2203-FM		4.9		4.9
111	2203-FM		9.5		9.5
112	2203-FM				
113	2203-FM		10.0		10.0
114	2203-FM		10.5		10.5
27A	2203-FM		11.2		11.2
37A	2203-FM		10.7		10.7
75A	2203-FM		10.9		10.9
78A	2203-FM			11.0	11.0
66*	2203-FM		10.7		10.7
81*	2203-FM		11.2		11.2

EURL Proficiency Study on the Determination of PCDD/Fs, PCBs, PBDEs, HBCDDs and PFASs in Fish Meal 2022 [EURL-PT-POP_2203-FM]

EURL for halogenated Persistent Organic Pollutants (POPs) in Feed and Food
12 June 2023

Annex 3: Participants' z-scores and bioassay-scores of PCDD/Fs and PCBs - Tables

Test sample - Fish Meal (2203-FM)

Z-scores of sum parameters and individual results

Calculation of z-score on basis of assigned value

$z = (x - x_a) / \sigma_p$

x_a: assigned value
x: participant's result
σ_p: fitness-for-purpose-based standard deviation for proficiency assessment
- 10%: WHO-PCDD/F-TEQ, WHO-PCB-TEQ and WHO-PCDD/F-PCB-TEQ
- 15%: Sum of six indicator PCBs (PCB 28, 52, 101, 138, 153, 180)
- 20%: Evaluated individual PCDD/F and PCB congeners

Bioassay-scores of BEQ results

Calculation of bioassay-score on basis of assigned value from physical-chemical methods

bioassay-score $= (x - x_a) / \sigma_{bioassay}$

x_a: assigned value (pyhsical-chemical methods)
x: participant's result (BEQ from bioanalytical screening method)
$\sigma_{bioassay}$: bioassay target deviation
- 20%: PCDD/F-PCB-BEQ, PCDD/F-BEQ and PCB-BEQ

* Modified/additional results reported after distribution of preliminary results to all participating laboratories

EURL Proficiency Study on the Determination of PCDD/Fs, PCBs, PBDEs, HBCDDs and PFASs in Fish Meal 2022 [EURL-PT-POP_2203-FM]
EURL for halogenated Persistent Organic Pollutants (POPs) in Feed and Food

Fish Meal (2203-FM)
Sum parameters - Z-scores

LC	Sample	Z-score [σ_p = 10 %]	WHO-PCDD/F-PCB-TEQ reported		WHO-PCDD/F-PCB-TEQ calculated		WHO-PCDD/F-TEQ reported		WHO-PCDD/F-TEQ calculated		WHO-PCB-TEQ reported		WHO-PCB-TEQ calculated		Z-score [σ_p = 15 %]	Sum Indicator PCBs reported		Sum Indicator PCBs calculated	
			upper bound	lower bound	upper bound	lower bound	upper bound	lower bound	upper bound	lower bound	upper bound	lower bound	upper bound	lower bound		upper bound	lower bound	upper bound	lower bound
1	2203-FM																		
2	2203-FM															-3.9	-4.0	-3.9	-4.0
3	2203-FM		-0.3	-0.2	-0.3	-0.2	-0.2	0.1	0.3	0.5	-1.2	-1.2	-1.2	-1.2		0.4	0.5	0.5	0.6
4	2203-FM		0.7	0.8	0.6	0.9	0.7	1.0	0.7	1.0	0.5	0.5	0.6	0.6		-0.1	0.0	-0.1	0.0
5	2203-FM		-2.9	-2.8	-2.9	-2.7	-3.4	-3.3	-3.4	-3.3	-2.1	-2.1	-2.1	-2.1		-0.4	-0.3	-0.4	-0.3
6	2203-FM		0.2	0.3	0.2	0.4	-0.3	0.0	-0.3	0.0	0.8	0.8	0.8	0.8		0.0	0.0	-0.1	0.1
7	2203-FM		0.3	0.4	0.2	0.4	0.1	0.4	0.1	0.4	0.5	0.5	0.5	0.5		0.0	0.1	0.0	0.1
8	2203-FM																		
9	2203-FM		0.9	-1.3	0.8	-1.2	1.6	-1.7	1.6	-1.6	-0.4	-0.5	-0.4	-0.5		0.1	0.2	0.1	0.2
10	2203-FM		-0.1	-0.2	-0.1	-0.2	-0.3	-0.5	-0.3	-0.5	0.1	0.1	0.1	0.1		-1.0	-0.9	-1.0	-0.9
11	2203-FM		0.0	-0.1	5.5	-1.8	-0.5	-0.5	8.8	-3.4	0.7	0.7	0.7	0.7		0.2	0.3	0.2	0.3
12	2203-FM		-2.4	-2.3	-2.2	-2.0	-2.5	-2.3	-2.5	-2.3	-1.7	-1.7	-1.7	-1.7		-0.2	-0.1	-0.2	-0.1
13	2203-FM		-0.2	-1.1	-0.2	-1.0	-1.2	-2.6	-1.2	-2.6	1.2	1.2	1.2	1.2		0.0	0.1	0.0	0.1
14	2203-FM																		
15	2203-FM		-0.2	-0.1	-0.3	-0.1	-0.4	-0.1	-0.4	-0.1	-0.1	-0.1	-0.1	-0.1		-0.2	-0.1	-0.2	-0.1
16	2203-FM															-0.6	-1.2	-0.6	-1.2
17	2203-FM		0.6	0.8	0.6	0.8	0.9	1.2	0.9	1.2	0.1	0.1	0.1	0.1		-0.4	-0.4	-0.5	-0.3
18	2203-FM																		
19	2203-FM																		
20	2203-FM																		
21	2203-FM		-0.1	0.1	-0.1	0.1	-0.9	-0.6	-0.9	-0.6	1.2	1.2	1.2	1.2		-0.3	-0.2	-0.3	-0.2
22	2203-FM		-0.4	-0.4	-0.5	-0.4	-0.5	-0.4	-0.5	-0.5	-0.4	-0.4	-0.4	-0.4		-1.6	-1.6	-1.7	-1.6
23	2203-FM		0.1	0.2	0.0	0.1	-0.2	0.0	-0.4	-0.2	0.5		0.5	0.5		-0.1	0.0	-0.1	0.1
24	2203-FM															7.8	8.0	7.8	8.1
25	2203-FM		-3.4	-3.4	-3.4	-3.4	-3.9	-3.8	-3.9	-3.8	-2.7	-2.7	-2.7	-2.7		0.9	1.0	0.9	1.0
26	2203-FM															-0.3	-0.2	-0.3	-0.2
27	2203-FM		-0.6	-0.5	-0.7	-0.5	-0.8	-0.6	-0.8	-0.6	-0.5	-0.5	-0.5	-0.5					
28	2203-FM		-0.3	-0.2	-0.3	-0.1	0.4	0.6	0.4	0.6	-1.3	-1.3	-1.3	-1.3		0.2	0.3	0.2	0.3
29	2203-FM		0.0	0.1	-0.1	0.2	0.3	0.6	0.3	0.6	-0.5	-0.5	-0.5	-0.5		-0.8	-0.7	-0.8	-0.7
30	2203-FM															6.8	5.8	6.8	5.9
31	2203-FM		-0.1	-0.1	-0.2	-0.1	-0.6	-0.6	-0.6	-0.6	0.6	0.6	0.6	0.6		0.2	0.3	0.2	0.3
32	2203-FM		-0.4	-1.0	-0.4	-1.0	-0.2	-1.2	-0.2	-1.2	-0.6	-0.6	-0.7	-0.7		0.0	0.1	0.0	0.1
33	2203-FM		0.3	0.3	0.2	0.4	0.0	0.2	0.0	0.2	0.7	0.7	0.6	0.6		0.7	0.7	0.8	0.9
34	2203-FM															-1.1		-1.1	-1.0
35	2203-FM																		
36	2203-FM		-1.2	-1.1	-1.3	-1.1	-0.3	0.0	-0.3	0.0	-2.7	-2.7	-2.7	-2.7		-0.7	-0.6	-0.7	-0.6
37	2203-FM		-0.4	-0.3	-0.5	-0.3	-0.2	0.1	-0.2	0.1	-0.8	-0.9	-0.8	-0.8		0.1	0.2	0.1	0.2
38	2203-FM																		
39	2203-FM		-0.3	-0.5	-0.6	-0.5	-0.5	-0.9	-1.0	-0.9	-0.1	-0.1	-0.1	-0.1		-0.4	-0.3	-0.4	-0.3
41	2203-FM																		
42	2203-FM																		
43	2203-FM		3.6	2.2	3.5	2.3	3.7	1.4	3.7	1.4	3.5	3.5	3.5	3.5		0.5	0.6	0.5	0.6
44	2203-FM		0.4		0.4	0.4	1.1		1.1	1.0	-0.6		-0.6	-0.6		-0.6		-0.1	-0.8
45	2203-FM																		
46	2203-FM		1.2	1.3	1.2	1.4	1.3	1.6	1.3	1.6	1.0	1.0	1.0	1.0		0.2	0.2	0.1	0.3
47	2203-FM		-0.8	-0.8	-0.9	-0.7	-0.3	-0.1	-0.3	-0.1	-1.7	-1.7	-1.6	-1.6		2.3	1.6	2.3	1.6
48	2203-FM		-0.7	-0.7	-0.8	-0.7	-1.0	-0.8	-1.0	-0.8	-0.4	-0.4	-0.4	-0.4		-0.1	0.0	-0.1	0.0
49	2203-FM		-1.0	-0.9	-1.0	-0.8	-0.4	-0.1	-0.4	-0.1	-2.0	-2.0	-2.0	-2.0		-0.6	-0.5	-0.6	-0.4
50	2203-FM		-0.8	-0.7	-0.9	-0.8	-0.2	-0.8	-0.4	-0.4	-1.7	-1.7	-1.6	-1.6		0.4	0.5	0.4	0.6
51	2203-FM																		
52	2203-FM		0.2	0.1	0.1	0.2	0.0	0.0	0.0	0.0	0.4	0.4	0.4	0.4		0.3	0.3	0.4	0.3
53	2203-FM		15.4	15.6	15.3	15.8	24.8	25.8	24.8	25.8	0.8	0.8	0.8	0.8		0.6	0.7	0.5	0.7
54	2203-FM																		
55	2203-FM		0.5	0.6	0.4	0.7	0.0	0.3	0.0	0.3	1.1	1.1	1.1	1.1		-0.7	-0.6	-0.7	-0.6
56	2203-FM		1.4	1.3	1.2	1.4	1.4	1.5	1.3	1.6	1.1	1.1	1.1	1.1					
57	2203-FM		-0.2	-0.6	-0.2	-0.5	0.3	-0.4	0.3	-0.4	-0.9	-0.9	-0.9	-0.9					
58	2203-FM		1.0	1.1	1.0	1.2	1.8	2.1	1.8	2.1	-0.3	-0.3	-0.2	-0.2		0.3	0.4	0.2	0.4
59	2203-FM		0.6	0.7	0.5	0.8	0.6	0.9	0.6	0.9	0.5	0.5	0.5	0.5		-0.2	-0.1	-0.2	-0.1
60	2203-FM															0.0	0.1	0.0	0.1
61	2203-FM		-0.2	-0.3	-0.2	-0.3	-0.5	-0.7	-0.4	-0.7	0.3	0.3	0.3	0.3		-0.7	-0.7	-0.7	-0.6
62	2203-FM		0.7	0.8	0.7	0.8	1.2	1.4	1.3	1.4	-0.1	-0.1	-0.1	-0.1		-0.1	0.0	-0.1	0.0
63	2203-FM		-0.1	0.1	-0.2	0.1	0.0	0.3	0.0	0.3	-0.3	-0.3	-0.3	-0.3		0.4	0.5	0.4	0.5
64	2203-FM		0.1	0.2	0.1	0.3	0.0	0.3	0.0	0.3	0.3	0.3	0.3	0.3		0.4	0.5	0.4	0.6
65	2203-FM		-0.8	-0.7	-0.7	-0.7	-0.2	0.1	-0.3	-0.2	-1.3	-1.4	-1.3	-1.4		0.4	0.2	0.4	0.2
66	2203-FM		1.7	1.2	1.6	1.3	1.4	0.8	1.4	0.8	1.9	1.9	1.9	1.9		0.6	0.5	0.6	0.5
67	2203-FM															-2.0	-2.7	-2.0	-2.7
68	2203-FM																		
69	2203-FM		0.5	0.7	0.5	0.7	0.5	0.8	0.5	0.8	0.5	0.5	0.5	0.5					
70	2203-FM		-0.3	-0.2	-0.4	-0.2	-0.8	-0.6	-0.9	-0.6	0.4	0.4	0.3	0.3		-0.8	-0.7	-0.8	-0.7
71	2203-FM															0.8	0.1	0.8	0.1
72	2203-FM																		
73	2203-FM															1.0	0.4	1.0	0.4
74	2203-FM		0.0	0.1	-0.1	0.2	-0.7	-0.5	-0.7	-0.5	1.1	1.1	1.1	1.1		0.4	0.5	0.4	0.5
75	2203-FM															0.4	0.5	0.4	0.5

EURL Proficiency Study on the Determination of PCDD/Fs, PCBs, PBDEs, HBCDDs and PFASs in Fish Meal 2022 [EURL-PT-POP_2203-FM]
EURL for halogenated Persistent Organic Pollutants (POPs) in Feed and Food

Fish Meal (2203-FM)
Sum parameters - Z-scores

LC	Sample	Z-score [σ_p = 10 %]	WHO-PCDD/F-PCB-TEQ reported		WHO-PCDD/F-PCB-TEQ calculated		WHO-PCDD/F-TEQ reported		WHO-PCDD/F-TEQ calculated		WHO-PCB-TEQ reported		WHO-PCB-TEQ calculated		Z-score [σ_p = 15 %]	Sum Indicator PCBs reported		Sum Indicator PCBs calculated	
			upper bound	lower bound	upper bound	lower bound	upper bound	lower bound	upper bound	lower bound	upper bound	lower bound	upper bound	lower bound		upper bound	lower bound	upper bound	lower bound
76	2203-FM															-0.7	-1.0	-0.3	-1.0
77	2203-FM		-0.3	-0.2	-0.3	-0.1	-0.4	-0.2	-0.4	-0.1	-0.1	-0.1	-0.1	-0.1		-1.9	-1.8	-1.9	-1.8
78	2203-FM																		
79	2203-FM		0.5	0.5	0.5	0.6	0.3	0.3	0.3	0.4	0.9	0.9	0.9	0.9		-0.4	-0.4	-0.4	-0.4
80	2203-FM															2.3	1.7	2.3	1.7
81	2203-FM		-0.2	-0.1	0.4	-0.5	0.3	0.6	1.3	-0.4	-0.9	-0.9	-0.9	-0.9					
82	2203-FM															1.3	0.6	1.3	0.6
83	2203-FM		0.0	0.1	-0.1	0.2	0.0	0.3	0.0	0.3	-0.1	-0.1	-0.1	-0.1		-0.4	-0.3	-0.4	-0.3
84	2203-FM																		
85	2203-FM		-0.4	-0.3	-0.5	-0.3	-0.5	-0.3	-0.5	-0.3	-0.4	-0.4	-0.4	-0.4		-0.8	-0.7	-0.9	-0.7
86	2203-FM		-0.6	-0.5	-0.7	-0.5	-0.3	0.0	-0.3	0.0	-1.3	-1.3	-1.3	-1.3		2.0	2.2	2.0	2.2
87	2203-FM		-0.4	-0.7	-0.4	-0.5	-0.4	-0.8	-0.4	-0.7	-0.4	-0.4	-0.4	-0.4		-0.8	-0.7	-0.8	-0.7
88	2203-FM		-2.2	-2.1	-2.2	-2.0	-2.4	-2.2	-2.4	-2.2	-1.8	-1.8	-1.7	-1.7		-0.6	-0.5	-1.7	-1.6
89	2203-FM		2.9	3.1	2.8	3.1	3.5	3.9	3.4	3.8	2.1	2.1	2.0	2.0		-0.6	-0.5	-0.6	-0.5
90	2203-FM		1.0	1.1	0.7	0.9	0.2	0.5	0.2	0.5	2.1	2.1	1.6	1.6		0.3	0.4	0.3	0.5
91	2203-FM		3.2	3.4	3.2	3.5	2.6	2.9	2.6	2.9	4.1	4.1	4.1	4.1		-0.6	-0.5	-0.6	-0.5
92	2203-FM															0.2	0.3	0.2	0.3
93	2203-FM																		
94	2203-FM		0.1	-0.2	-0.1	0.1	-0.8	-1.1	-1.1	-0.9	1.4	1.3	1.4	1.3		-0.3	-1.0	-0.7	-0.6
95	2203-FM		0.4	0.5	0.3	0.5	0.6	0.9	0.6	0.9	-0.1	-0.1	-0.1	-0.1		-0.4	-0.3	-0.4	-0.3
96	2203-FM																		
97	2203-FM		0.3	0.3	0.3	0.4	-0.1	0.0	-0.1	0.0	0.8	0.8	0.9	0.8		2.1	0.6	2.1	0.6
98	2203-FM															1.2	0.5	1.2	0.6
99	2203-FM		-3.0	-3.1	-3.1	-3.0	-1.8	-1.8	-1.8	-1.8	-4.9	-4.9	-4.9	-4.9		-0.8	-0.7	-0.8	-0.7
100	2203-FM		0.5	0.7	0.5	0.8	-0.5	-0.3	-0.5	-0.3	2.2	2.2	2.2	2.2		0.3	0.4	0.3	0.4
101	2203-FM		-0.6	-0.6	-0.6	-0.4	0.4	0.7	0.7	0.9	-2.5	-2.5	-2.5	-2.5					
102	2203-FM		-2.9	-2.9	-3.0	-2.9	-3.8	-3.8	-3.8	-3.7	-1.6	-1.6	-1.6	-1.6		-0.1	0.0	-0.2	-0.1
103	2203-FM																		
104	2203-FM		0.1	-0.1	0.0	-0.1	0.2	0.1	0.2	0.1	-0.2	-0.3	-0.2	-0.3		0.7	-0.2	0.7	-0.1
105	2203-FM		1.5	1.6	1.5	1.6	1.2	1.4	1.3	1.4	1.9	1.9	1.9	1.9		0.2	0.3	0.2	0.4
106	2203-FM		0.8	0.9	0.7	0.9	0.0	0.3	0.0	0.3	1.8	1.8	1.8	1.8		0.7	0.8	0.7	0.9
107	2203-FM															6.9	4.7	6.9	4.8
108	2203-FM																		
109	2203-FM		0.1	0.2	0.1	0.3	0.7	1.0	0.7	1.0	-0.9	-0.9	-0.9	-0.9		-0.5	-0.4	-0.5	-0.4
110	2203-FM		-1.0	-1.0	-1.1	-0.9	-1.2	-1.0	-1.2	-1.0	-0.9	-0.9	-0.9	-0.9		-0.2	-0.1	-0.2	-0.1
111	2203-FM															0.6	0.7	0.6	0.7
112	2203-FM															-0.2	-0.3	-0.2	-0.3
113	2203-FM		1.4	1.5	1.3	1.5	0.4	0.7	0.4	0.7	2.6	2.6	2.7	2.7		0.7	0.8	0.6	0.8
114	2203-FM															0.9	0.2	0.9	0.3
27A	2203-FM		-0.8	-0.7	-0.8	-0.6	0.0	0.3	0.0	0.3	-2.0	-2.0	-1.9	-1.9					
37A	2203-FM															1.0	0.4	1.0	0.4
57A	2203-FM						0.9	-3.2	0.9	-3.2									
69A	2203-FM		0.4	0.5	0.4	0.6	0.3	0.6	0.3	0.6	0.6	0.6	0.6	0.6					
75A	2203-FM															0.3	0.3	0.3	0.3
11*	2203-FM		0.0	-0.1	-0.1	0.1	-0.5	-0.5	-0.5	-0.4	0.7	0.7	0.7	0.7		0.2	0.3	0.2	0.3
13*	2203-FM		-0.5	-1.4	-0.5	-1.3	-1.7	-3.1	-1.7	-3.1	1.2	1.2	1.2	1.2		0.0	0.1	0.0	0.1
81*	2203-FM		-0.2	-0.1	-0.2	0.0	0.3	0.6	0.3	0.6	-0.9	-0.9	-0.9	-0.9					

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Fish Meal (2203-FM)
PCDD/F - Z-scores

LC	Sample	Z-score [σ_p = 10 %]	WHO-PCDD/F-TEQ reported		WHO-PCDD/F-TEQ calculated		Z-score [σ_p = 20 %]	2,3,7,8-TCDD	1,2,3,7,8-PeCDD	1,2,3,4,7,8-HxCDD	1,2,3,6,7,8-HxCDD	1,2,3,7,8,9-HxCDD	1,2,3,4,6,7,8-HpCDD	OCDD	2,3,7,8-TCDF	1,2,3,7,8-PeCDF	2,3,4,7,8-PeCDF	1,2,3,4,7,8-HxCDF	1,2,3,6,7,8-HxCDF	2,3,4,6,7,8-HxCDF
			upper bound	lower bound	upper bound	lower bound														
1	2203-FM																			
2	2203-FM																			
3	2203-FM		-0.2	0.1	0.3	0.5		2.4	-1.0		0.8				0.3	0.0	0.2	0.8	1.2	-0.9
4	2203-FM		0.7	1.0	0.7	1.0		1.2	1.3		0.0		0.8	-0.2	0.3	0.5	0.0	-0.2	0.1	0.3
5	2203-FM		-3.4	-3.3	-3.4	-3.3		-2.6	-1.6		-0.7		-0.9	-1.3	-2.4	-1.8	-1.4	-1.1	-1.3	-0.8
6	2203-FM		-0.3	0.0	-0.3	0.0		0.4	0.6		-0.3		-0.3		0.0	-0.1	-0.4	-0.6	-0.3	-0.7
7	2203-FM		0.1	0.4	0.1	0.4		0.1	-0.3		0.2		-0.3	0.0	0.1	-0.2	0.3	-0.3	0.6	0.1
8	2203-FM																			
9	2203-FM		1.6	-1.7	1.6	-1.6			-0.8						0.0	2.3	-0.1			
10	2203-FM		-0.3	-0.5	-0.3	-0.5		-0.6	-0.6		1.5		3.2	2.0	-0.6	-0.2	0.0		1.8	1.9
11	2203-FM		-0.5	-0.5	8.8	-3.4								0.3	-0.4		0.0			
12	2203-FM		-2.5	-2.3	-2.5	-2.3		-1.7	-0.6		-1.0		2.0	6.1	-1.9	-1.5	-1.2	-0.5	-0.9	0.2
13	2203-FM		-1.2	-2.6	-1.2	-2.6							73.2	57.6	3.1	24.5	-0.8			
14	2203-FM																			
15	2203-FM		-0.4	-0.1	-0.4	-0.1		0.0	-0.3		-0.4		-0.9	-0.8	-0.1	-0.3	0.1	-1.0	-0.9	-0.4
16	2203-FM																			
17	2203-FM		0.9	1.2	0.9	1.2		0.1	1.0		-0.5		0.3	-1.3	1.0	1.1	0.4	0.0	0.3	0.3
18	2203-FM																			
19	2203-FM																			
20	2203-FM																			
21	2203-FM		-0.9	-0.6	-0.9	-0.6		-1.3	-0.1		-0.1		-0.1	-0.2	0.0	0.3	-0.5	-0.2	0.0	-0.2
22	2203-FM		-0.5	-0.4	-0.5	-0.5		-0.8	-0.4		-1.6		-1.4	-2.3	0.3	-0.5	-0.2	-0.9	-1.2	0.0
23	2203-FM		-0.2	0.0	-0.4	-0.2		-1.6	1.7		-0.3		-1.9	-2.6	-0.4	4.8	-0.6	0.5	-0.8	-1.6
24	2203-FM																			
25	2203-FM		-3.9	-3.8	-3.9	-3.8		-1.7	-1.9		-2.2			-0.2	-2.0	-2.3	-1.9	-2.9		-2.8
26	2203-FM																			
27	2203-FM		-0.8	-0.6	-0.8	-0.6		-0.9	0.3		-0.8		1.0	0.4	-0.7	0.2	-0.4	-0.1	-0.6	-0.4
28	2203-FM		0.4	0.6	0.4	0.6		0.6	-0.1		0.1		-0.4	-1.2	0.5	0.1	0.3	-0.4	0.4	-0.8
29	2203-FM		0.3	0.6	0.3	0.6		0.6	0.0		-0.1		1.5	0.6	-0.3	0.0	0.4	0.5	-0.6	-0.2
30	2203-FM																			
31	2203-FM		-0.6	-0.6	-0.6	-0.6		-0.3	-1.2		-0.8				-0.1	0.1	0.0	-0.2	0.0	-0.7
32	2203-FM		-0.2	-1.2	-0.2	-1.2			-0.6		-1.1		0.9	2.6	-0.3	-0.6	0.2			
33	2203-FM		0.0	0.2	0.0	0.2		0.6	-0.6		0.7		1.3	4.1	-0.3	1.1	0.2	0.5	0.7	1.2
34	2203-FM																			
35	2203-FM																			
36	2203-FM		-0.3	0.0	-0.3	0.0		-1.2	0.7		-0.6		-0.2	-1.1	-1.1	-0.4	0.2	-0.4	-0.4	-0.2
37	2203-FM		-0.2	0.1	-0.2	0.1		0.6	-1.0		0.5		6.7	7.8	2.3	-0.8	-0.4	3.0	0.3	2.1
38	2203-FM																			
39	2203-FM		-0.5	-0.9	-1.0	-0.9		-2.1	-0.1		-0.8			0.6	-1.3	-0.5	-0.1	-1.3	-0.2	0.1
41	2203-FM																			
42	2203-FM																			
43	2203-FM		3.7	1.4	3.7	1.4		-0.5					2.7	1.0	1.3	62.5	0.6	58.9	14.8	
44	2203-FM		1.1		1.1	1.0		0.1	-0.4		0.4				0.4	-0.4	0.3		36.7	-0.2
45	2203-FM																			
46	2203-FM		1.3	1.6	1.3	1.6		1.5	0.1		0.4		0.4	-0.6	1.4	1.1	0.7	0.0	-0.2	0.9
47	2203-FM		-0.3	-0.1	-0.3	-0.1		-0.2	-0.6		-1.5		-0.4		1.8	0.0	-0.3	-0.6	-0.4	-0.7
48	2203-FM		-1.0	-0.8	-1.0	-0.8		-0.5	-1.0		0.0		0.3	0.9	-0.6	-0.1	-0.2	-0.6	-0.2	0.0
49	2203-FM		-0.4	-0.1	-0.4	-0.1		-0.5	-0.2		-0.1		-0.8	-0.2	-0.3	-0.4	0.1	-0.7	-1.1	-0.6
50	2203-FM		-0.2	-0.8	-0.4	-0.4		-0.9	1.0		-0.5		-0.1	-1.5	-1.1	-2.2	-0.3	1.1	0.8	-2.0
51	2203-FM																			
52	2203-FM		0.0	0.0	0.0	0.0		0.1	0.3		-0.3		0.9		-0.3	-0.3	-0.2	1.0	0.8	0.8
53	2203-FM		24.8	25.8	24.8	25.8		34.4	20.8		2.3		13.2	0.7	7.6	27.5	6.5	28.8	27.7	39.0
54	2203-FM																			
55	2203-FM		0.0	0.3	0.0	0.3		-0.4	-0.2		-0.5		-0.5	-0.3	0.0	0.2	0.3	-0.2	-0.1	0.1
56	2203-FM		1.4	1.5	1.3	1.6		0.6	1.0		0.8		0.9	-0.3	0.8	1.1	0.6	-0.1	1.0	1.7
57	2203-FM		0.3	-0.4	0.3	-0.4		1.5	-0.1		-0.2				-0.4	-0.3	-0.2			
58	2203-FM		1.8	2.1	1.8	2.1		1.0	1.4		1.1		1.2	3.0	1.2	1.8	0.8	1.8	-1.6	1.6
59	2203-FM		0.6	0.9	0.6	0.9		0.2	0.5		-0.3		-0.6	0.2	-0.1	0.2	0.5	0.7	0.1	0.2
60	2203-FM																			
61	2203-FM		-0.5	-0.7	-0.4	-0.7		-1.3	0.0		-0.8				-0.4	-0.8	-0.1			
62	2203-FM		1.2	1.4	1.3	1.4		0.7	0.8		0.5		-0.2	-0.6	0.4	0.4	0.7	-0.1	0.3	0.4
63	2203-FM		0.0	0.3	0.0	0.3		-0.1	0.1		-0.3		-0.4	-0.7	0.5	0.7	0.0	-0.8	-0.5	-0.5
64	2203-FM		0.0	0.3	0.0	0.3		1.0	0.0		0.7		-0.2	-0.9	0.0	0.1	-0.1	0.4	0.0	0.1
65	2203-FM		-0.2	0.1	-0.3	-0.2		-0.5	0.1		-0.5				-0.4	-0.6	-0.1	1.1	-0.1	0.8
66	2203-FM		1.4	0.8	1.4	0.8		-0.1	0.7						0.5		0.9			
67	2203-FM																			
68	2203-FM																			
69	2203-FM		0.5	0.8	0.5	0.8		0.1	0.8		0.0		-0.2	-0.4	-0.1	0.0	0.4	-0.7	-1.0	-1.0
70	2203-FM		-0.8	-0.6	-0.9	-0.6		-1.3	-0.6		1.0		-4.1	2.9	-0.4	0.6	-0.2	0.0	0.3	-0.1
71	2203-FM																			
72	2203-FM																			
73	2203-FM																			
74	2203-FM		-0.7	-0.5	-0.7	-0.5		0.2	-0.1		-0.5		-0.9	-1.1	-0.3	0.0	-0.4	-0.2	-0.3	0.0
75	2203-FM																			

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Fish Meal (2203-FM)
PCDD/F - Z-scores

LC	Sample	Z-score [σ_p = 10 %]	WHO-PCDD/F-TEQ reported		WHO-PCDD/F-TEQ calculated		Z-score [σ_p = 20 %]	2,3,7,8-TCDD	1,2,3,7,8-PeCDD	1,2,3,4,7,8-HxCDD	1,2,3,6,7,8-HxCDD	1,2,3,7,8,9-HxCDD	1,2,3,4,6,7,8-HpCDD	OCDD	2,3,7,8-TCDF	1,2,3,7,8-PeCDF	2,3,4,7,8-PeCDF	1,2,3,4,7,8-HxCDF	1,2,3,6,7,8-HxCDF	2,3,4,6,7,8-HxCDF
			upper bound	lower bound	upper bound	lower bound														
76	2203-FM																			
77	2203-FM		-0.4	-0.2	-0.4	-0.1		0.3	-0.1		1.3		4.6	4.5	-0.1	-0.8	-0.2	0.3	-0.1	-0.5
78	2203-FM																			
79	2203-FM		0.3	0.3	0.3	0.4		0.5	-0.7		-0.3		0.6	2.0	0.7	0.6	0.3	0.1	1.2	-0.5
80	2203-FM																			
81	2203-FM		0.3	0.6	1.3	-0.4			0.2		-0.3		-0.2	-0.7	0.0	0.2	0.3	0.4	0.3	0.2
82	2203-FM																			
83	2203-FM		0.0	0.3	0.0	0.3		-0.3	1.0		-0.5		-1.4	0.1	0.1	-0.3	-0.2	-0.3	-0.1	1.3
84	2203-FM																			
85	2203-FM		-0.5	-0.3	-0.5	-0.3		0.2	-0.3		0.2		-0.9	-1.0	-0.2	-0.3	-0.2	-0.8	-0.6	-0.5
86	2203-FM		-0.3	0.0	-0.3	0.0		-0.2	0.6		0.2		0.1	-0.1	0.1	-0.3	-0.4	0.5	0.8	1.5
87	2203-FM		-0.4	-0.8	-0.4	-0.7		-1.0	-0.1		-0.3			0.3	-0.2	0.3	-0.2			
88	2203-FM		-2.4	-2.2	-2.4	-2.2		-1.3	-0.9		-0.1		-0.7	-1.0	-1.4	-1.4	-1.2	-1.5	-0.8	-1.1
89	2203-FM		3.5	3.9	3.4	3.8		1.2	3.8		0.2		2.4	1.4	0.7	1.1	1.4	2.4	2.5	3.5
90	2203-FM		0.2	0.5	0.2	0.5		-0.4	-0.6		0.3		0.4	-0.1	0.0	0.6	0.6	1.1	1.0	-0.2
91	2203-FM		2.6	2.9	2.6	2.9		0.3	4.8		0.6		0.8	0.2	0.2	0.2	0.7	-0.2	1.1	1.1
92	2203-FM																			
93	2203-FM																			
94	2203-FM		-0.8	-1.1	-1.1	-0.9		-1.1	-2.0		-2.2		-0.6	0.5	0.4	-0.3	0.0	-1.9	-2.4	-1.4
95	2203-FM		0.6	0.9	0.6	0.9		-0.6	0.3		0.9		0.2	0.6	0.9	0.5	0.5	0.1	-0.4	-0.8
96	2203-FM																			
97	2203-FM		-0.1	0.0	-0.1	0.0		2.0	0.2		1.4				-0.1	-0.1	-0.5	1.3	2.0	
98	2203-FM																			
99	2203-FM		-1.8	-1.8	-1.8	-1.8		-1.0	-1.0		-0.9				-0.9	-1.2	-1.0	2.9	0.9	
100	2203-FM		-0.5	-0.3	-0.5	-0.3		-0.6	0.0		-0.3		-0.7	0.9	0.3	0.1	-0.3	-0.8	-0.7	-0.7
101	2203-FM		0.4	0.7	0.7	0.9		1.1	-0.7		1.0		10.5	8.0	0.6	-0.7	0.5	4.7	2.0	1.8
102	2203-FM		-3.8	-3.8	-3.8	-3.7		-3.1	-1.5		-1.4		-0.3	0.5	-2.7	-2.0	-1.7	-1.7	-1.2	-1.5
103	2203-FM																			
104	2203-FM		0.2	0.1	0.2	0.1		1.5	0.1		1.0				-0.3	-0.1	-0.2		2.8	0.6
105	2203-FM		1.2	1.4	1.3	1.4		0.0	-0.7		-0.5		2.0	2.1	1.1	0.3	1.2	0.8	0.7	0.2
106	2203-FM		0.0	0.3	0.0	0.3		1.3	0.6		0.4		-0.5	-1.1	-0.6	0.0	-0.1	0.8	0.1	0.5
107	2203-FM																			
108	2203-FM																			
109	2203-FM		0.7	1.0	0.7	1.0		0.2	0.9		0.3		0.6	1.3	0.7	0.7	0.3	-0.2	0.3	-0.3
110	2203-FM		-1.2	-1.0	-1.2	-1.0		0.1	0.1		0.2		0.2	-1.3	-0.9	-1.1	-0.8	-0.1	-1.1	-0.9
111	2203-FM																			
112	2203-FM																			
113	2203-FM		0.4	0.7	0.4	0.7		1.4	0.3		0.3		-0.5	-0.3	0.4	0.1	0.1	-0.7	-0.7	-0.5
114	2203-FM																			
27A	2203-FM		0.0	0.3	0.0	0.3		-0.6	0.9		-0.1		0.3	-1.2	-0.3	0.6	0.0	-0.1	0.0	-0.6
57A	2203-FM		0.9	-3.2	0.9	-3.2		0.3							-0.4	0.3	-0.7			
69A	2203-FM		0.3	0.6	0.3	0.6		0.7	0.1		-0.8		-0.7	-0.8	-0.4	-0.2	0.4	-1.3	-1.0	-0.1
11*	2203-FM		-0.5	-0.5	-0.5	-0.4		-1.0	-0.4		-0.6		-0.3	0.3	-0.4	-0.8	0.0	0.6	-0.1	0.5
13*	2203-FM		-1.7	-3.1	-1.7	-3.1							73.2	57.6	3.1	-2.0	-0.8			
81*	2203-FM		0.3	0.6	0.3	0.6		0.2	0.2		-0.3		-0.2	-0.7	0.0	0.2	0.3	0.4	0.3	0.2

EURL Proficiency Study on the Determination of PCDD/Fs, PCBs, PBDEs, HBCDDs and PFASs in Fish Meal 2022 [EURL-PT-POP_2203-FM]
EURL for halogenated Persistent Organic Pollutants (POPs) in Feed and Food

Fish Meal (2203-FM)
Dioxin-like PCB - Z-scores

LC	Sample	Z-score [σ_p = 10 %]	WHO-PCB-TEQ reported upper bound	WHO-PCB-TEQ reported lower bound	WHO-PCB-TEQ calculated upper bound	WHO-PCB-TEQ calculated lower bound	Z-score [σ_p = 20 %]	PCB 105	PCB 114	PCB 118	PCB 123	PCB 156	PCB 157	PCB 167	PCB 189	PCB 77	PCB 81	PCB 126	PCB 169
1	2203-FM																		
2	2203-FM																		
3	2203-FM		-1.2	-1.2	-1.2	-1.2		0.2	-0.4	-0.8		0.5	-0.2	0.4	0.7	0.8	1.0	-0.6	-0.4
4	2203-FM		0.5	0.5	0.6	0.6		0.5	2.1	0.6		0.4	0.2	-0.1	0.1	0.0	0.6	0.3	0.3
5	2203-FM		-2.1	-2.1	-2.1	-2.1		-1.2	-1.6	-1.2		-0.6	-0.8	-0.8		-1.4	-1.3	-1.1	-0.6
6	2203-FM		0.8	0.8	0.8	0.8		0.2	0.1	0.2		0.2	0.3	0.8	0.4	-0.2	0.0	0.5	0.1
7	2203-FM		0.5	0.5	0.5	0.5		0.5	0.4	0.3		0.5	0.9	0.9	0.9	0.3	0.1	0.2	0.6
8	2203-FM																		
9	2203-FM		-0.4	-0.5	-0.4	-0.5		-0.2		-0.4		-0.1		0.0		0.1		-0.2	0.0
10	2203-FM		0.1	0.1	0.1	0.1		-0.8	0.4	-0.8		-0.4	-0.2	-0.8	-0.7	-0.6	9.5	0.1	0.4
11	2203-FM		0.7	0.7	0.7	0.7		-0.1	0.4	0.1		0.0	0.2	0.2	0.0	0.1		0.4	0.1
12	2203-FM		-1.7	-1.7	-1.7	-1.7		-0.5	-0.2	-0.7		-0.3	-0.4	-0.1	0.1	-1.0	64.6	-0.9	-0.5
13	2203-FM		1.2	1.2	1.2	1.2		0.6	0.2	0.6		0.1	0.9	-0.1	-0.5	0.8	1.2	0.8	-0.3
14	2203-FM																		
15	2203-FM		-0.1	-0.1	-0.1	-0.1		0.2	-0.4	-0.2		-0.1	0.0	-0.1	-0.1	-0.3	0.3	0.0	0.0
16	2203-FM																		
17	2203-FM		0.1	0.1	0.1	0.1		0.0	0.7	0.4		0.1	-0.1	0.1	0.2	0.8	0.5	0.1	0.1
18	2203-FM																		
19	2203-FM																		
20	2203-FM																		
21	2203-FM		1.2	1.2	1.2	1.2		0.4	0.8	0.5		0.2	0.2	0.1	0.4	1.6	-0.6	0.6	0.6
22	2203-FM		-0.4	-0.4	-0.4	-0.4		0.5	0.2	0.8		0.7	0.1	0.5	1.0	1.5	4.5	0.1	-2.3
23	2203-FM		0.5		0.5	0.5		-0.3	-0.7	-0.3		0.2	0.0	0.1	-0.2	-0.1	-0.5	0.2	0.9
24	2203-FM																		
25	2203-FM		-2.7	-2.7	-2.7	-2.7		-1.2	-1.2	-1.5		-1.3	-1.3	-1.1	-0.1	-1.7		-1.3	-1.1
26	2203-FM																		
27	2203-FM		-0.5	-0.5	-0.5	-0.5		-0.8	-0.9	-0.9		-0.7	-0.7	0.0	-0.3	0.8	103.7	-0.4	0.6
28	2203-FM		-1.3	-1.3	-1.3	-1.3		0.0	0.0	0.2		0.0	-0.2	-0.8	-0.4	-0.3	1.2	-0.6	-1.3
29	2203-FM		-0.5	-0.5	-0.5	-0.5		-0.3	-0.4	-0.6		-0.2	-1.2	-1.1	0.0	-0.2	0.4	-0.2	0.0
30	2203-FM																		
31	2203-FM		0.6	0.6	0.6	0.6		0.8	2.8	0.2		0.6	0.2	0.5	-0.2	0.1	-0.2	0.3	0.2
32	2203-FM		-0.6	-0.6	-0.7	-0.7		0.0	-0.8	0.2		0.1	0.0	-1.2	0.4	0.0	0.5	-0.3	-0.5
33	2203-FM		0.7	0.7	0.6	0.6		0.3	0.4	0.4		0.2	0.7	0.2	0.0	-0.8		0.2	0.9
34	2203-FM																		
35	2203-FM																		
36	2203-FM		-2.7	-2.7	-2.7	-2.7		-0.6	-0.6	-0.2		-0.7	-0.6	-0.9	-0.3	-0.9	-0.6	-1.5	-1.3
37	2203-FM		-0.8	-0.9	-0.8	-0.8		-0.6	-0.1	-0.9		-0.5	-0.6	-0.3	-0.4	-0.2	8.6	-0.4	-0.2
38	2203-FM																		
39	2203-FM		-0.1	-0.1	-0.1	-0.1		-0.5	-0.6	-0.3		-0.1	-0.2	0.3	-0.6	-1.0	-0.5	0.0	-0.1
41	2203-FM																		
42	2203-FM																		
43	2203-FM		3.5	3.5	3.5	3.5		-0.2	6.6	-0.3		0.1	1.0	-0.8	-0.1	0.1	74.4	2.3	-0.6
44	2203-FM		-0.6		-0.6	-0.6		-0.2	-0.1	-0.2		-0.5	-0.4	0.7	-0.3	-0.6		-0.3	-0.3
45	2203-FM																		
46	2203-FM		1.0	1.0	1.0	1.0		0.6	1.6	0.2		0.1	0.3	-0.3	-0.1	0.4	0.9	0.2	2.4
47	2203-FM		-1.7	-1.7	-1.6	-1.6		-0.2	-1.2	0.1		-1.0	-1.3	-1.3	-1.3	-1.6		-0.8	-0.9
48	2203-FM		-0.4	-0.4	-0.4	-0.4		-0.3	0.6	-0.2		0.0	-0.2	0.1	0.2	-0.4	0.1	-0.2	-0.2
49	2203-FM		-2.0	-2.0	-2.0	-2.0		-1.1	-1.4	-1.4		-1.3	-1.7	-1.8	-1.4	-1.1	-1.4	-1.0	-1.1
50	2203-FM		-1.7	-1.7	-1.6	-1.6		-0.1	0.9	-0.1		0.2	-0.2	0.1	0.7	-0.6	0.4	-0.8	-1.5
51	2203-FM																		
52	2203-FM		0.4	0.4	0.4	0.4		0.1	0.7	0.2		0.0	0.1	0.2	0.1	0.3		0.2	0.6
53	2203-FM		0.8	0.8	0.8	0.8		0.3	0.1	0.4		0.3	0.3	0.3	0.5	0.2	-0.1	0.4	0.4
54	2203-FM																		
55	2203-FM		1.1	1.1	1.1	1.1		0.7	0.7	0.7		0.4	0.5	0.5	0.1	0.2	0.5	0.6	0.2
56	2203-FM		1.1	1.1	1.1	1.1		0.5	0.4	0.1		0.5	0.7	0.3	0.2	0.3	0.2	0.7	0.2
57	2203-FM		-0.9	-0.9	-0.9	-0.9		-0.3	-0.4	-0.2		-0.2	-0.5	-0.4	-0.4	-0.5		-0.5	-0.4
58	2203-FM		-0.3	-0.3	-0.2	-0.2		-0.3	-0.2	0.0		-0.4	-0.6	-0.5	-0.4	0.0	-0.5	-0.1	-0.2
59	2203-FM		0.5	0.5	0.5	0.5		0.0	0.4	0.0		0.2	0.4	0.1	0.4	0.2	0.1	0.2	0.5
60	2203-FM																		
61	2203-FM		0.3	0.3	0.3	0.3		0.0	0.8	0.0		0.3	0.3	0.5	0.3	0.0	-0.6	0.2	0.1
62	2203-FM		-0.1	-0.1	-0.1	-0.1		-0.5	-0.7	-0.4		-0.5	-0.3	-0.1	-0.5	0.4	0.9	-0.1	0.6
63	2203-FM		-0.3	-0.3	-0.3	-0.3		0.3	-0.7	0.2		0.2	0.1	-0.5	-0.3	-0.1	-0.6	-0.2	0.2
64	2203-FM		0.3	0.3	0.3	0.3		0.2	0.2	0.0		0.6	0.4	0.5	0.5	0.7	1.1	0.0	0.9
65	2203-FM		-1.3	-1.4	-1.3	-1.4		-0.4	0.0	-0.7		-0.2	-0.6	-0.2	-0.4		0.2	-0.7	-0.6
66	2203-FM		1.9	1.9	1.9	1.9		0.7		1.0		0.8	0.4	0.7	-0.5	0.8		1.0	0.6
67	2203-FM																		
68	2203-FM																		
69	2203-FM		0.5	0.5	0.5	0.5		0.3	0.7	0.3		0.6	0.1	1.3	0.2	0.3	0.2	0.2	0.7
70	2203-FM		0.4	0.4	0.3	0.3		0.7	-0.6	0.1		0.1	-0.1	0.6	0.0	2.6	-0.1	0.0	1.4
71	2203-FM																		
72	2203-FM																		
73	2203-FM																		
74	2203-FM		1.1	1.1	1.1	1.1		0.5	1.0	0.6		0.8	0.7	-0.4	0.9	0.6	0.0	0.5	0.6
75	2203-FM																		

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EURL for halogenated Persistent Organic Pollutants (POPs) in Feed and Food

Fish Meal (2203-FM)
Dioxin-like PCB - Z-scores

LC	Sample	Z-score [σ_p = 10 %]	WHO-PCB-TEQ reported upper bound	WHO-PCB-TEQ reported lower bound	WHO-PCB-TEQ calculated upper bound	WHO-PCB-TEQ calculated lower bound	Z-score [σ_p = 20 %]	PCB 105	PCB 114	PCB 118	PCB 123	PCB 156	PCB 157	PCB 167	PCB 189	PCB 77	PCB 81	PCB 126	PCB 169
76	2203-FM																		
77	2203-FM		-0.1	-0.1	-0.1	-0.1		-0.9	0.4	-0.5		-0.7	-0.1	-0.4	-0.5	0.2	0.2	0.1	-0.7
78	2203-FM																		
79	2203-FM		0.9	0.9	0.9	0.9		0.5	0.2	0.4		0.5	0.2	0.6	0.4	0.5	5.2	0.5	0.1
80	2203-FM																		
81	2203-FM		-0.9	-0.9	-0.9	-0.9		-0.9	-0.6	-0.7		-0.8	-0.9	-0.8	-0.8	-0.7	-0.3	-0.4	-0.4
82	2203-FM																		
83	2203-FM		-0.1	-0.1	-0.1	-0.1		-0.1	-0.1	-1.6		0.2	0.7	1.3	0.6	0.0	0.2	0.0	0.0
84	2203-FM																		
85	2203-FM		-0.4	-0.4	-0.4	-0.4		-0.3	0.7	-0.1		-0.2	-0.3	-0.4	-0.3	-0.6	-0.8	-0.2	-0.3
86	2203-FM		-1.3	-1.3	-1.3	-1.3		-0.3	0.7	0.2		-0.5	-0.5	-0.4	-0.3	0.2	0.2	-0.8	-0.2
87	2203-FM		-0.4	-0.4	-0.4	-0.4		0.3	-0.7	0.4		0.8	1.1	0.2	1.1	-0.1		-0.3	0.3
88	2203-FM		-1.8	-1.8	-1.7	-1.7		-0.4	-1.1	-0.3		-0.5	-0.4	0.0	-0.5	-0.5	-0.2	-1.0	-0.6
89	2203-FM		2.1	2.1	2.0	2.0		0.3	5.6	0.2		0.3	0.3	0.3	0.2	0.1	3.7	1.2	0.1
90	2203-FM		2.1	2.1	1.6	1.6		0.1	0.2	1.1		0.0	-0.1	-0.3	0.2	0.6	-1.3	0.9	0.3
91	2203-FM		4.1	4.1	4.1	4.1		0.2	0.5	0.3		0.2	0.4	0.2	0.2	0.4	0.9	2.5	0.5
92	2203-FM																		
93	2203-FM																		
94	2203-FM		1.4	1.3	1.4	1.3		-0.9	-0.4	0.4		-0.9	-1.3	-0.4	-0.8	-0.4		-0.3	7.7
95	2203-FM		-0.1	-0.1	-0.1	-0.1		-0.2	0.0	-0.3		-0.7	0.1	0.4	-0.3	0.2	2.0	-0.1	0.8
96	2203-FM																		
97	2203-FM		0.8	0.8	0.9	0.8		1.8	10.7	2.5		1.2	0.6	1.0	0.2	9.3		0.4	-0.6
98	2203-FM																		
99	2203-FM		-4.9	-4.9	-4.9	-4.9		-0.6	-0.5	-0.8			-0.6	-0.6	-0.4	-0.6		-2.8	-0.7
100	2203-FM		2.2	2.2	2.2	2.2		1.2	0.5	1.4		-0.1	-0.2	0.0	0.5	-0.3		1.5	-1.0
101	2203-FM		-2.5	-2.5	-2.5	-2.5		0.8	6.2	1.0		0.1	2.2	2.0	0.8	-0.9	-0.5	-1.9	-0.7
102	2203-FM		-1.6	-1.6	-1.6	-1.6		-1.0	-0.3	-0.5		-0.7	-0.6	0.2	-0.8	-1.3	-1.0	-0.8	-0.8
103	2203-FM																		
104	2203-FM		-0.2	-0.3	-0.2	-0.3		0.1	-0.4	-0.3		-0.3	0.2		0.4	0.4		-0.1	0.0
105	2203-FM		1.9	1.9	1.9	1.9		1.3	1.9	0.8		0.9	1.0	0.4	0.5	0.3		1.1	0.2
106	2203-FM		1.8	1.8	1.8	1.8		0.5	1.3	0.6		0.4	0.4	0.2	0.7	0.9		0.9	0.8
107	2203-FM																		
108	2203-FM																		
109	2203-FM		-0.9	-0.9	-0.9	-0.9		0.1	-0.6	0.1		0.4	0.2	-0.2	0.0	-0.6	-0.4	-0.5	-0.5
110	2203-FM		-0.9	-0.9	-0.9	-0.9		-0.3	-0.9	-0.3		-0.4	-0.8	-0.6	0.0	-0.5	-1.1	-0.4	-0.3
111	2203-FM																		
112	2203-FM																		
113	2203-FM		2.6	2.6	2.7	2.7		0.7	6.6	0.4		0.5	1.4	6.6	1.0	1.9	3.6	1.4	1.1
114	2203-FM																		
27A	2203-FM		-2.0	-2.0	-1.9	-1.9		-1.4	-1.3	-1.2		-1.4	-1.3	-0.8	-0.5	0.7	82.8	-1.1	-0.1
69A	2203-FM		0.6	0.6	0.6	0.6		0.3	1.5	0.2		1.1	0.3	0.4	0.0	0.3	0.2	0.2	0.7

EURL Proficiency Study on the Determination of PCDD/Fs, PCBs, PBDEs, HBCDDs and PFASs in Fish Meal 2022 [EURL-PT-POP_2203-FM]
EURL for halogenated Persistent Organic Pollutants (POPs) in Feed and Food

Fish Meal (2203-FM)
Non dioxin-like PCB - Z-scores

LC	Sample	Z-score [σ_p = 15 %]	Sum Indicator PCBs reported upper bound	Sum Indicator PCBs reported lower bound	Sum Indicator PCBs calculated upper bound	Sum Indicator PCBs calculated lower bound	Z-score [σ_p = 20 %]	PCB 28	PCB 52	PCB 101	PCB 138	PCB 153	PCB 180
1	2203-FM												
2	2203-FM		-3.9	-4.0	-3.9	-4.0		4.0	-1.8	-2.4	-1.0		-2.8
3	2203-FM		0.4	0.5	0.5	0.6		2.4	1.6	0.9	-0.1	0.8	-0.2
4	2203-FM		-0.1	0.0	-0.1	0.0		0.1	-0.2	0.0	0.0	0.0	0.3
5	2203-FM		-0.4	-0.3	-0.4	-0.3		-1.3	-1.0	-1.0	0.8	-0.4	-0.8
6	2203-FM		0.0	0.0	-0.1	0.1		-0.7	-0.1	-0.1	0.0	0.1	0.2
7	2203-FM		0.0	0.1	0.0	0.1		-0.4	0.1	0.3	-0.1	0.2	-0.1
8	2203-FM												
9	2203-FM		0.1	0.2	0.1	0.2		1.7	-0.8	-1.4	3.6	-2.1	1.6
10	2203-FM		-1	-1	-1	-1		-1.9	-0.8	-0.6	-1	0	-0.5
11	2203-FM		0.2	0.3	0.2	0.3		0.7	0.0	0.3	0.3	0.3	0.1
12	2203-FM		-0.2	-0.1	-0.2	-0.1		0.4	-0.8	-0.5	-0.2	0.2	0.0
13	2203-FM		0	0.1	0	0.1		1.8	-0.5	0.3	-1.2	0.9	-0.1
14	2203-FM												
15	2203-FM		-0.2	-0.1	-0.2	-0.1		-1.0	-0.3	0.0	-0.2	0.1	0.0
16	2203-FM		-0.6	-1.2	-0.6	-1.2				-0.5	0.9	-1.7	-0.9
17	2203-FM		-0.4	-0.4	-0.5	-0.3		-1.2	-0.4	0.0	-0.3	-0.2	-0.3
18	2203-FM												
19	2203-FM												
20	2203-FM												
21	2203-FM		-0.3	-0.2	-0.3	-0.2		-0.9	0.2	0.2	0.4	-0.7	0.3
22	2203-FM		-1.6	-1.6	-1.7	-1.6		12.1	0.1	-1.1	-1.4	-1.5	-1.9
23	2203-FM		-0.1	0.0	-0.1	0.1		-0.9	-0.2	0.3	-0.2	0.1	0.3
24	2203-FM		7.8	8.0	7.8	8.1		17.4	9.4	4.5	7.2	4.1	8.5
25	2203-FM		0.9	1.0	0.9	1.0		2.4	-0.1	0.0	2.1	0.4	-0.3
26	2203-FM		-0.3	-0.2	-0.3	-0.2		1.1	0.4	-0.2	0.5	-0.6	-0.4
27	2203-FM												
28	2203-FM		0	0.3	0.2	0.3		-0.8	-0.1	-0.3	0.7	0.2	0.4
29	2203-FM		-0.8	-0.7	-0.8	-0.7		-0.8	-0.9	-0.7	-0.7	-0.3	-0.4
30	2203-FM		6.8	5.8	6.8	5.9			22.3	18.9	3.1	-0.4	3.3
31	2203-FM		0.2	0.3	0.2	0.3		-1.0	-0.2	0.1	1.2	-0.2	0.0
32	2203-FM		0	0	0	0		-1.0	-0.1	0.6	-1.8	1.2	0.3
33	2203-FM		0.7	0.7	0.8	0.9		4.3	1.8	0.4	0.8	0.6	0.2
34	2203-FM		-1.1		-1.1	-1.0		-1.3	-0.3	-0.4	-0.7	-0.8	-0.8
35	2203-FM												
36	2203-FM		-0.7	-0.6	-0.7	-0.6		-0.9	-0.5	0.0	-0.6	-0.4	-0.5
37	2203-FM		0.1	0.2	0.1	0.2		1.4	-1.3	-0.5	2.1	-0.6	-0.6
38	2203-FM												
39	2203-FM		-0.4	-0.3	-0.4	-0.3		0.4	-0.7	0.0	-0.3	-0.2	0.0
41	2203-FM												
42	2203-FM												
43	2203-FM		0.5	0.6	0.5	0.6		2.5	-0.5	0.0	-0.4	1.4	0.0
44	2203-FM		-0.6		-0.1	-0.8				0.5	-0.6	-0.4	0.0
45	2203-FM												
46	2203-FM		0.2	0.2	0.1	0.3		0.6	-0.5	-0.2	-0.1	0.5	0.5
47	2203-FM		2.3	1.6	2.3	1.6				1.4	2.0	1.3	2.0
48	2203-FM		-0.1	0.0	-0.1	0.0		0.0	-0.5	-0.2	0.0	0.2	0.2
49	2203-FM		-0.6	-0.5	-0.6	-0.4		3.2	-0.4	0.6	-0.1	-1.0	-0.1
50	2203-FM		0.4	0.5	0.4	0.6		0.4	0.3	0.9	0.1	0.5	0.7
51	2203-FM												
52	2203-FM		0.3	0.3	0.4	0.3			-0.4	0.8	0.6	0.2	0.2
53	2203-FM		0.6	0.7	0.5	0.7		-0.2	0.1	0.5	0.6	0.5	0.6
54	2203-FM												
55	2203-FM		-0.7	-0.6	-0.7	-0.6		-1.5	-0.7	-0.3	-0.6	-0.4	-0.2
56	2203-FM												
57	2203-FM												
58	2203-FM		0.3	0.4	0.2	0.4		0.2	0.3	0.3	0.1	0.3	0.5
59	2203-FM		-0.2	-0.1	-0.2	-0.1		-0.4	-0.2	-0.1	-0.2	0.1	-0.1
60	2203-FM		0.0	0.1	0.0	0.1		-0.2	-1.4	-1.7	1.2	0.4	-0.8
61	2203-FM		-0.7	-0.7	-0.7	-0.6		2.0	-1.1	-0.8	-0.2	-0.5	-0.7
62	2203-FM		-0.1	0.0	-0.1	0.0		-1.5	-0.5	-0.2	0.1	0.2	-0.2
63	2203-FM		0.4	0.5	0.4	0.5		0.4	-0.1	0.4	0.6	0.3	0.5
64	2203-FM		0.4	0.5	0.4	0.6		0.0	0.0	0.5	0.3	0.7	0.0
65	2203-FM		0.4	0.2	0.4	0.2		3.7		0.9	1.0	-0.3	0.2
66	2203-FM		0.6	0.5	0.6	0.5			0.8	0.9	0.4	0.7	-0.2
67	2203-FM		-2.0	-2.7	-2.0	-2.7				-0.9	-1.3	-2.2	-2.7
68	2203-FM												
69	2203-FM												
70	2203-FM		-0.8	-0.7	-0.8	-0.7		-1.9	-1.0	0.9	-0.2	-0.8	-1.1
71	2203-FM		0.8	0.1	0.8	0.1				-0.6	2.0	0.1	-0.6
72	2203-FM												
73	2203-FM		1.0	0.4	1.0	0.4				0.0	2.0	0.3	-0.4
74	2203-FM		0.4	0.5	0.4	0.5		-0.2	0.3	0.3	0.4	0.5	0.4
75	2203-FM		0.4	0.5	0.4	0.5		0.8	0.3	0.6	0.0	0.7	0.0

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EURL for halogenated Persistent Organic Pollutants (POPs) in Feed and Food

Fish Meal (2203-FM)
Non dioxin-like PCB - Z-scores

LC	Sample	Z-score [σ_p = 15 %]	Sum Indicator PCBs reported upper bound	Sum Indicator PCBs reported lower bound	Sum Indicator PCBs calculated upper bound	Sum Indicator PCBs calculated lower bound	Z-score [σ_p = 20 %]	PCB 28	PCB 52	PCB 101	PCB 138	PCB 153	PCB 180
76	2203-FM		-0.7	-1.0	-0.3	-1.0				-1.0	0.7	-0.8	-1.3
77	2203-FM		-1.9	-1.8	-1.9	-1.8		-2.3	-1.6	-1.4	-1.7	-1.1	-1.0
78	2203-FM												
79	2203-FM		-0.4	-0.4	-0.4	-0.4			-1.4	0.0	-0.1	-0.5	0.6
80	2203-FM		2.3	1.7	2.3	1.7				0.7	3.6	1.0	0.7
81	2203-FM												
82	2203-FM		1.3	0.6	1.3	0.6				0.9	0.9	0.9	0.3
83	2203-FM		-0.4	-0.3	-0.4	-0.3		0.2	0.6	0.5	-0.6	-0.3	0.3
84	2203-FM												
85	2203-FM		-0.8	-0.7	-0.9	-0.7		-1.2	-0.3	-0.2	-0.8	-0.6	-0.4
86	2203-FM		2.0	2.2	2.0	2.2		-0.3	0.9	0.7	0.9	2.7	1.8
87	2203-FM		-0.8	-0.7	-0.8	-0.7		-1.8	-1.6	-0.4	-1.2	-0.1	-0.1
88	2203-FM		-0.6	-0.5	-1.7	-1.6		-1.8	-1.7	-1.2	0.0	-1.8	-1.6
89	2203-FM		-0.6	-0.5	-0.6	-0.5		-0.8	-0.4	-0.4	-0.3	-0.3	-0.3
90	2203-FM		0.3	0.4	0.3	0.5		0.1	-0.7	-0.1	0.3	0.7	0.2
91	2203-FM		-0.6	-0.5	-0.6	-0.5		0.2	0.6	-0.4	-0.3	-0.3	-1.0
92	2203-FM		0.2	0.3	0.2	0.3		0.4	0.6	0.1	-0.1	0.4	0.4
93	2203-FM												
94	2203-FM		-0.3	-1.0	-0.7	-0.6		1.7	-1.1	0.6	-0.6	-0.9	0.1
95	2203-FM		-0.4	-0.3	-0.4	-0.3		-0.4	0.3	-0.1	-0.2	-0.5	0.6
96	2203-FM												
97	2203-FM		2.1	0.6	2.1	0.6				3.5	0.5	0.1	0.7
98	2203-FM		1.2	0.5	1.2	0.6				0.6	1.0	0.8	0.7
99	2203-FM		-0.8	-0.7	-0.8	-0.7		1.4	-0.7	-0.1	-1.0	-0.3	-0.8
100	2203-FM		0	0	0	0.4		0.1	0.5	0.4	-0.9	0.4	2.5
101	2203-FM												
102	2203-FM		-0.1	0.0	-0.2	-0.1		-0.3	-1.3	-0.9	-0.4	0.7	-0.1
103	2203-FM												
104	2203-FM		0.7	-0.2	0.7	-0.1				0.7	-0.1	0.4	0.0
105	2203-FM		0.2	0.3	0.2	0.4		1.4	-0.4	0.9	0.1	0.3	0.2
106	2203-FM		0.7	0.8	0.7	0.9		-0.3	0.4	0.5	0.4	1.0	0.6
107	2203-FM		6.9	4.7	6.9	4.8			20.6	17.3	5.6	-0.6	
108	2203-FM												
109	2203-FM		-0.5	-0.4	-0.5	-0.4		-1.5	-0.7	-0.2	-0.4	-0.1	-0.5
110	2203-FM		-0.2	-0.1	-0.2	-0.1		-0.4	-0.8	-0.1	-0.2	0.0	0.2
111	2203-FM		0.6	0.7	0.6	0.7		-0.2	0.2	0.3	3.3	-1.0	0.3
112	2203-FM		-0.2	-0.3	-0.2	-0.3			-1.1	-0.6	0.6	-0.2	-0.4
113	2203-FM		0.7	0.8	0.6	0.8		1.7	4.6	1.4	-0.2	0.5	0.4
114	2203-FM		0.9	0.2	0.9	0.3				0.5	0.3	0.6	0.9
37A	2203-FM		1.0	0.4	1.0	0.4				-0.5	2.9	-0.4	0.2
75A	2203-FM		0.3	0.3	0.3	0.3			-0.3	0.6	-0.3	0.8	-0.1

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EURL for halogenated Persistent Organic Pollutants (POPs) in Feed and Food

Fish Meal (2203-FM)
Bioanalytical screening methods - Bioassay-scores

LC	Sample	Bioassay-score [$\sigma_{bioassay}$ = 20 %]	PCDD/F + DL-PCB	PCDD/F	DL-PCB
1	2203-FM				
2	2203-FM				
3	2203-FM				
4	2203-FM				
5	2203-FM				
6	2203-FM				
7	2203-FM				
8	2203-FM				
9	2203-FM				
10	2203-FM				
11	2203-FM				
12	2203-FM				
13	2203-FM				
14	2203-FM				
15	2203-FM				
16	2203-FM				
17	2203-FM				
18	2203-FM				
19	2203-FM				
20	2203-FM				
21	2203-FM				
22	2203-FM				
23	2203-FM				
24	2203-FM				
25	2203-FM				
26	2203-FM				
27	2203-FM				
28	2203-FM				
29	2203-FM				
30	2203-FM				
31	2203-FM				
32	2203-FM				
33	2203-FM				
34	2203-FM				
35	2203-FM				
36	2203-FM				
37	2203-FM				
38	2203-FM				
39	2203-FM				
41	2203-FM				
42	2203-FM				
43	2203-FM				
44	2203-FM				
45	2203-FM				
46	2203-FM		1.1	1.4	1.1
47	2203-FM				
48	2203-FM				
49	2203-FM				
50	2203-FM		4.2	5.5	3.1
51	2203-FM				
52	2203-FM				
53	2203-FM				
54	2203-FM				
55	2203-FM				
56	2203-FM				
57	2203-FM				
58	2203-FM				
59	2203-FM		3.9		
60	2203-FM		0.3		
61	2203-FM				
62	2203-FM				
63	2203-FM				
64	2203-FM				
65	2203-FM				
66	2203-FM				
67	2203-FM				
68	2203-FM				
69	2203-FM				
70	2203-FM				
71	2203-FM				
72	2203-FM				
73	2203-FM				
74	2203-FM				
75	2203-FM				

EURL Proficiency Study on the Determination of PCDD/Fs, PCBs, PBDEs, HBCDDs and PFASs in Fish Meal 2022 [EURL-PT-POP_2203-FM]
EURL for halogenated Persistent Organic Pollutants (POPs) in Feed and Food

Fish Meal (2203-FM)
Bioanalytical screening methods - Bioassay-scores

LC	Sample	Bioassay-score [$\sigma_{bioassay}$ = 20 %]	PCDD/F + DL-PCB	PCDD/F	DL-PCB
76	2203-FM				
77	2203-FM				
78	2203-FM		-1.8		
79	2203-FM				
80	2203-FM				
81	2203-FM				
82	2203-FM				
83	2203-FM		-2.9		
84	2203-FM				
85	2203-FM				
86	2203-FM				
87	2203-FM				
88	2203-FM				
89	2203-FM				
90	2203-FM				
91	2203-FM				
92	2203-FM				
93	2203-FM				
94	2203-FM				
95	2203-FM				
96	2203-FM				
97	2203-FM				
98	2203-FM				
99	2203-FM				
100	2203-FM				
101	2203-FM		-1.6	-1.2	-2.1
102	2203-FM				
103	2203-FM				
104	2203-FM				
105	2203-FM				
106	2203-FM				
107	2203-FM				
108	2203-FM				
109	2203-FM				
110	2203-FM				
111	2203-FM				
112	2203-FM				
113	2203-FM				
114	2203-FM				
78A	2203-FM		-1.8	-2.6	

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Fish Meal (2203-FM)
Moisture content - Results

LC	Sample	Z-score [σ_p = 10 %]	**Moisture content** [%] Physico-chemical methods	**Moisture content** [%] Bioanalytical methods	**Moisture content** [%] Mean
1	2203-FM				
2	2203-FM		0.8		0.8
3	2203-FM		0.0		0.0
4	2203-FM		1.8		1.8
5	2203-FM		0.0		0.0
6	2203-FM		0.1		0.1
7	2203-FM		-0.4		-0.4
8	2203-FM				
9	2203-FM		-0.9		-0.9
10	2203-FM		-0.5		-0.5
11	2203-FM		-0.1		-0.1
12	2203-FM		0.8		0.8
13	2203-FM		-0.7		-0.7
14	2203-FM				
15	2203-FM		-0.7		-0.7
16	2203-FM		-0.9	1.2	0.2
17	2203-FM		-1.3	-1.3	-1.3
18	2203-FM				
19	2203-FM				
20	2203-FM				
21	2203-FM		1.5		1.5
22	2203-FM		-10.0		-10.0
23	2203-FM				
24	2203-FM		0.0		0.0
25	2203-FM		-0.1		-0.1
26	2203-FM		0.1		0.1
27	2203-FM		0.6		0.6
28	2203-FM		-1.0		-1.0
29	2203-FM		0.1		0.1
30	2203-FM		0.1		0.1
31	2203-FM		0.5		0.5
32	2203-FM		-0.2		-0.2
33	2203-FM		0.2		0.2
34	2203-FM		-0.1		-0.1
35	2203-FM				
36	2203-FM		-0.3		-0.3
37	2203-FM		0.5		0.5
38	2203-FM				
39	2203-FM		-0.4		-0.4
41	2203-FM				
42	2203-FM				
43	2203-FM		0.5		0.5
44	2203-FM			0.0	0.0
45	2203-FM				
46	2203-FM		0.5	-0.4	0.0
47	2203-FM				
48	2203-FM		0.4		0.4
49	2203-FM		0.2		0.2
50	2203-FM		0.8	0.8	0.8
51	2203-FM				
52	2203-FM		0.1		0.1
53	2203-FM				
54	2203-FM				
55	2203-FM		-1.3		-1.3
56	2203-FM		0.0		0.0
57	2203-FM		-1.9		-1.9
58	2203-FM				
59	2203-FM		0.2		0.2
60	2203-FM		-0.5	-0.5	-0.5
61	2203-FM		0.0		0.0
62	2203-FM		0.7		0.7
63	2203-FM		-0.2		-0.2
64	2203-FM		0.4		0.4
65	2203-FM		-0.1		-0.1
66	2203-FM		73.4		73.4
67	2203-FM		0.0		0.0
68	2203-FM				
69	2203-FM		0.1		0.1
70	2203-FM		-0.2		-0.2
71	2203-FM		0.2		0.2
72	2203-FM				
73	2203-FM		0.2		0.2
74	2203-FM		0.2		0.2
75	2203-FM		0.2		0.2

EURL Proficiency Study on the Determination of PCDD/Fs, PCBs, PBDEs, HBCDDs and PFASs in Fish Meal 2022 [EURL-PT-POP_2203-FM]
EURL for halogenated Persistent Organic Pollutants (POPs) in Feed and Food

Fish Meal (2203-FM)
Moisture content - Results

LC	Sample	Z-score [σ_p = 10 %]	**Moisture content** [%] Physico-chemical methods	**Moisture content** [%] Bioanalytical methods	**Moisture content** [%] Mean
76	2203-FM		72.6	72.6	72.6
77	2203-FM		-1.7	-1.7	-1.7
78	2203-FM			0.3	0.3
79	2203-FM		0.7		0.7
80	2203-FM		0.2	0.2	0.2
81	2203-FM		73.0		73.0
82	2203-FM		0.5		0.5
83	2203-FM		0.2	0.2	0.2
84	2203-FM				
85	2203-FM		73.5		73.5
86	2203-FM		-0.2		-0.2
87	2203-FM		-0.8		-0.8
88	2203-FM		0.2		0.2
89	2203-FM		1.7		1.7
90	2203-FM		-8.1		-8.1
91	2203-FM		0.6		0.6
92	2203-FM		0.1		0.1
93	2203-FM				
94	2203-FM		0.0		0.0
95	2203-FM		2.1		2.1
96	2203-FM				
97	2203-FM		-1.0		-1.0
98	2203-FM		0.0		0.0
99	2203-FM		-0.3		-0.3
100	2203-FM		-1.6		-1.6
101	2203-FM				
102	2203-FM		-1.1		-1.1
103	2203-FM				
104	2203-FM		0.0		0.0
105	2203-FM		0.1		0.1
106	2203-FM		0.5		0.5
107	2203-FM		0.2		0.2
108	2203-FM				
109	2203-FM		0.0		0.0
110	2203-FM		-5.4		-5.4
111	2203-FM		-1.1		-1.1
112	2203-FM				
113	2203-FM		-0.7		-0.7
114	2203-FM		-0.2		-0.2
27A	2203-FM		0.5		0.5
37A	2203-FM		0.0		0.0
75A	2203-FM		0.2		0.2
78A	2203-FM			0.3	0.3
66*	2203-FM		0.0		0.0
81*	2203-FM		0.5		0.5

EURL Proficiency Study on the Determination of PCDD/Fs, PCBs, PBDEs, HBCDDs and PFASs in Fish Meal 2022 [EURL-PT-POP_2203-FM]

EURL for halogenated Persistent Organic Pollutants (POPs) in Feed and Food

12 June 2023

Annex 4: Participants' z-scores of PCDD/Fs and PCBs - Charts

Test sample - Fish Meal (2203-FM)

Z-scores of sum parameters and individual results

Calculation of z-score on basis of assigned value

$$z = (x - x_a) / \sigma_p$$

x_a: assigned value

x: participant's result

σ_p: fitness-for-purpose-based standard deviation for proficiency assessment

- 10%: WHO-PCDD/F-TEQ, WHO-PCB-TEQ and WHO-PCDD/F-PCB-TEQ
- 15%: Sum of six indicator PCBs (PCB 28, 52, 101, 138, 153, 180)
- 20%: Evaluated individual PCDD/F and PCB congeners

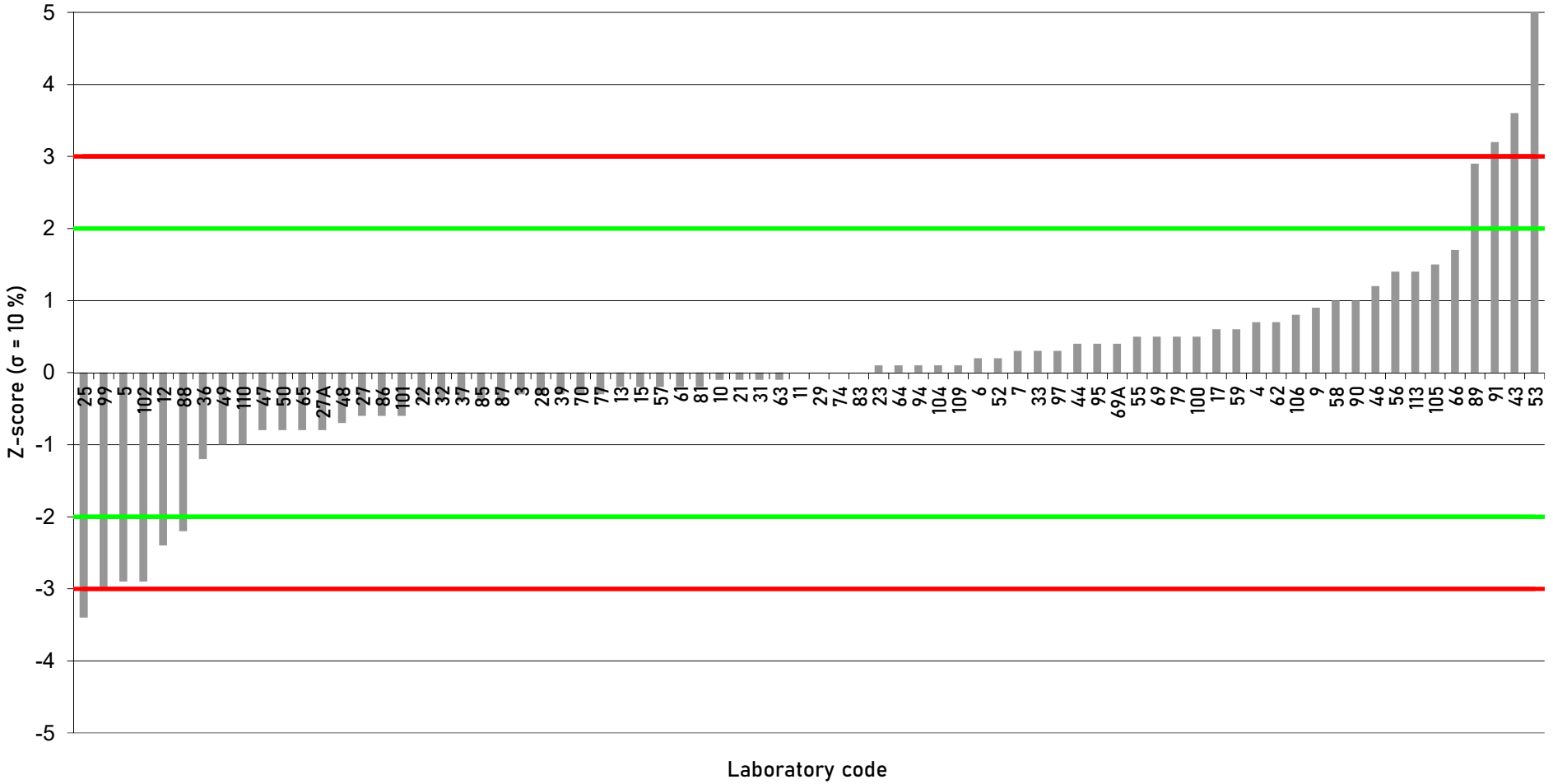
± 2 z-scores:

± 3 z-scores:

Fish Meal (2203-FM)

WHO-PCDD/F-PCB-TEQ upper bound (reported)

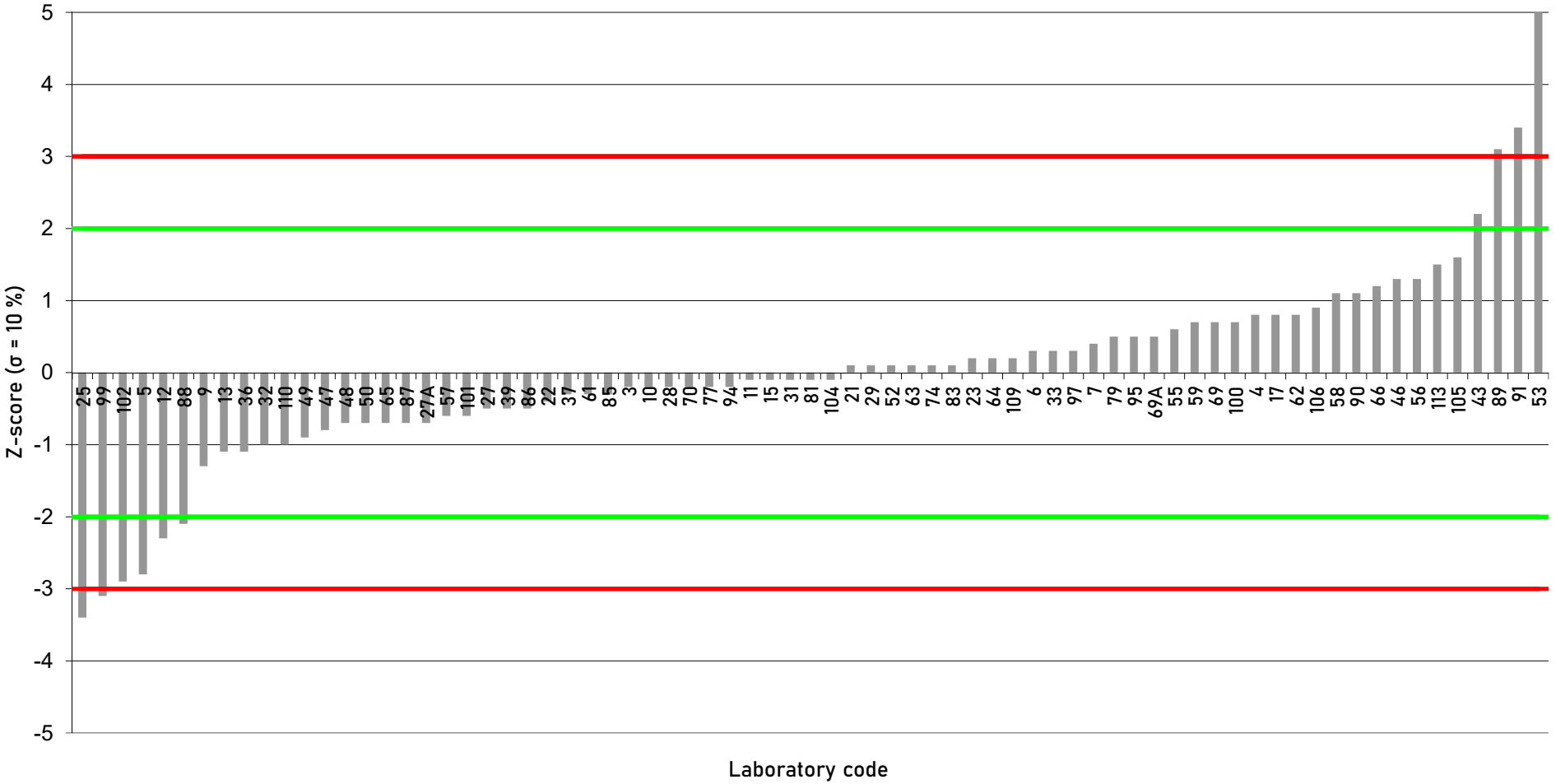
Assigned value: 1.85 ng/kg (12% moisture content)



Fish Meal (2203-FM)

WHO-PCDD/F-PCB-TEQ lower bound (reported)

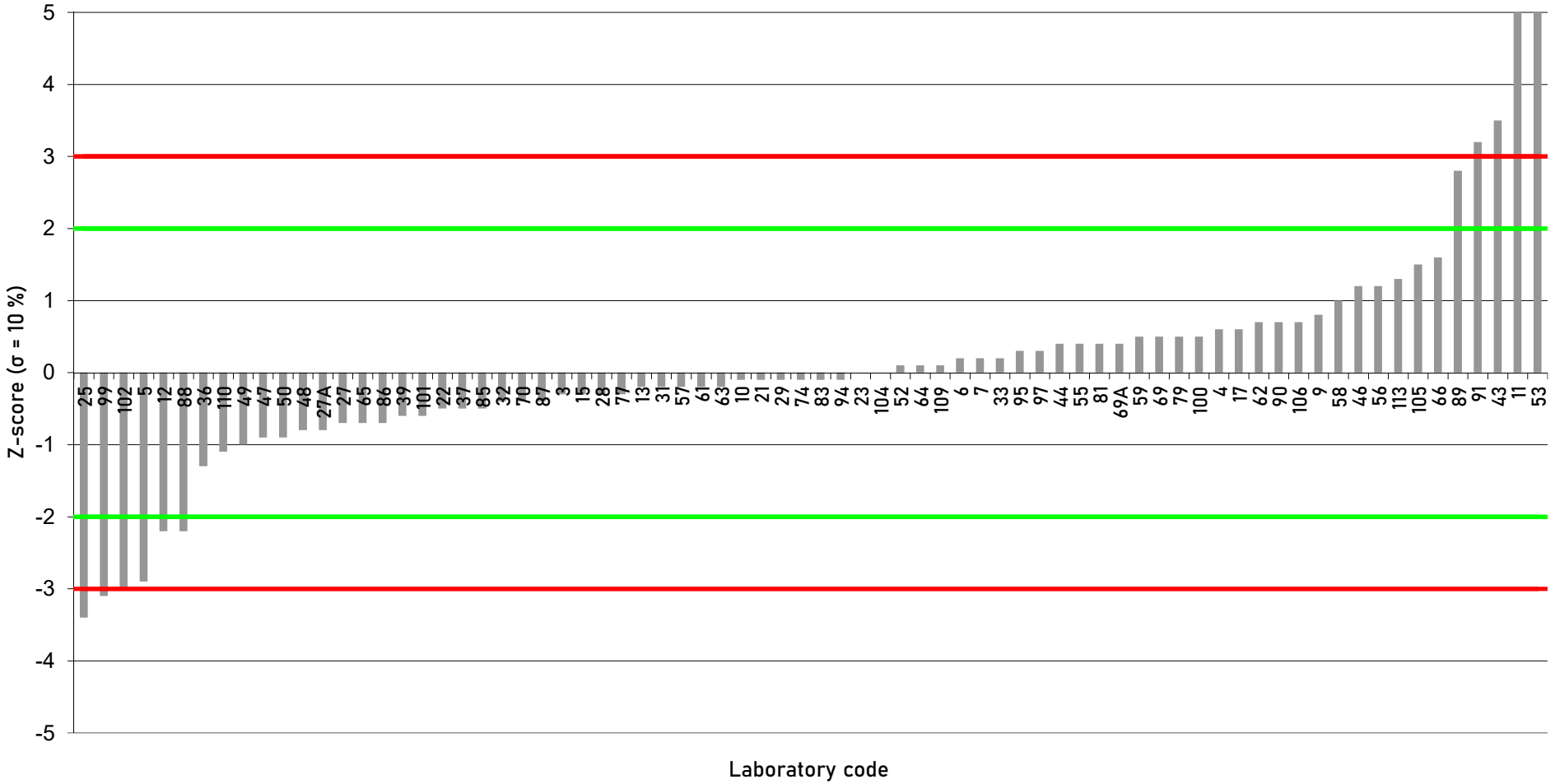
Assigned value: 1.83 ng/kg (12% moisture content)



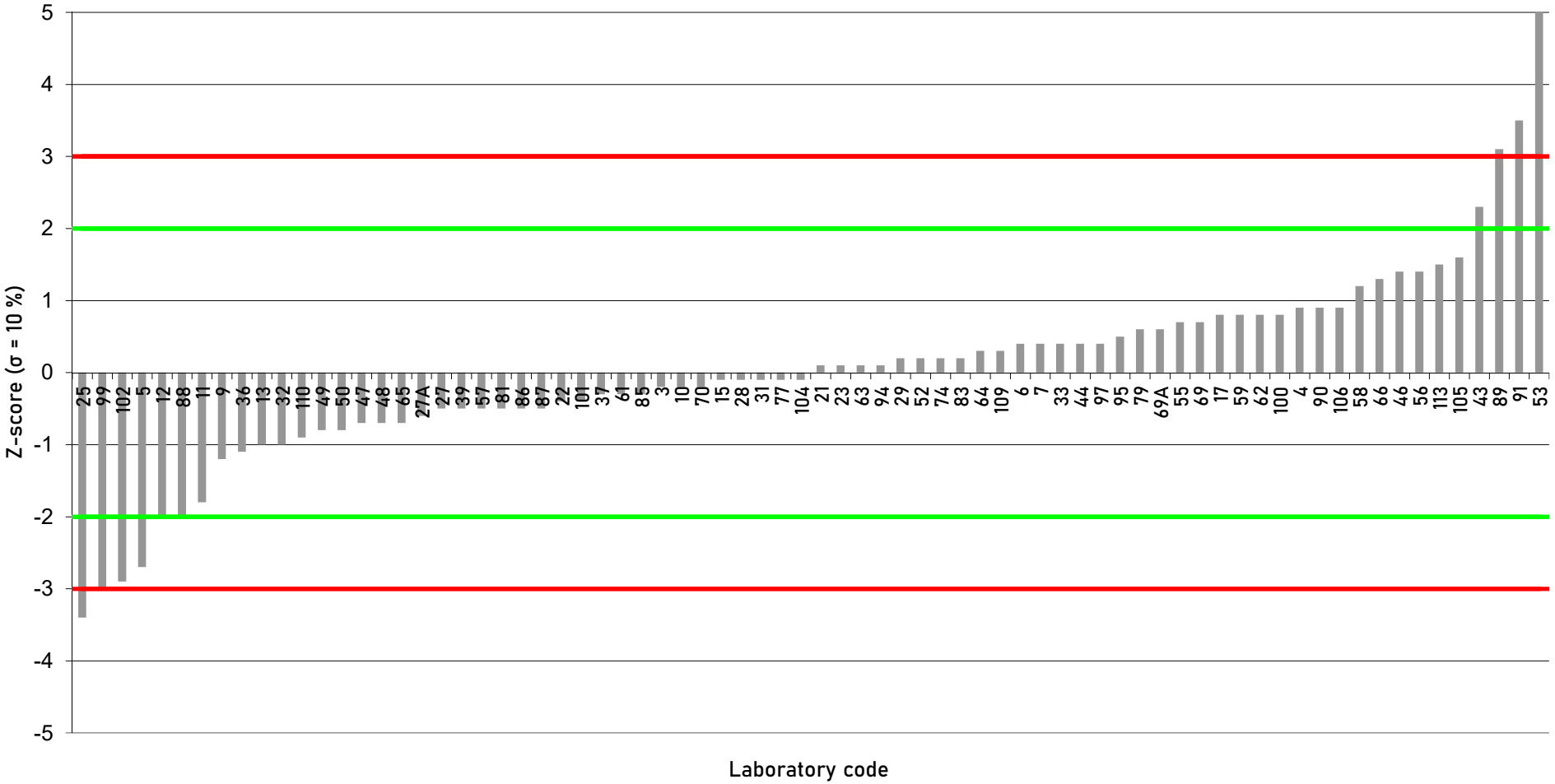
Fish Meal (2203-FM)

WHO-PCDD/F-PCB-TEQ upper bound (calculated)

Assigned value: 1.86 ng/kg (12% moisture content)



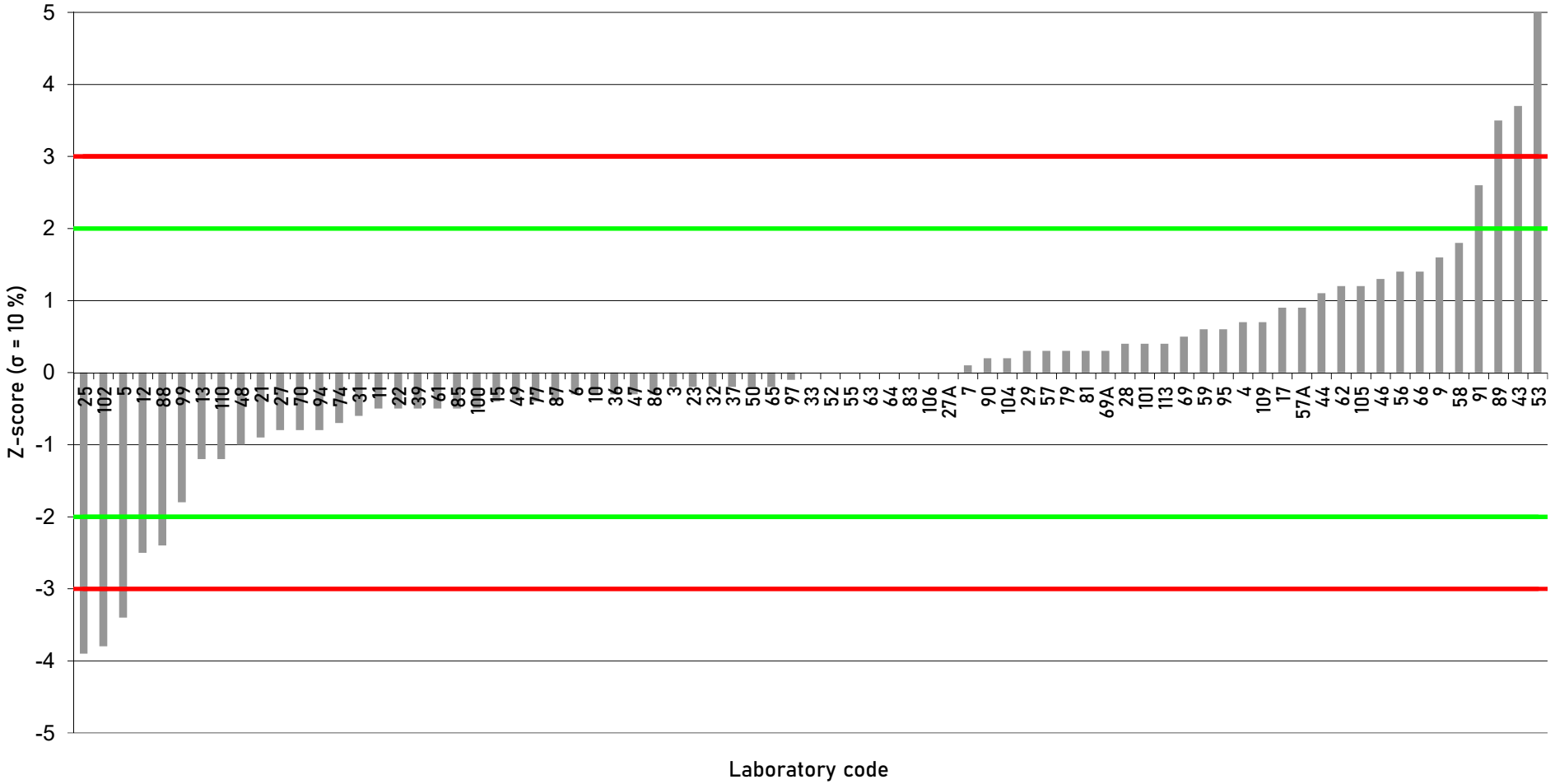
Fish Meal (2203-FM)
WHO-PCDD/F-PCB-TEQ lower bound (calculated)
Assigned value: 1.82 ng/kg (12% moisture content)



Fish Meal (2203-FM)

WHO-PCDD/F-TEQ upper bound (reported)

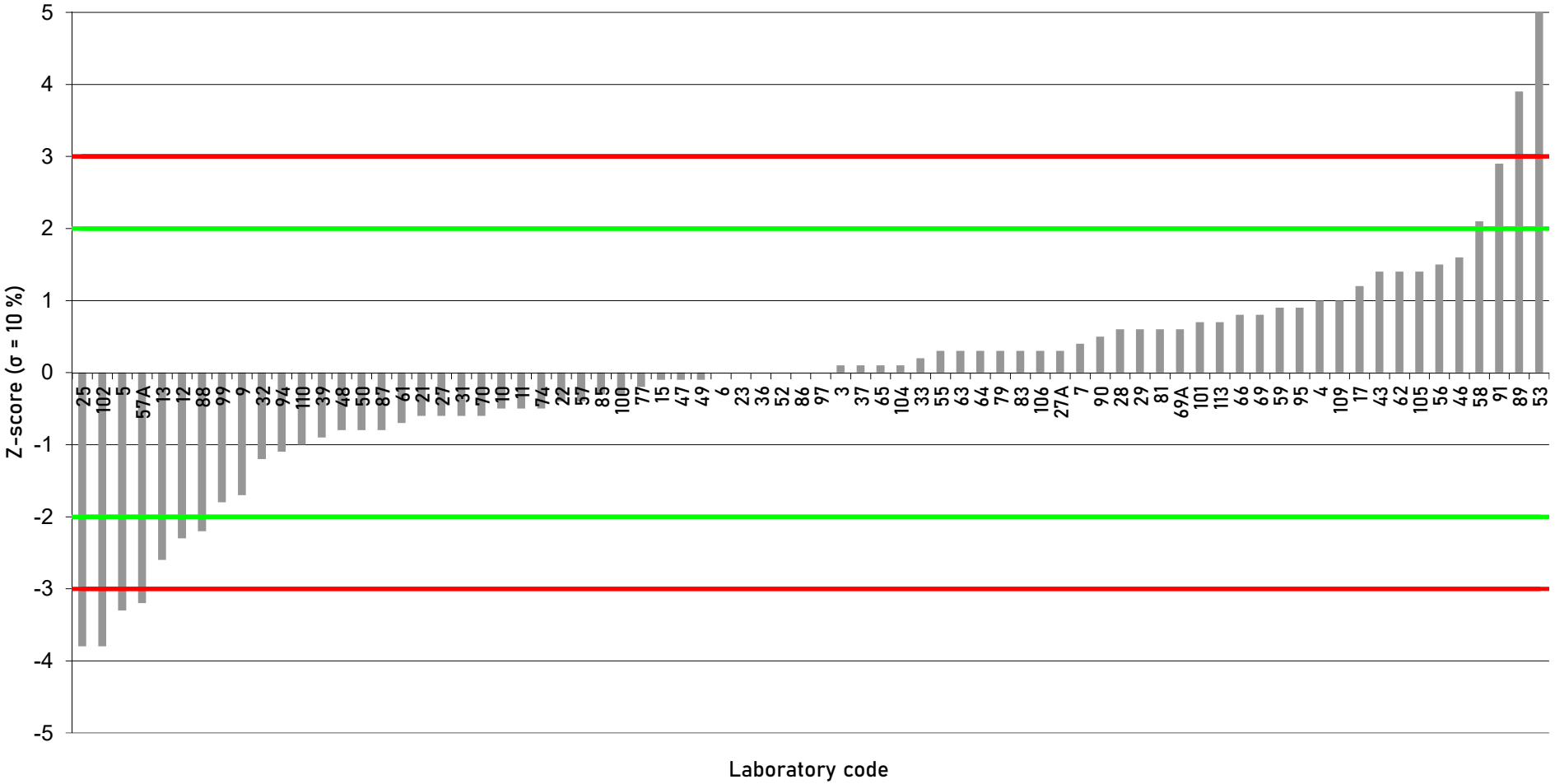
Assigned value: 1.12 ng/kg (12% moisture content)



Fish Meal (2203-FM)

WHO-PCDD/F-TEQ lower bound (reported)

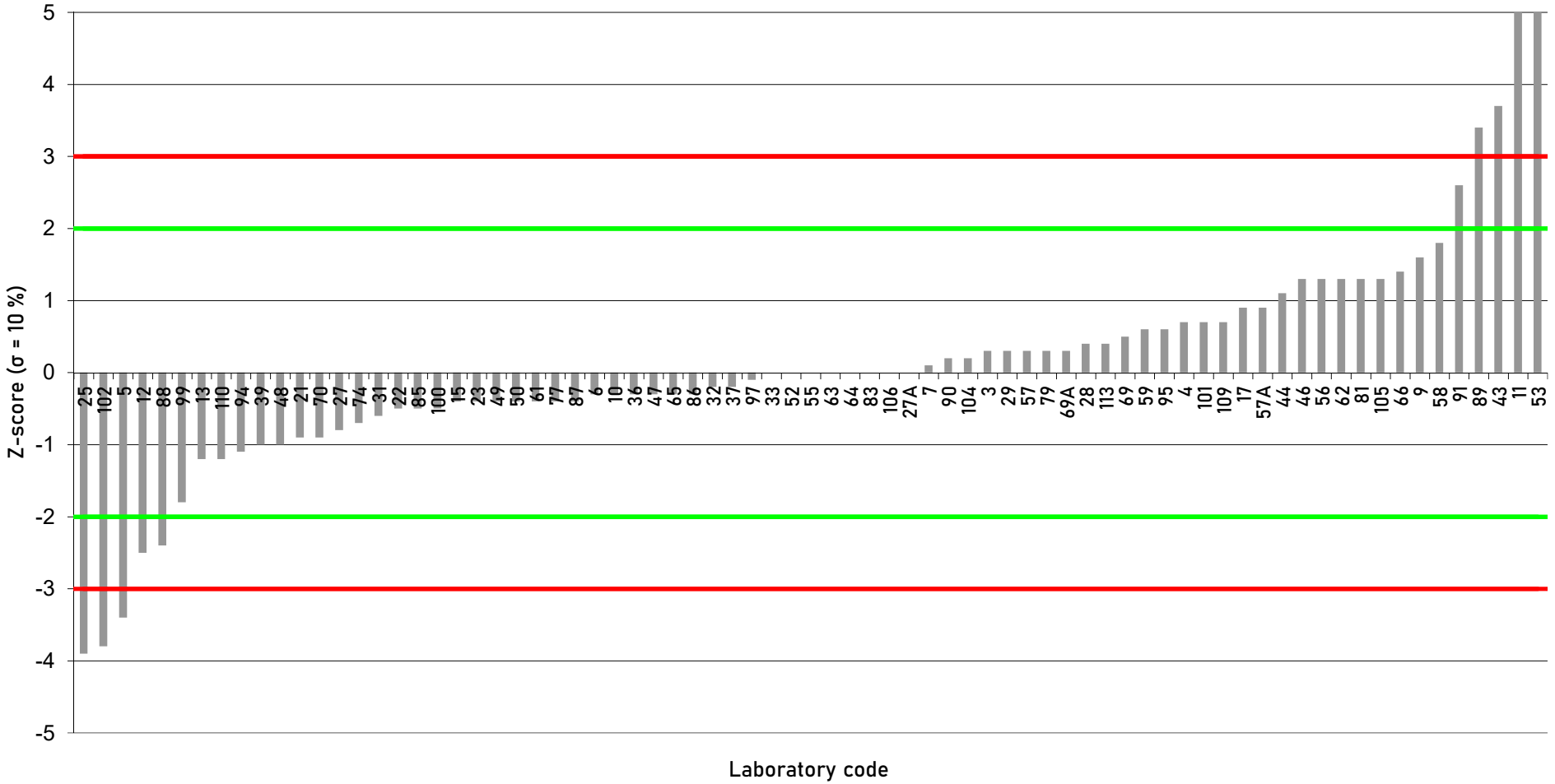
Assigned value: 1.09 ng/kg (12% moisture content)



Fish Meal (2203-FM)

WHO-PCDD/F-TEQ upper bound (calculated)

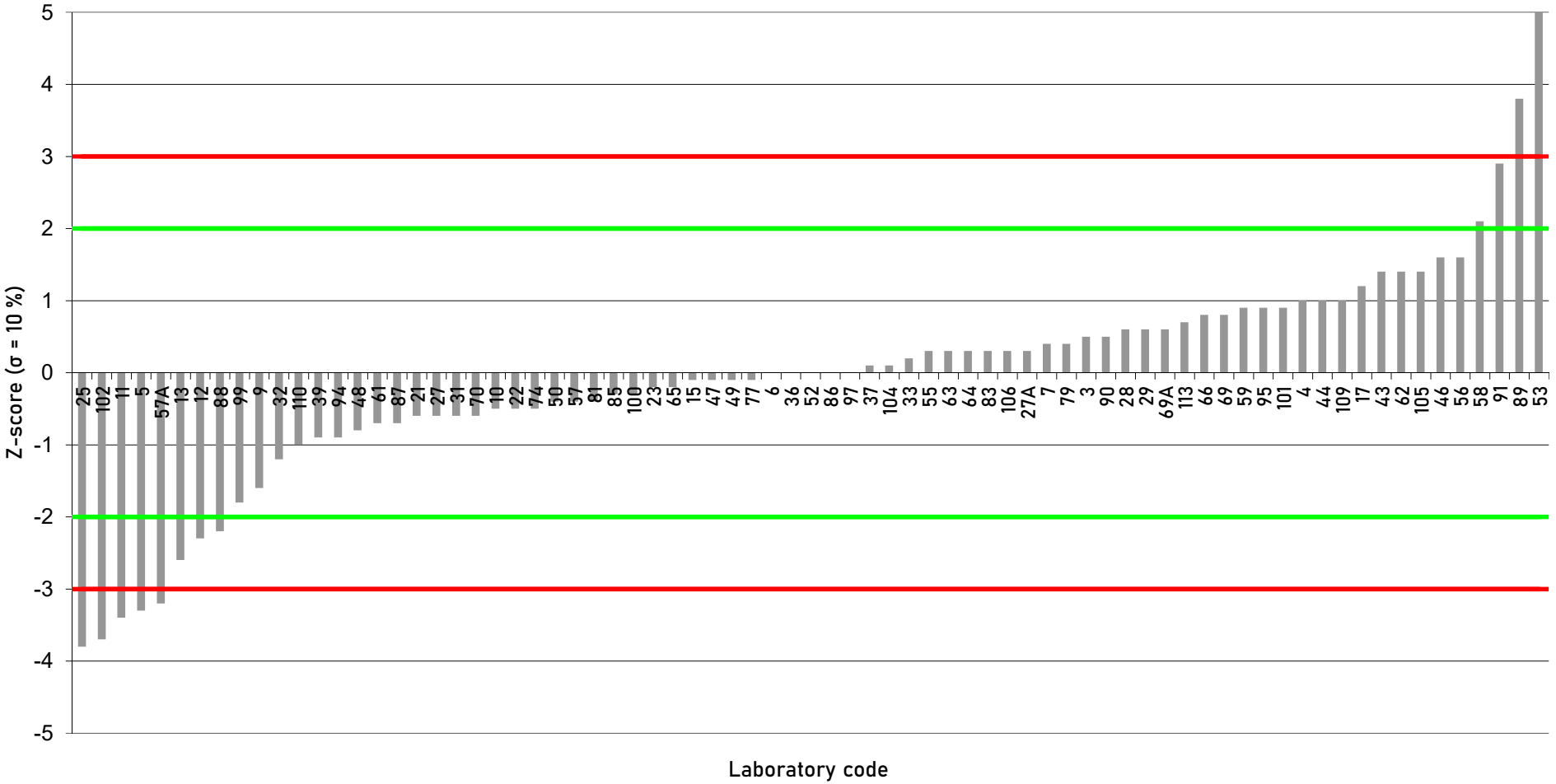
Assigned value: 1.12 ng/kg (12% moisture content)



Fish Meal (2203-FM)

WHO-PCDD/F-TEQ lower bound (calculated)

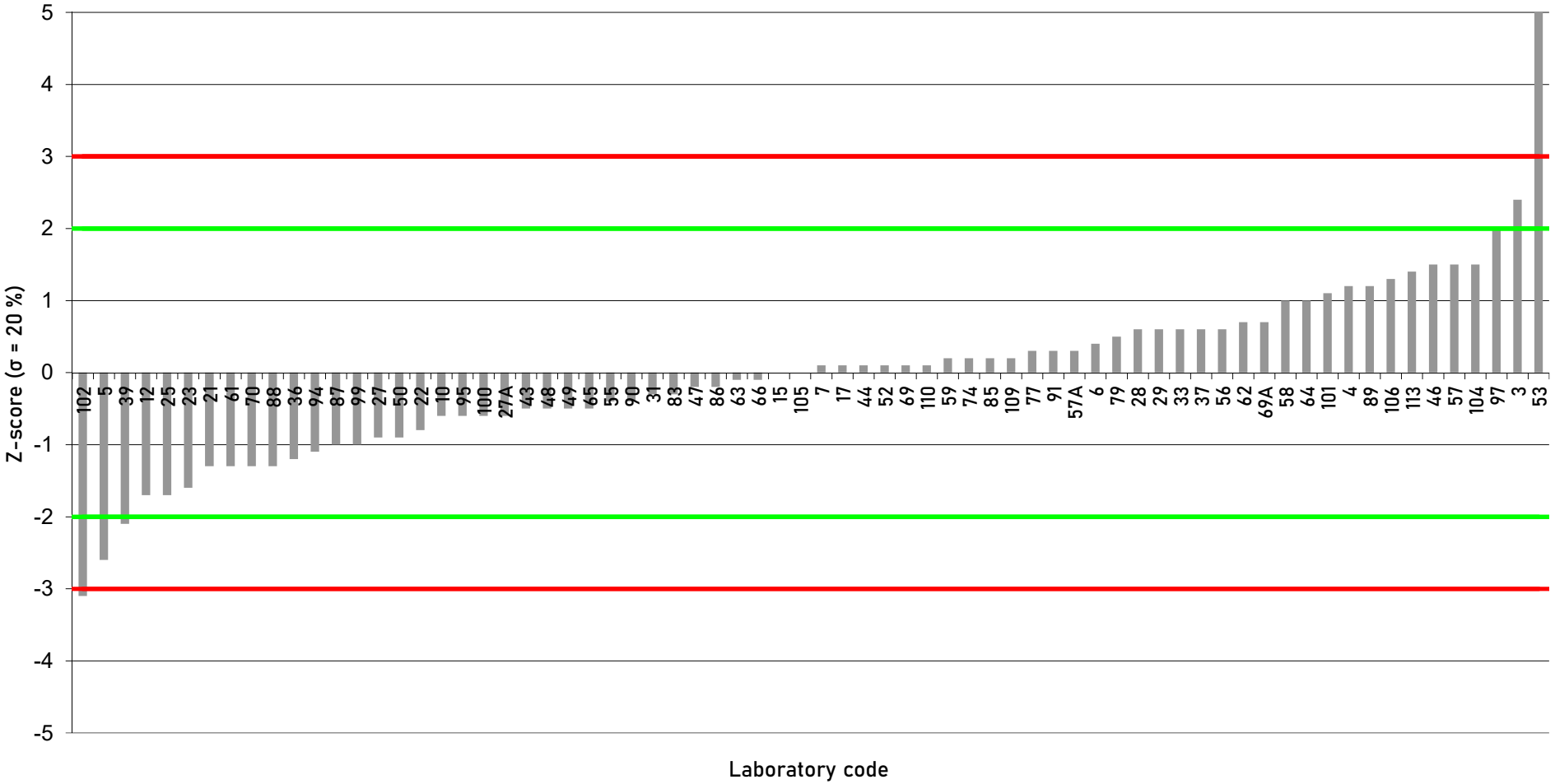
Assigned value: 1.09 ng/kg (12% moisture content)



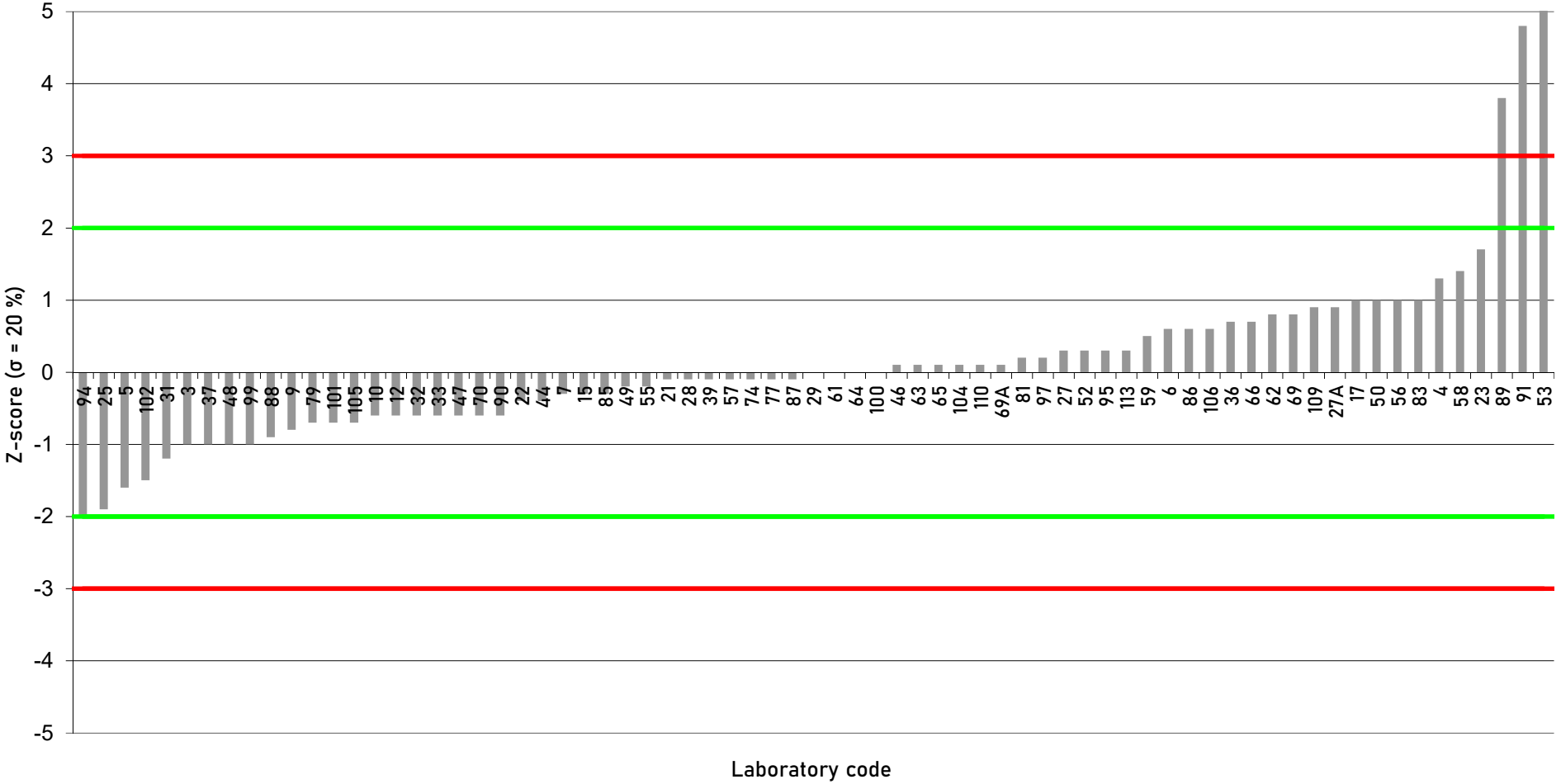
Fish Meal (2203-FM)

2,3,7,8-TCDD

Assigned value: 0.0881 ng/kg (12% moisture content)



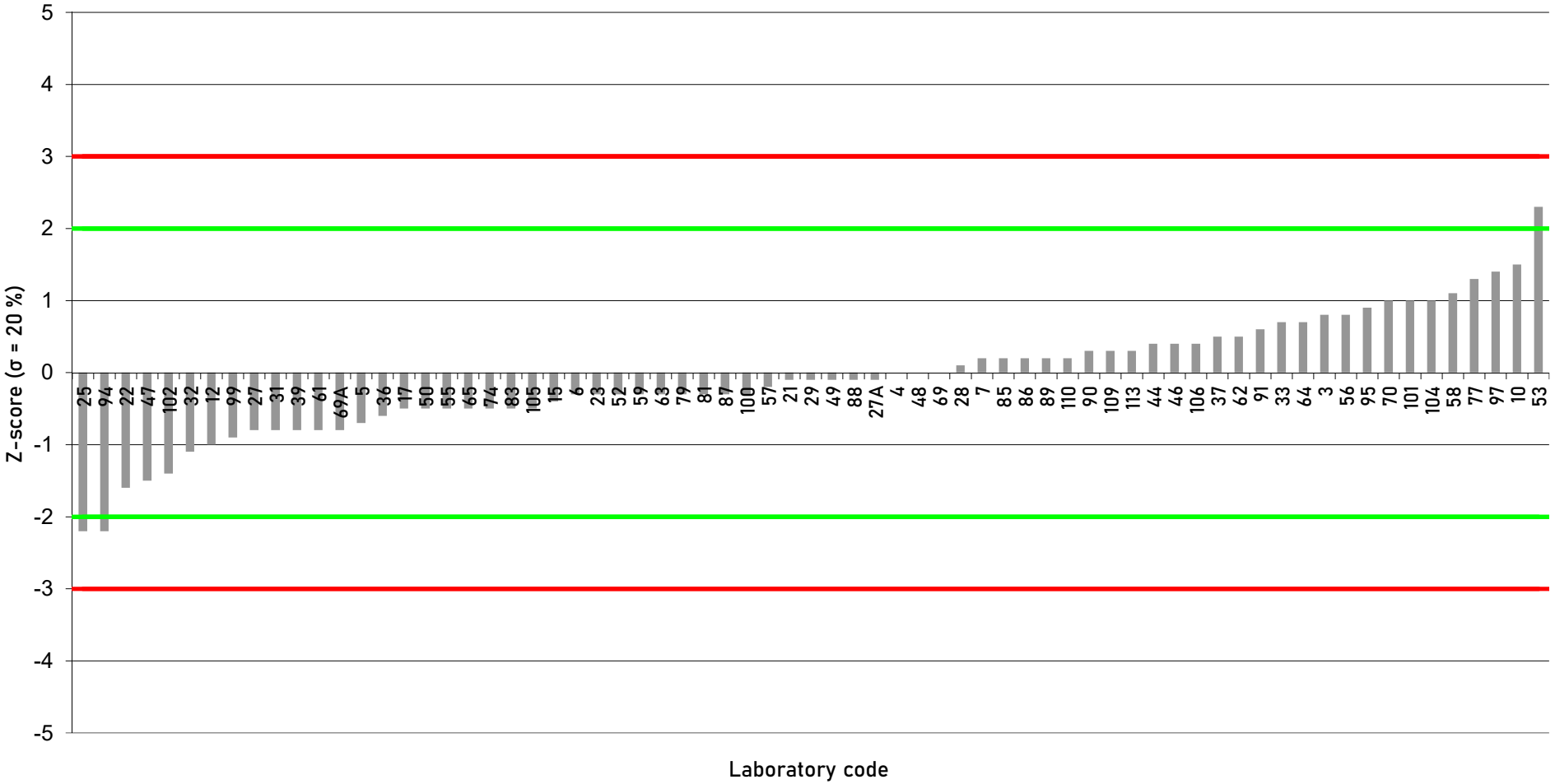
Fish Meal (2203-FM)
1,2,3,7,8-PeCDD
Assigned value: 0.215 ng/kg (12% moisture content)



Fish Meal (2203-FM)

1,2,3,6,7,8-HxCDD

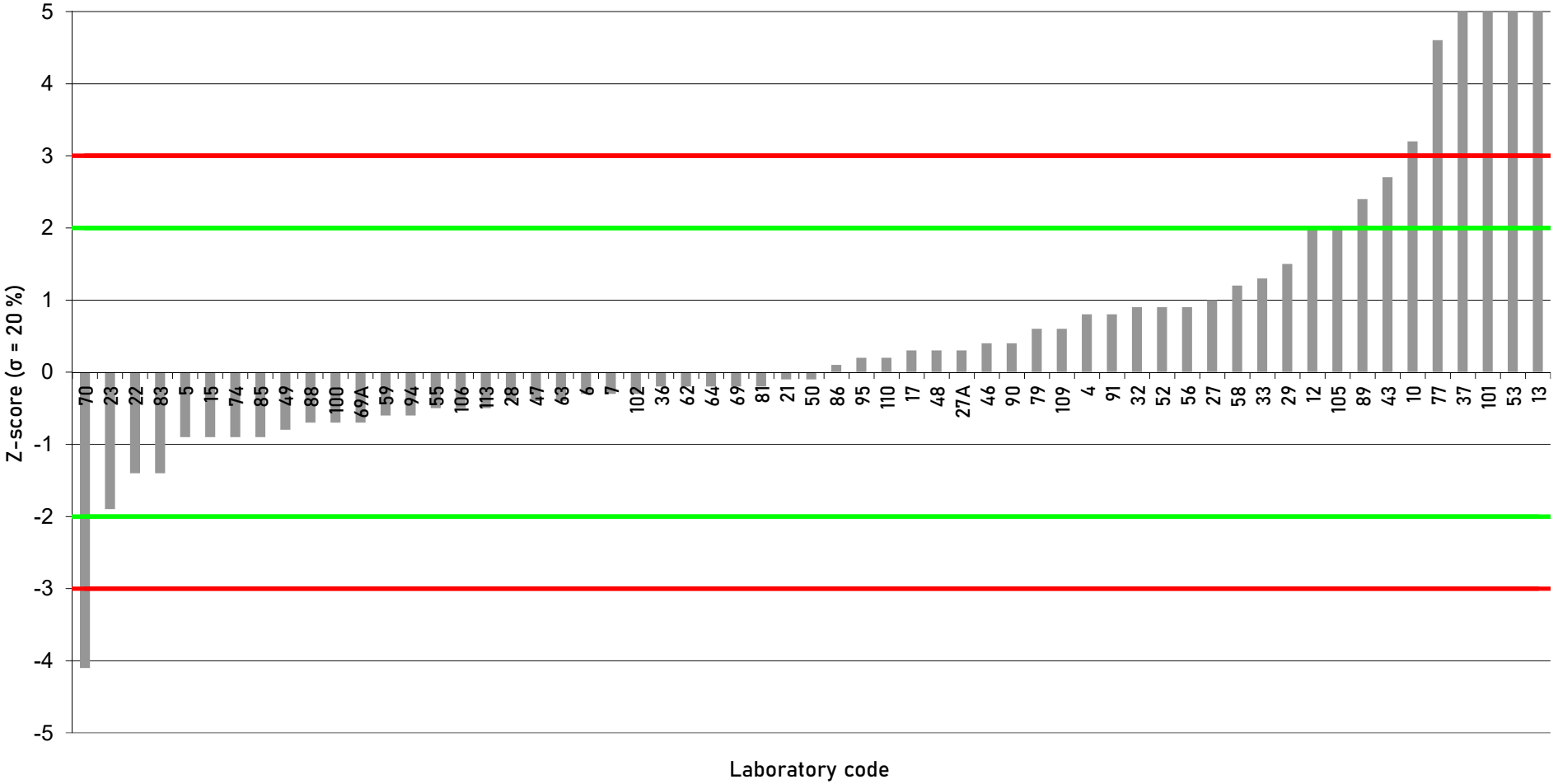
Assigned value: 0.2 ng/kg (12% moisture content)



Fish Meal (2203-FM)

1,2,3,4,6,7,8-HpCDD

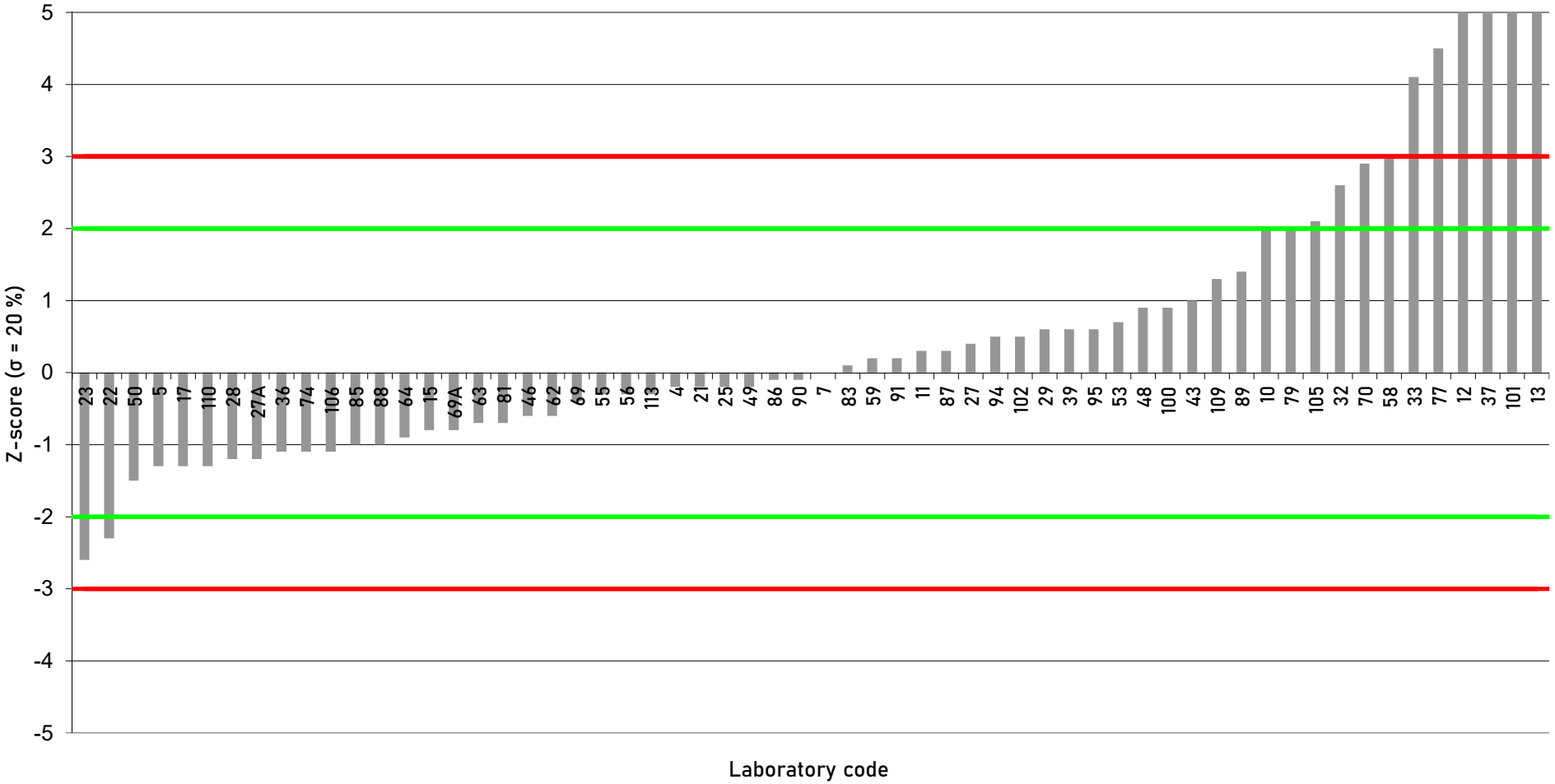
Assigned value: 0.094 ng/kg (12% moisture content)



Fish Meal (2203-FM)

OCDD

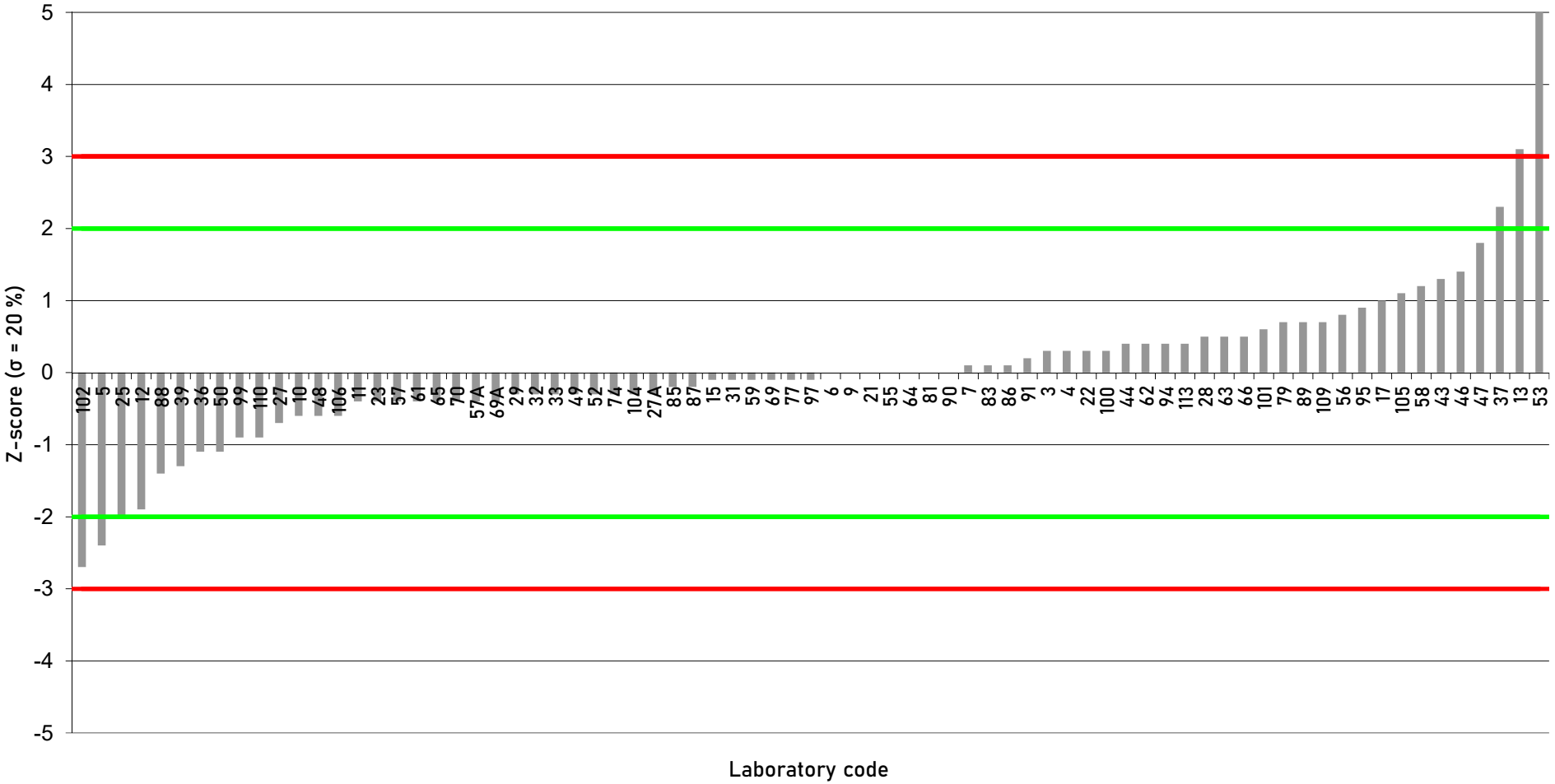
Assigned value: 0.227 ng/kg (12% moisture content)



Fish Meal (2203-FM)

2,3,7,8-TCDF

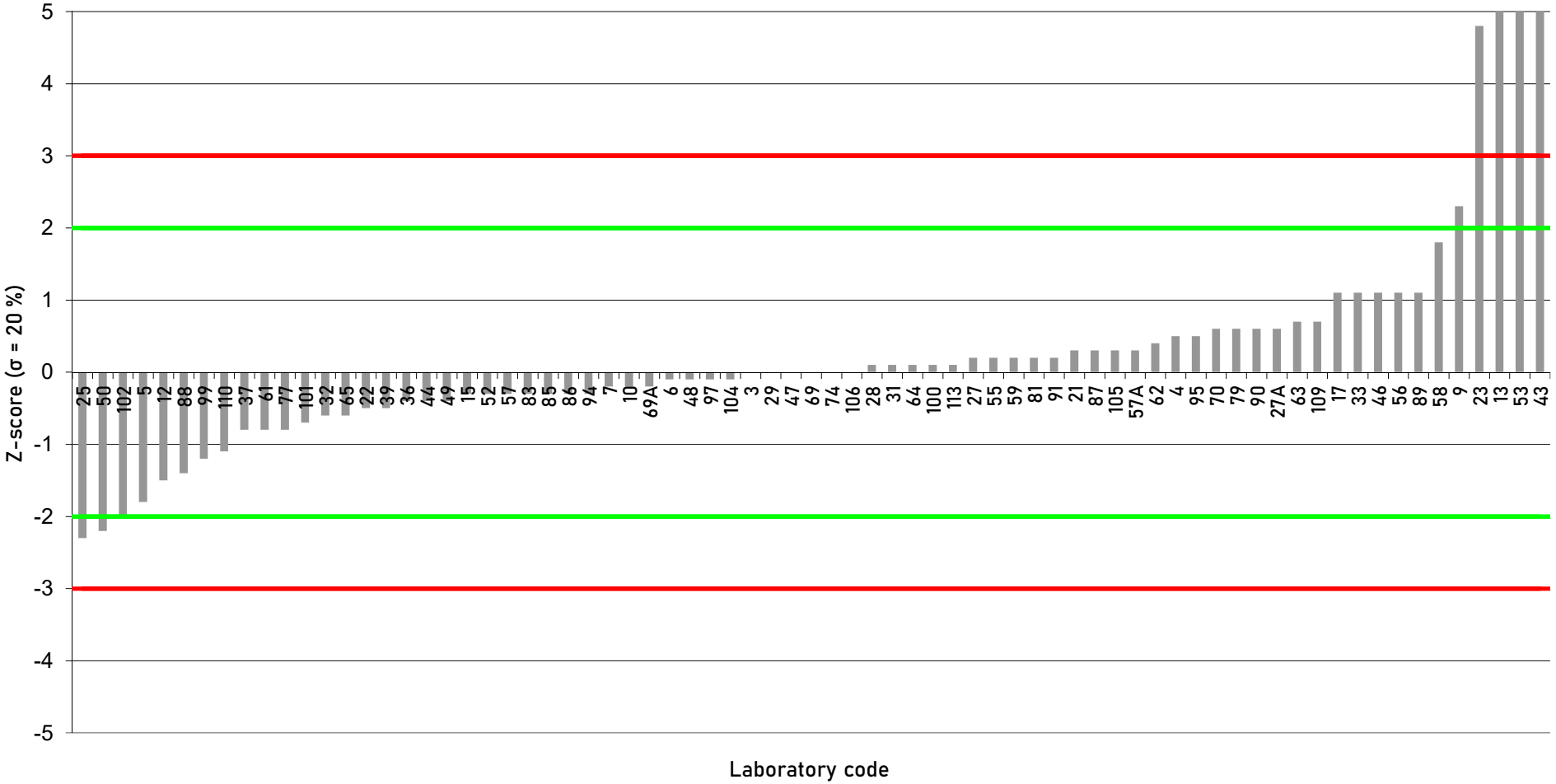
Assigned value: 1.52 ng/kg (12% moisture content)



Fish Meal (2203-FM)

1,2,3,7,8-PeCDF

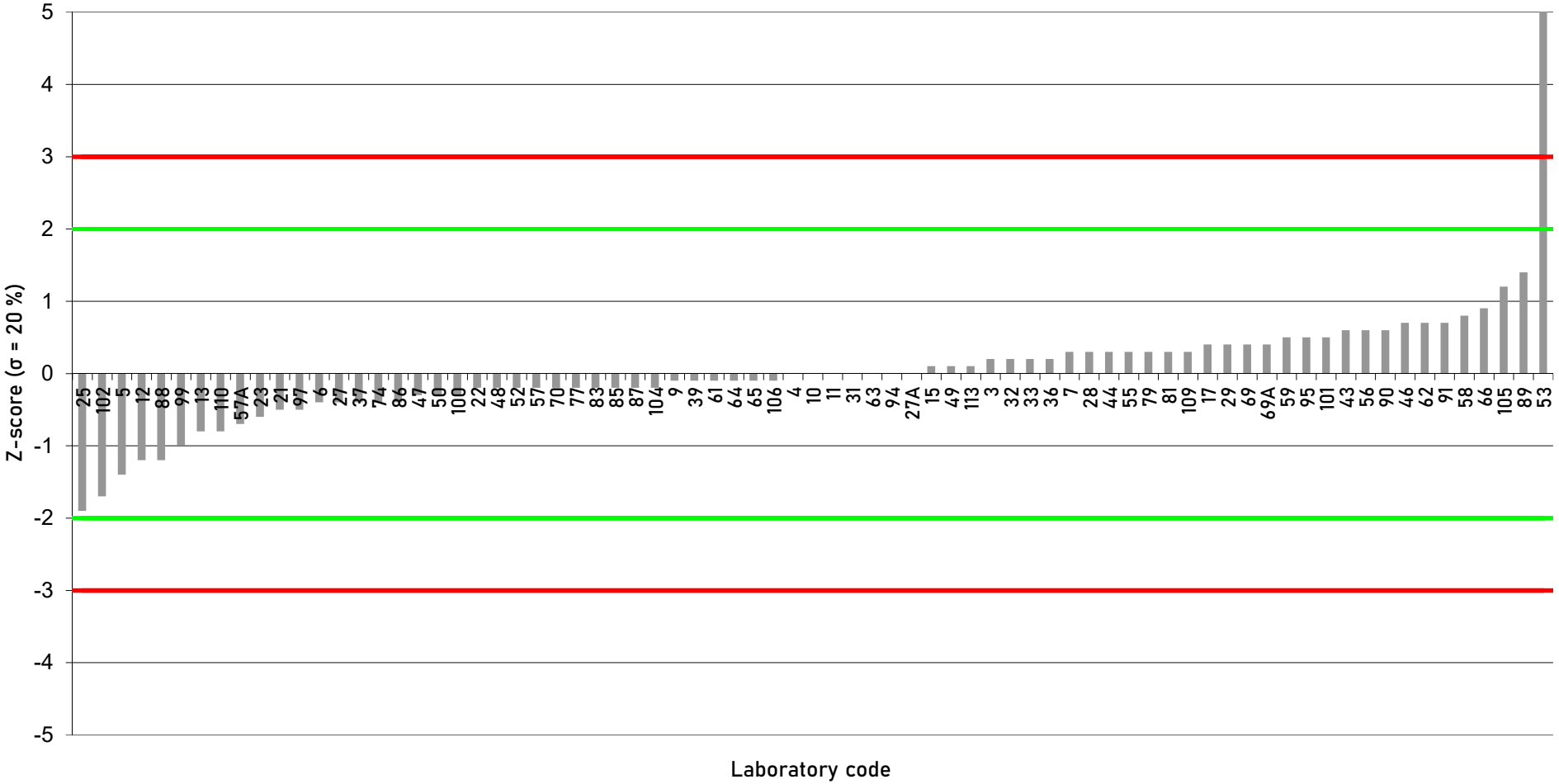
Assigned value: 0.342 ng/kg (12% moisture content)



Fish Meal (2203-FM)

2,3,4,7,8-PeCDF

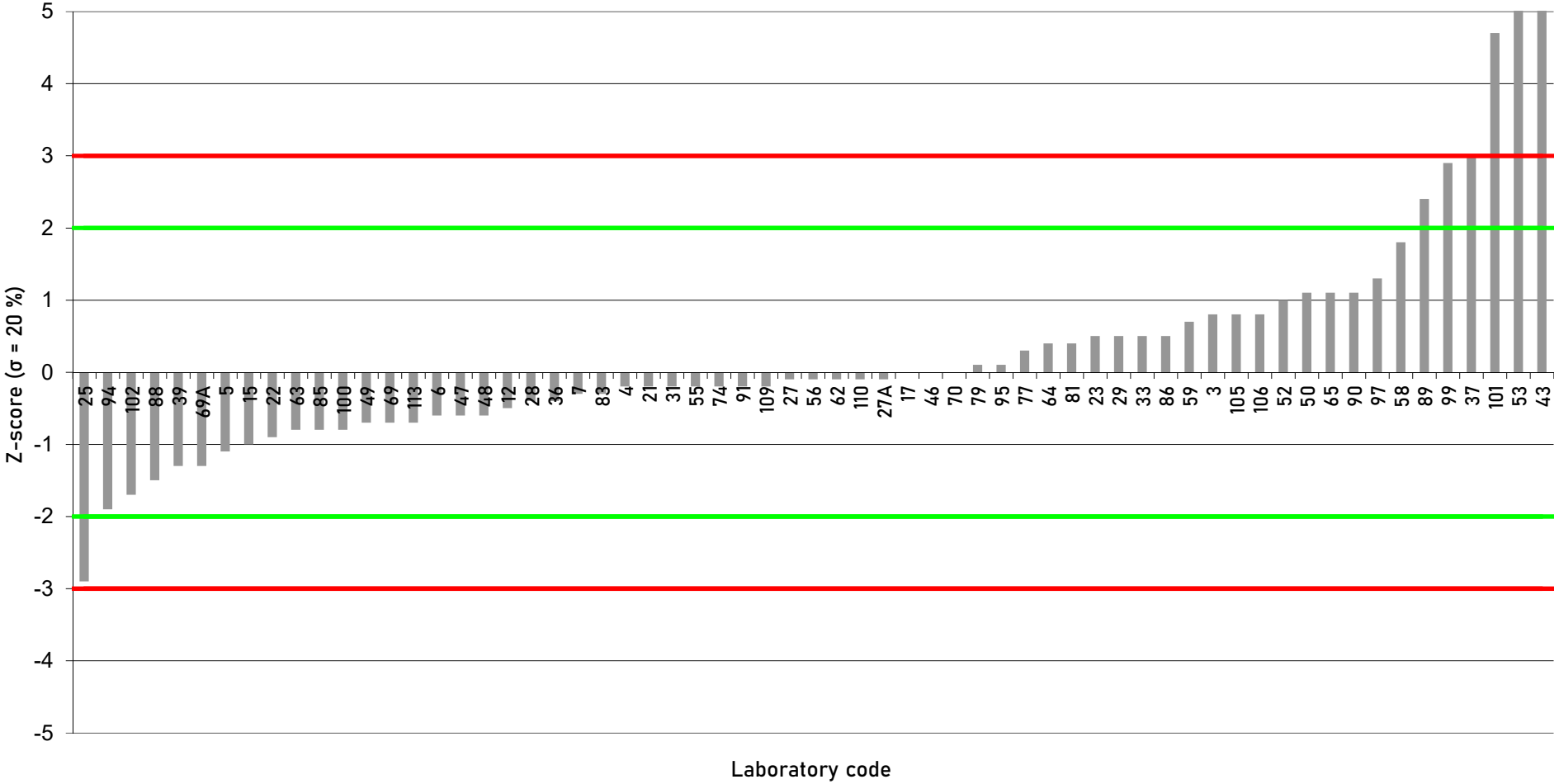
Assigned value: 1.93 ng/kg (12% moisture content)



Fish Meal (2203-FM)

1,2,3,4,7,8-HxCDF

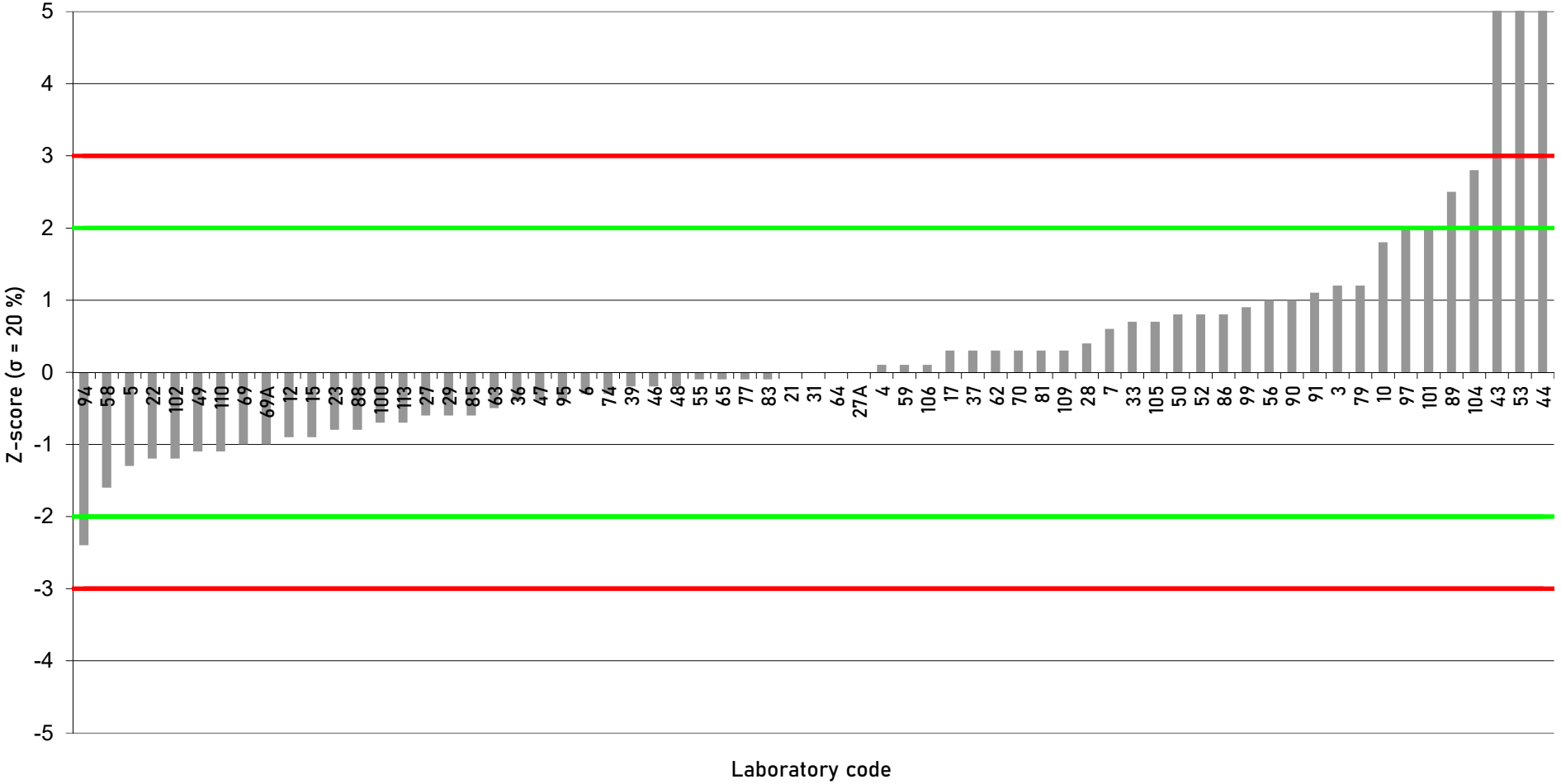
Assigned value: 0.0814 ng/kg (12% moisture content)



Fish Meal (2203-FM)

1,2,3,6,7,8-HxCDF

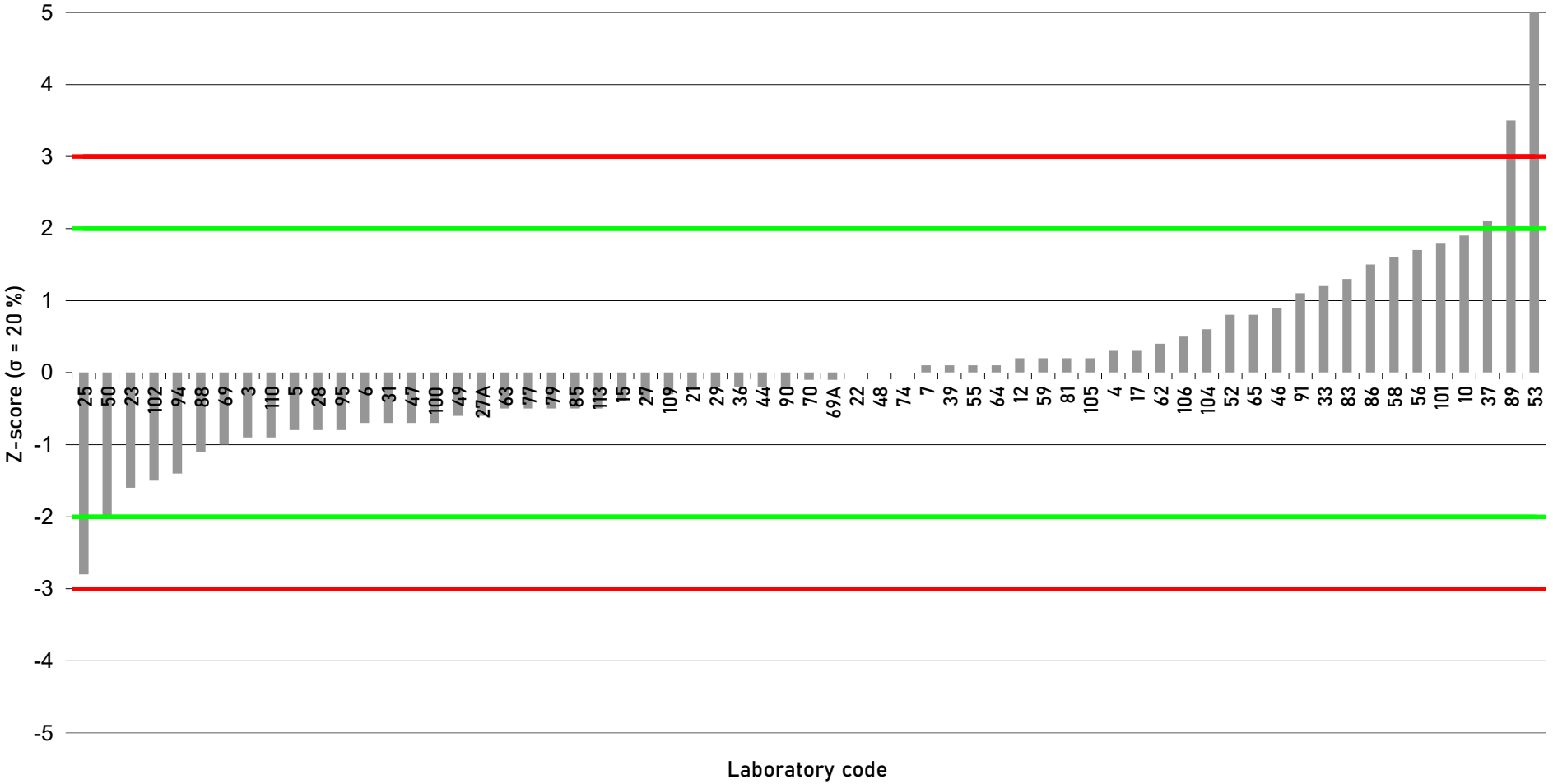
Assigned value: 0.113 ng/kg (12% moisture content)



Fish Meal (2203-FM)

2,3,4,6,7,8-HxCDF

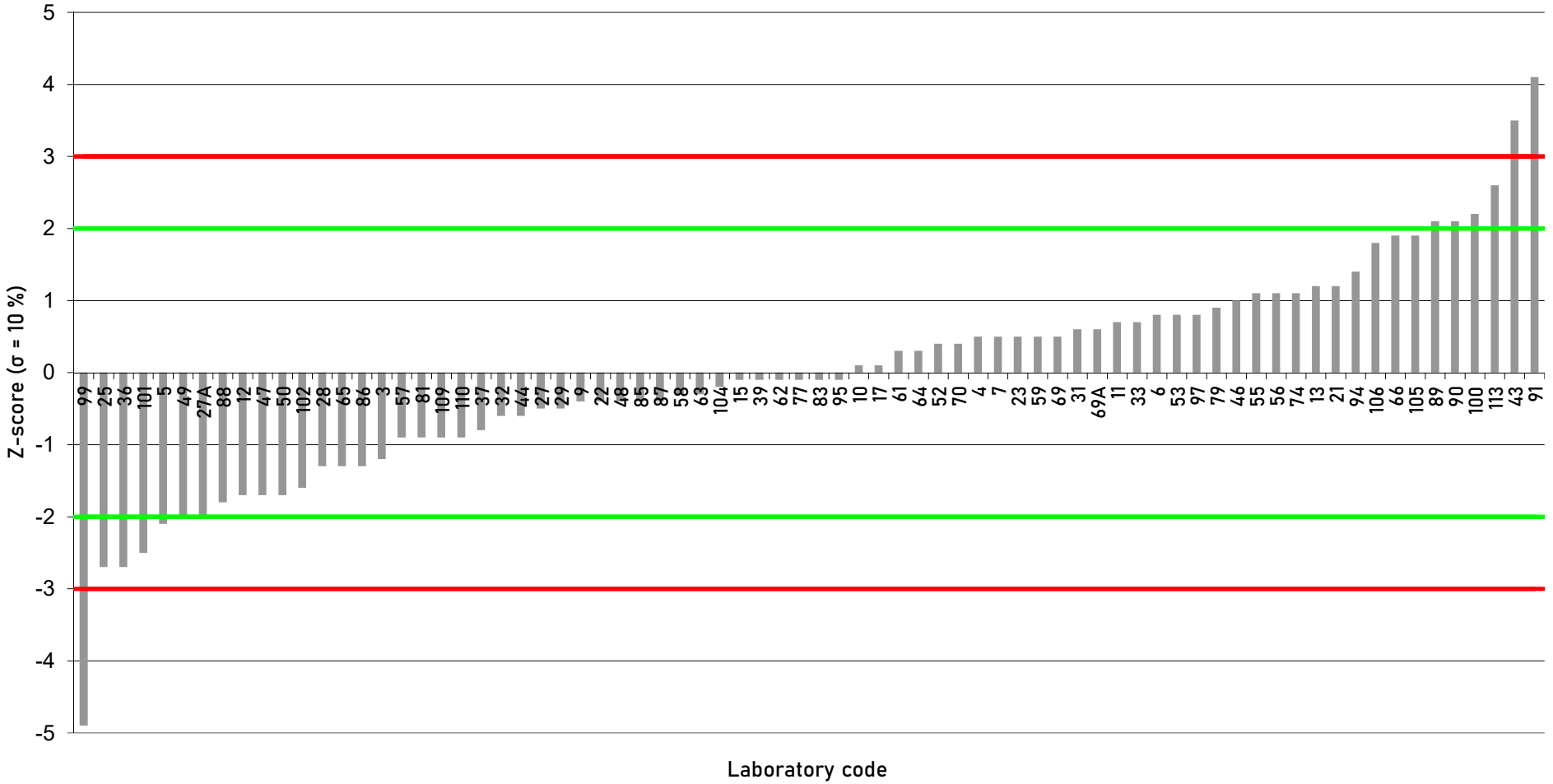
Assigned value: 0.112 ng/kg (12% moisture content)



Fish Meal (2203-FM)

WHO-PCB-TEQ upper bound (reported)

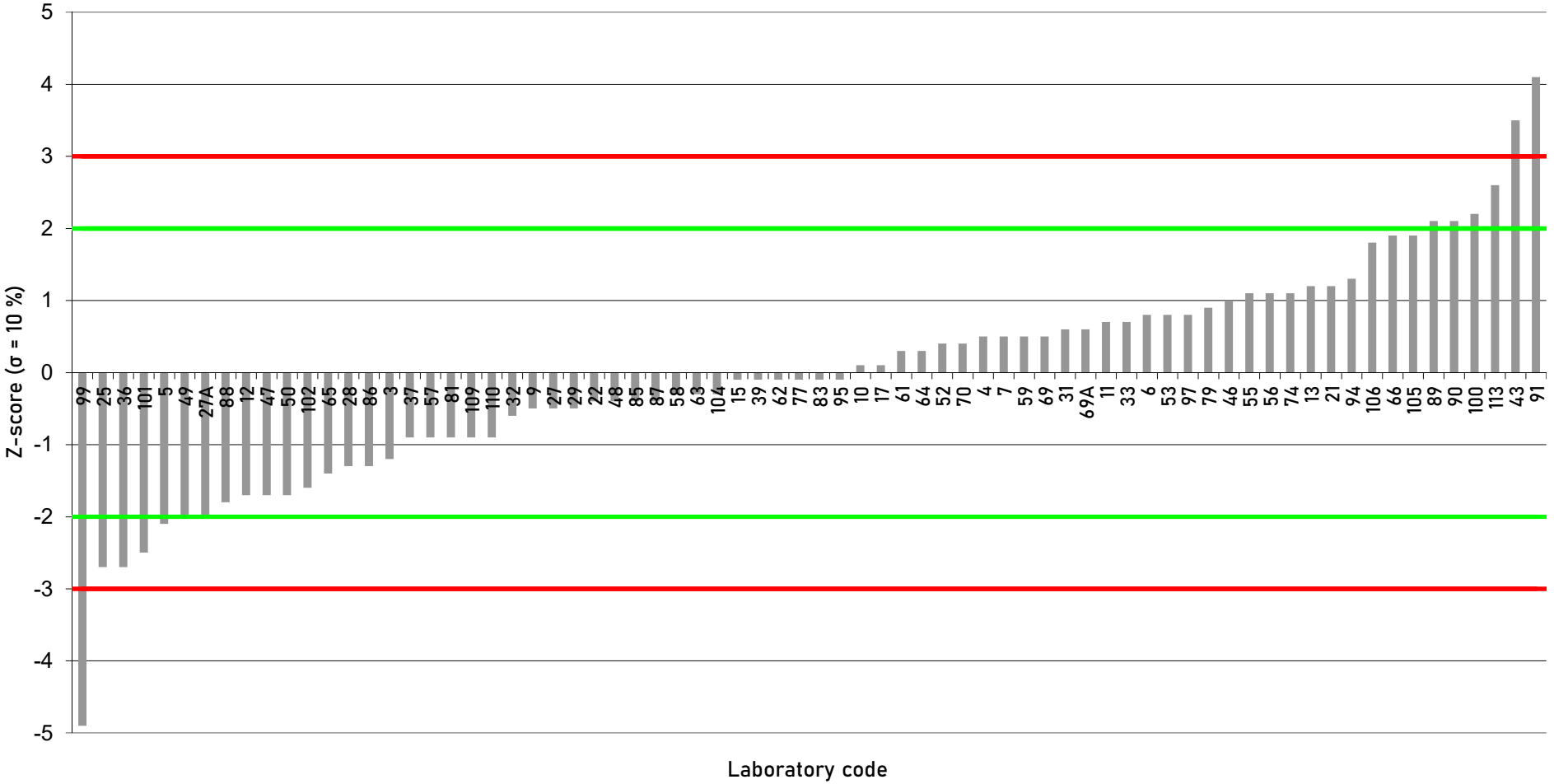
Assigned value: 0.736 ng/kg (12% moisture content)



Fish Meal (2203-FM)

WHO-PCB-TEQ lower bound (reported)

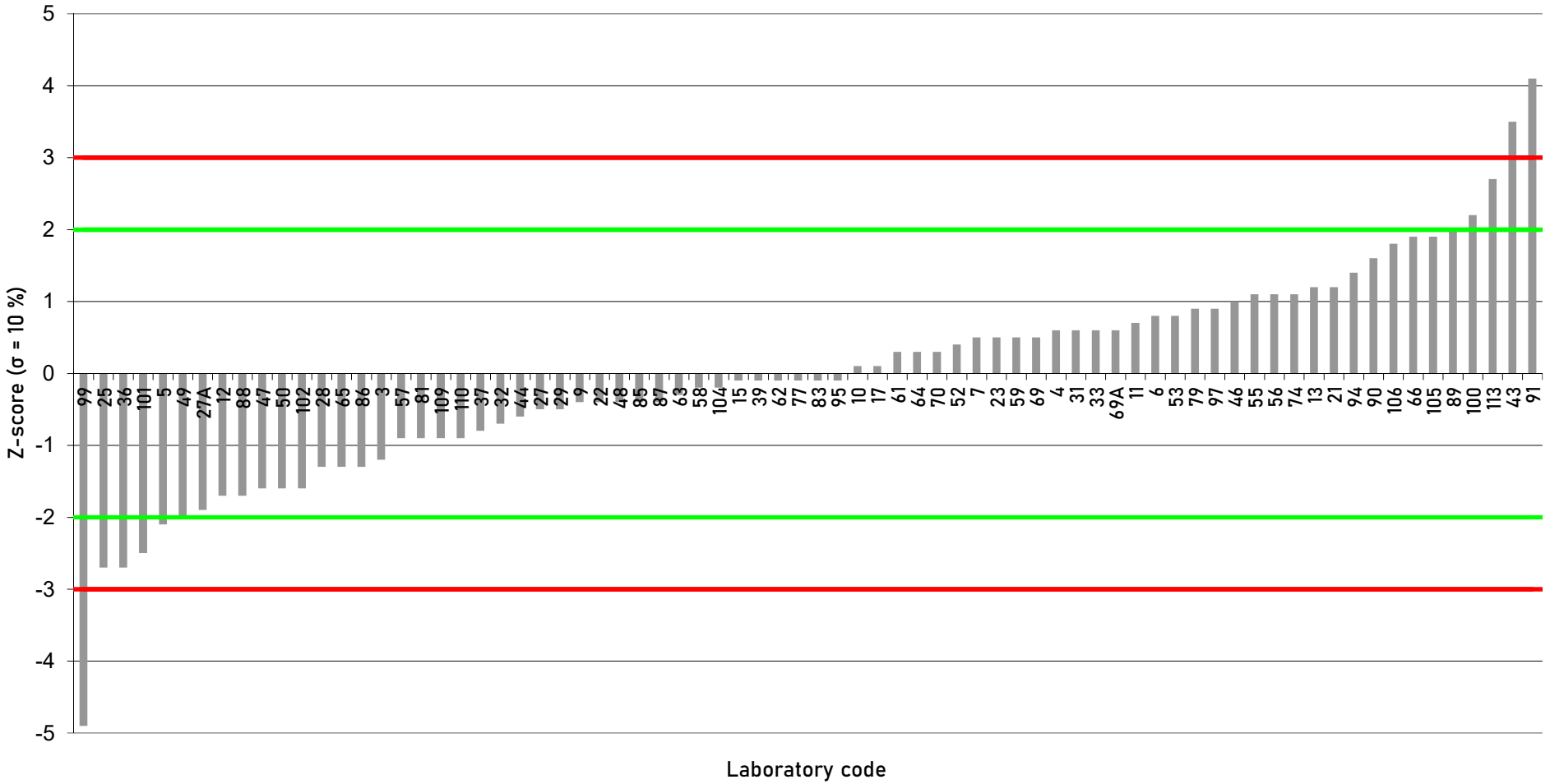
Assigned value: 0.736 ng/kg (12% moisture content)



Fish Meal (2203-FM)

WHO-PCB-TEQ upper bound (calculated)

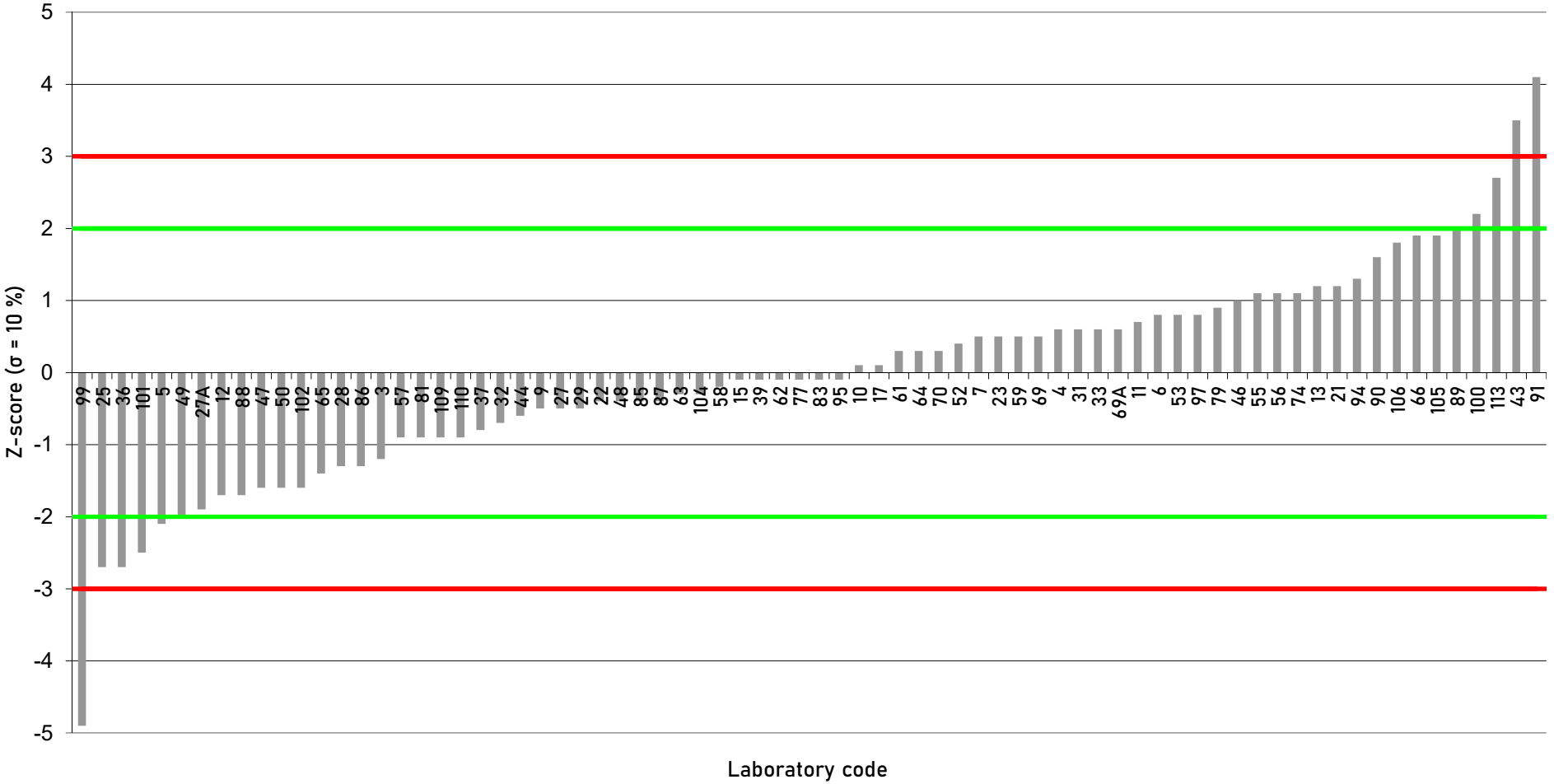
Assigned value: 0.735 ng/kg (12% moisture content)



Fish Meal (2203-FM)

WHO-PCB-TEQ lower bound (calculated)

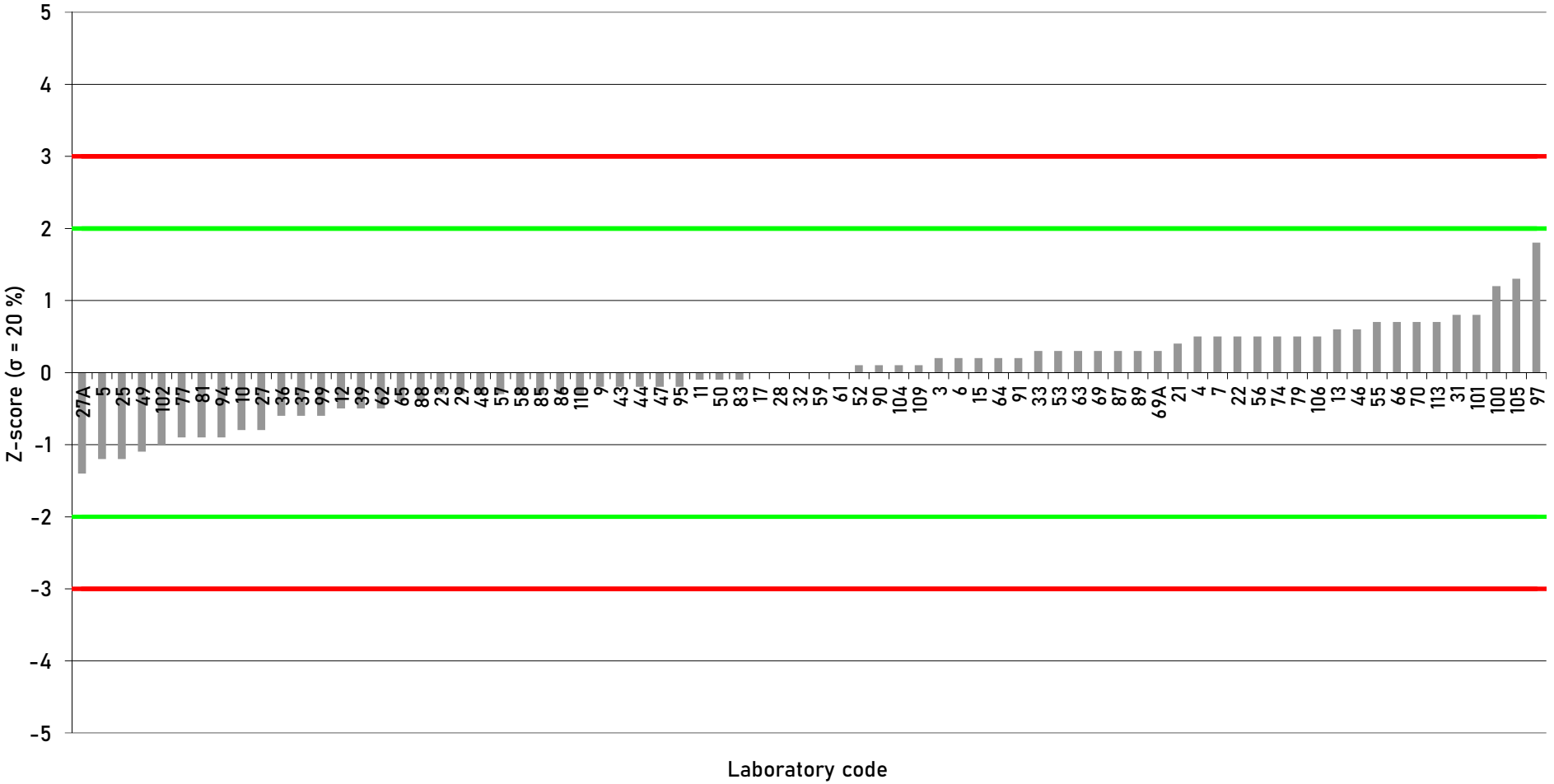
Assigned value: 0.735 ng/kg (12% moisture content)



Fish Meal (2203-FM)

PCB 105

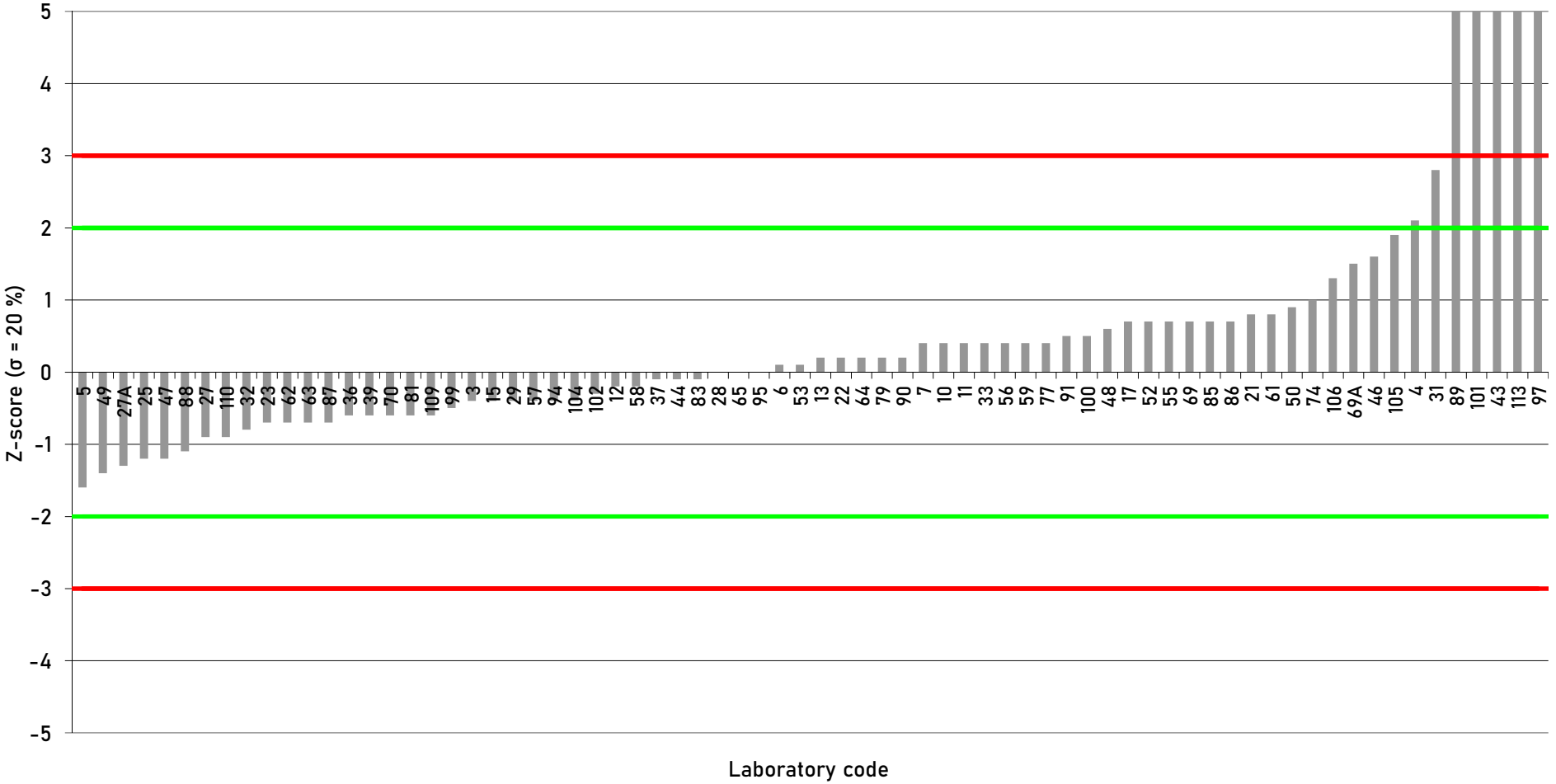
Assigned value: 346 ng/kg (12% moisture content)



Fish Meal (2203-FM)

PCB 114

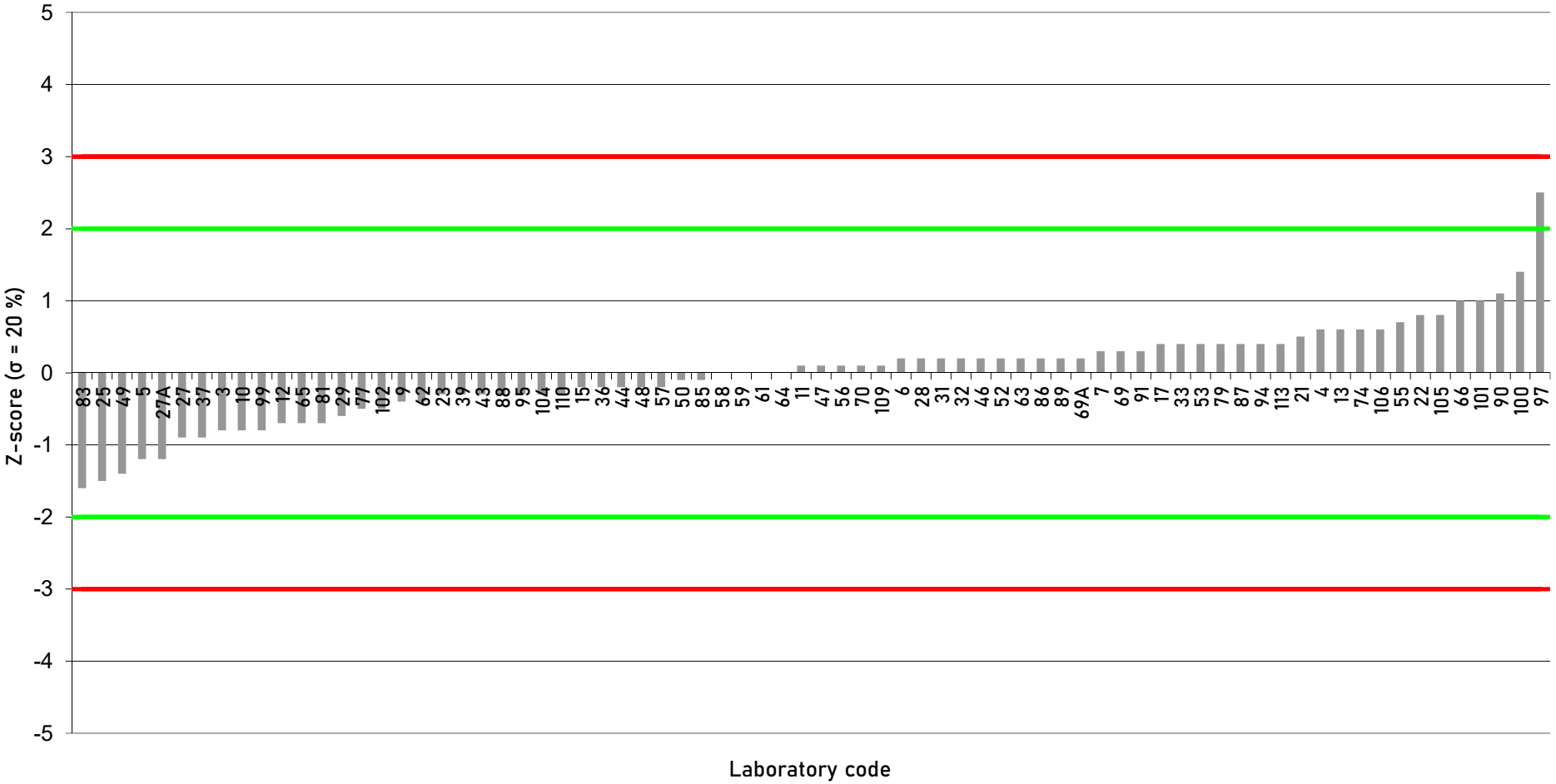
Assigned value: 18.5 ng/kg (12% moisture content)



Fish Meal (2203-FM)

PCB 118

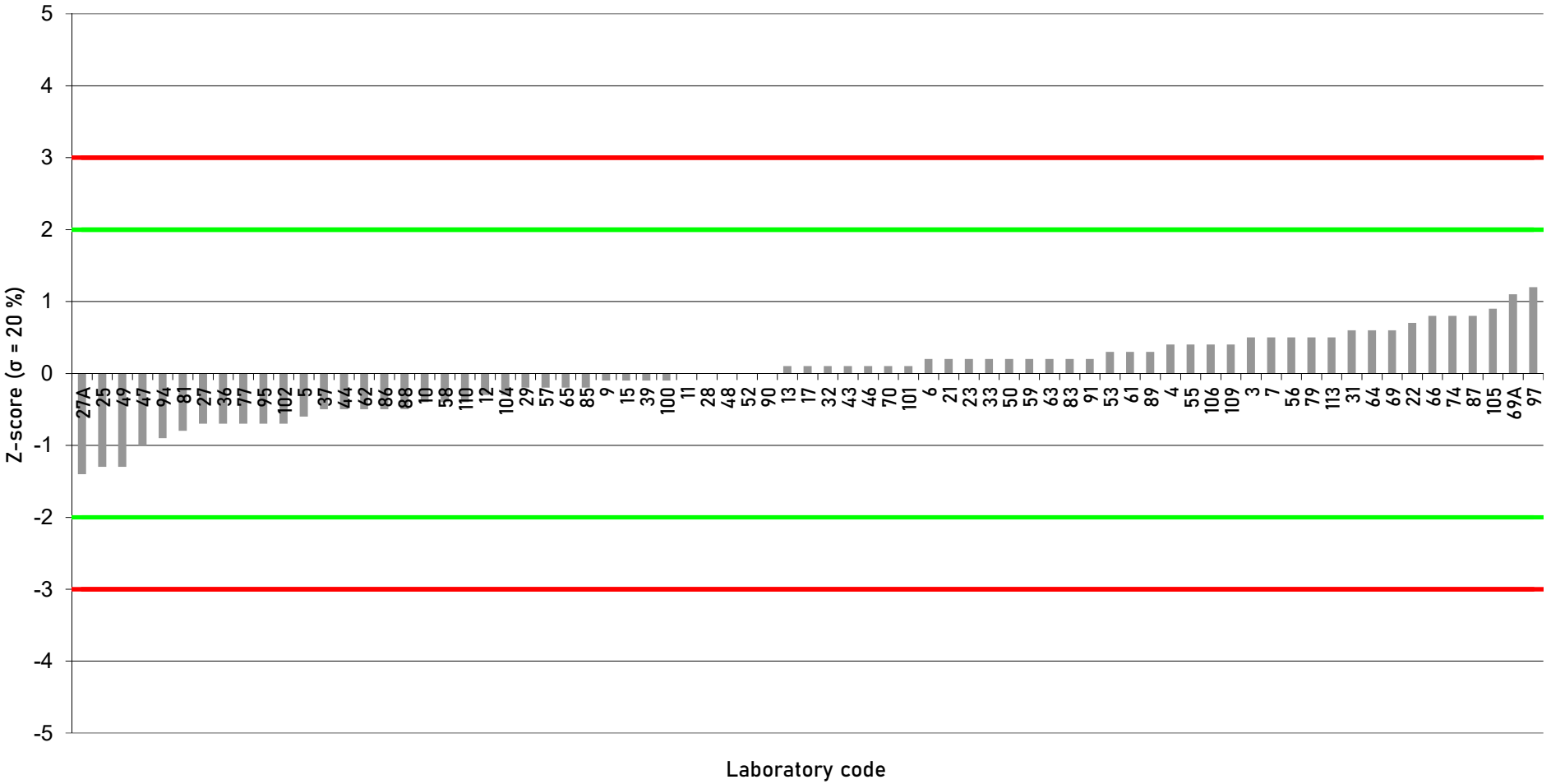
Assigned value: 1020 ng/kg (12% moisture content)



Fish Meal (2203-FM)

PCB 156

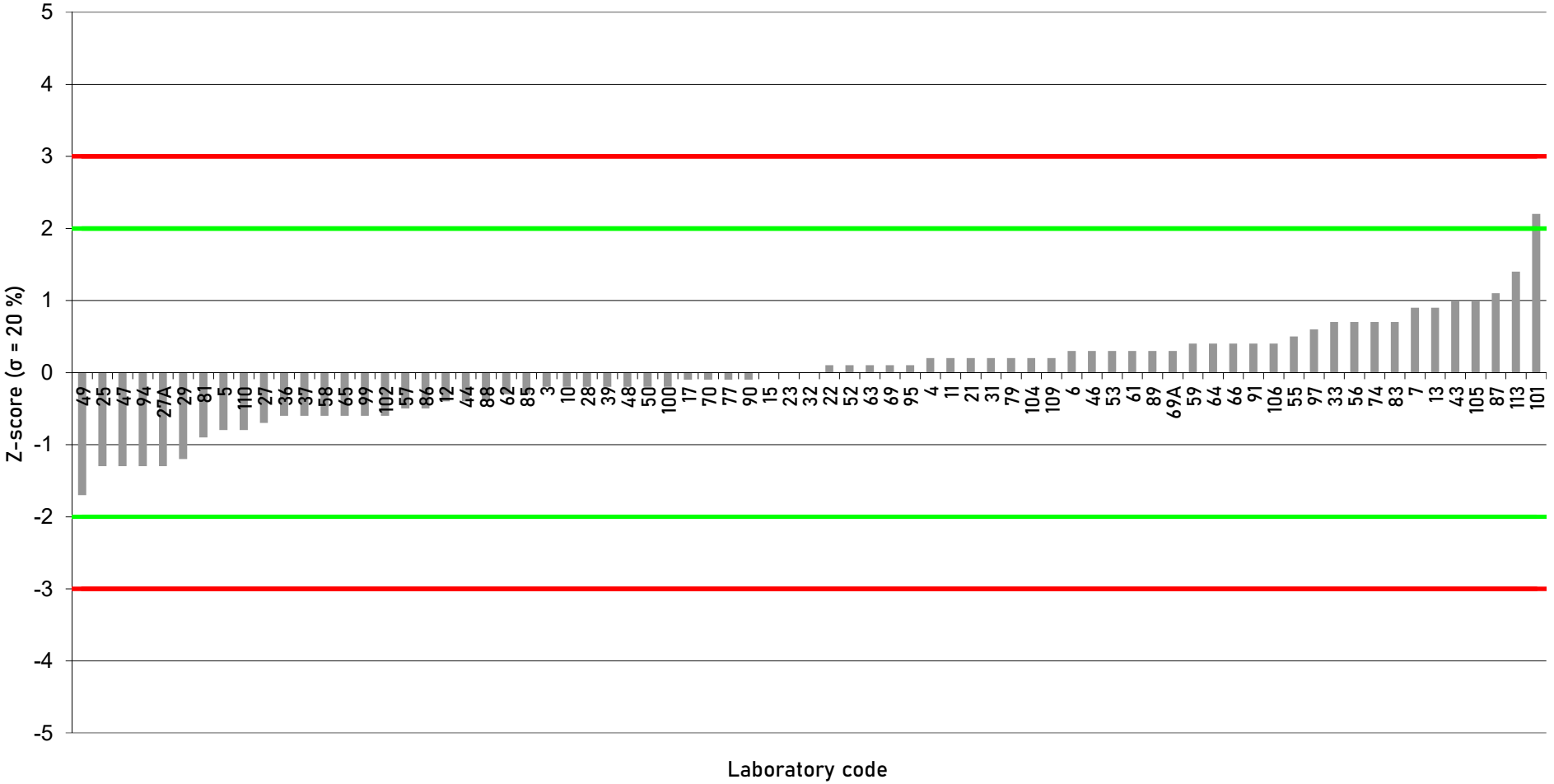
Assigned value: 165 ng/kg (12% moisture content)



Fish Meal (2203-FM)

PCB 157

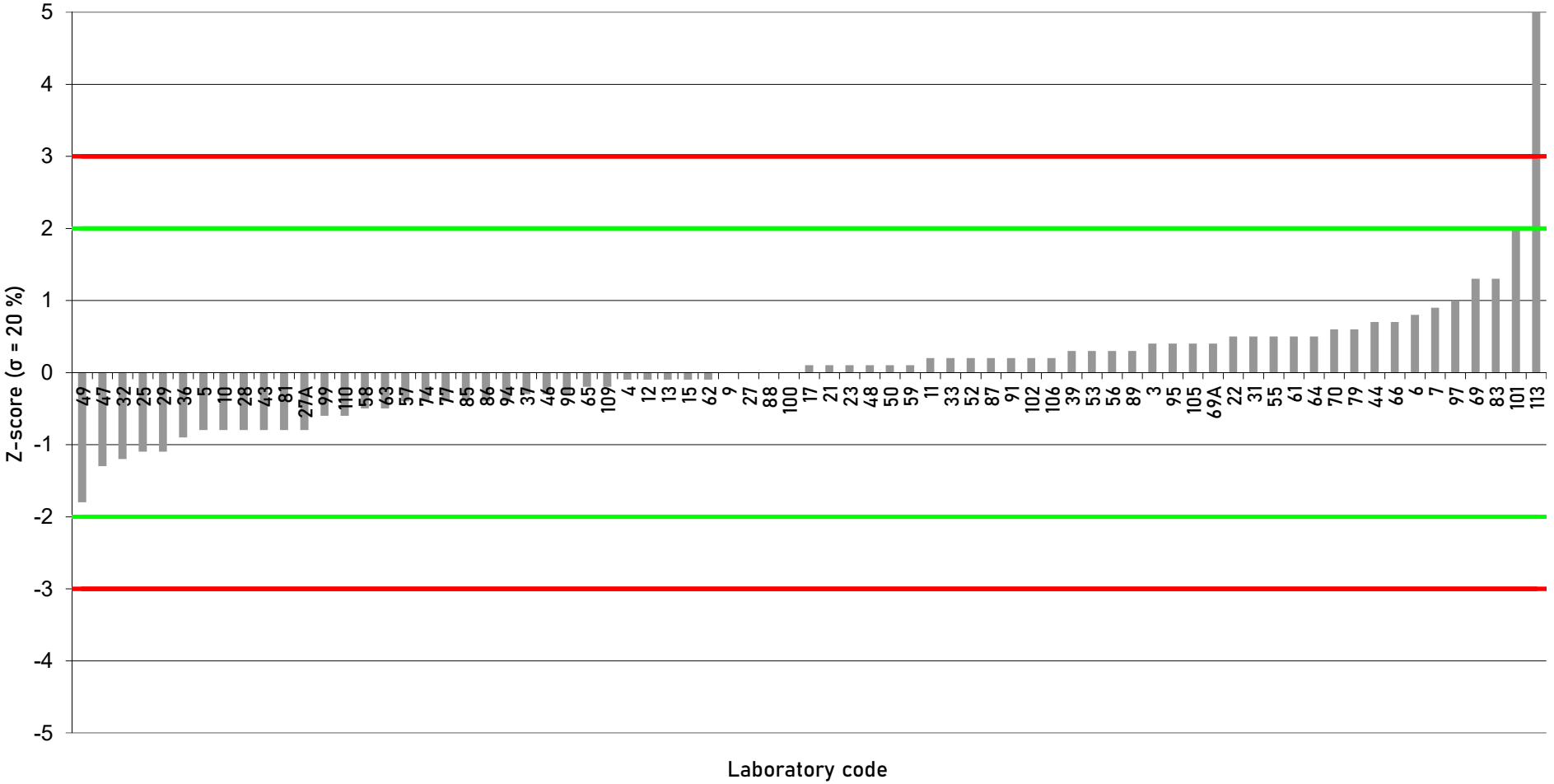
Assigned value: 39.4 ng/kg (12% moisture content)



Fish Meal (2203-FM)

PCB 167

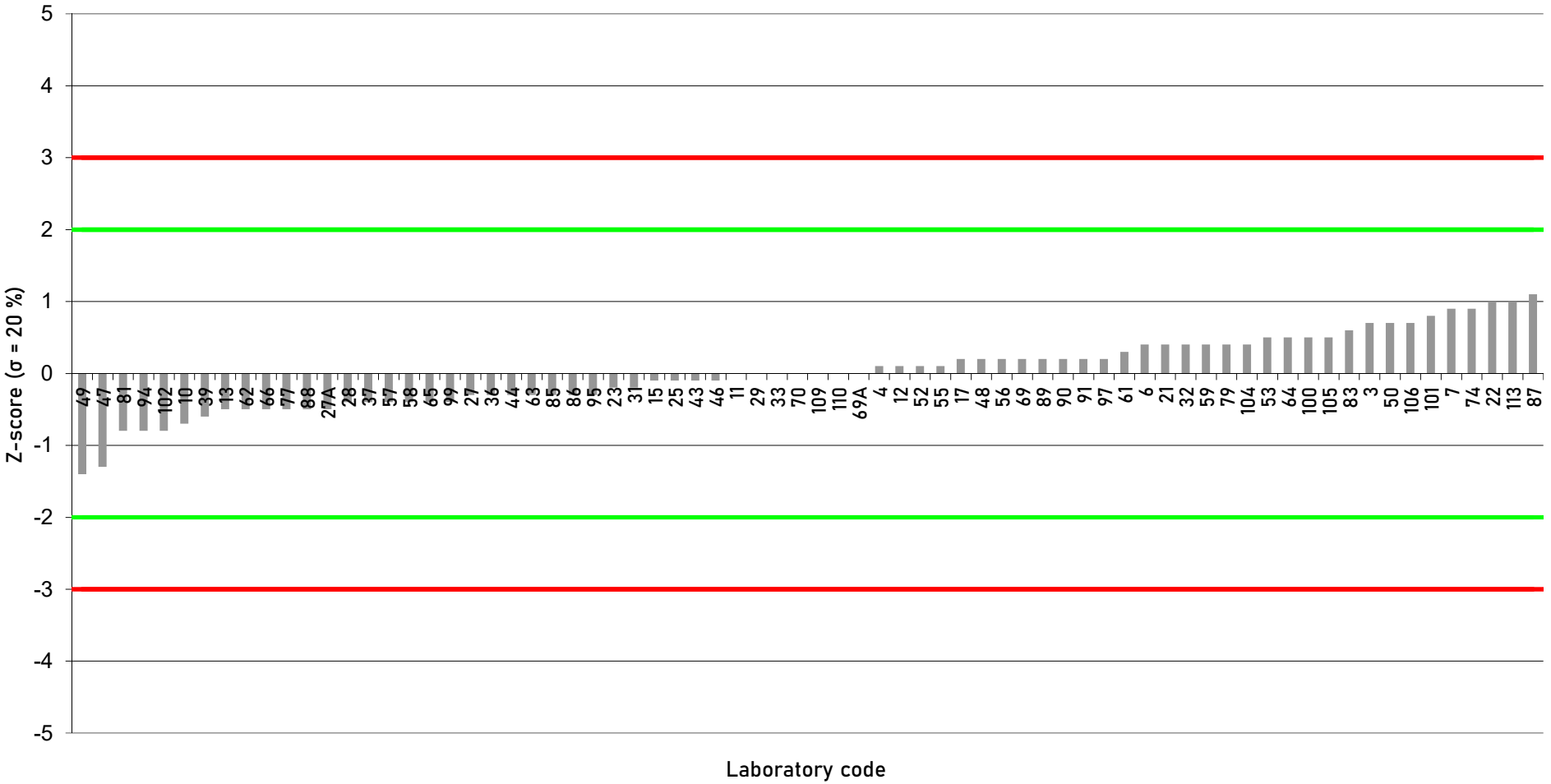
Assigned value: 85.3 ng/kg (12% moisture content)



Fish Meal (2203-FM)

PCB 189

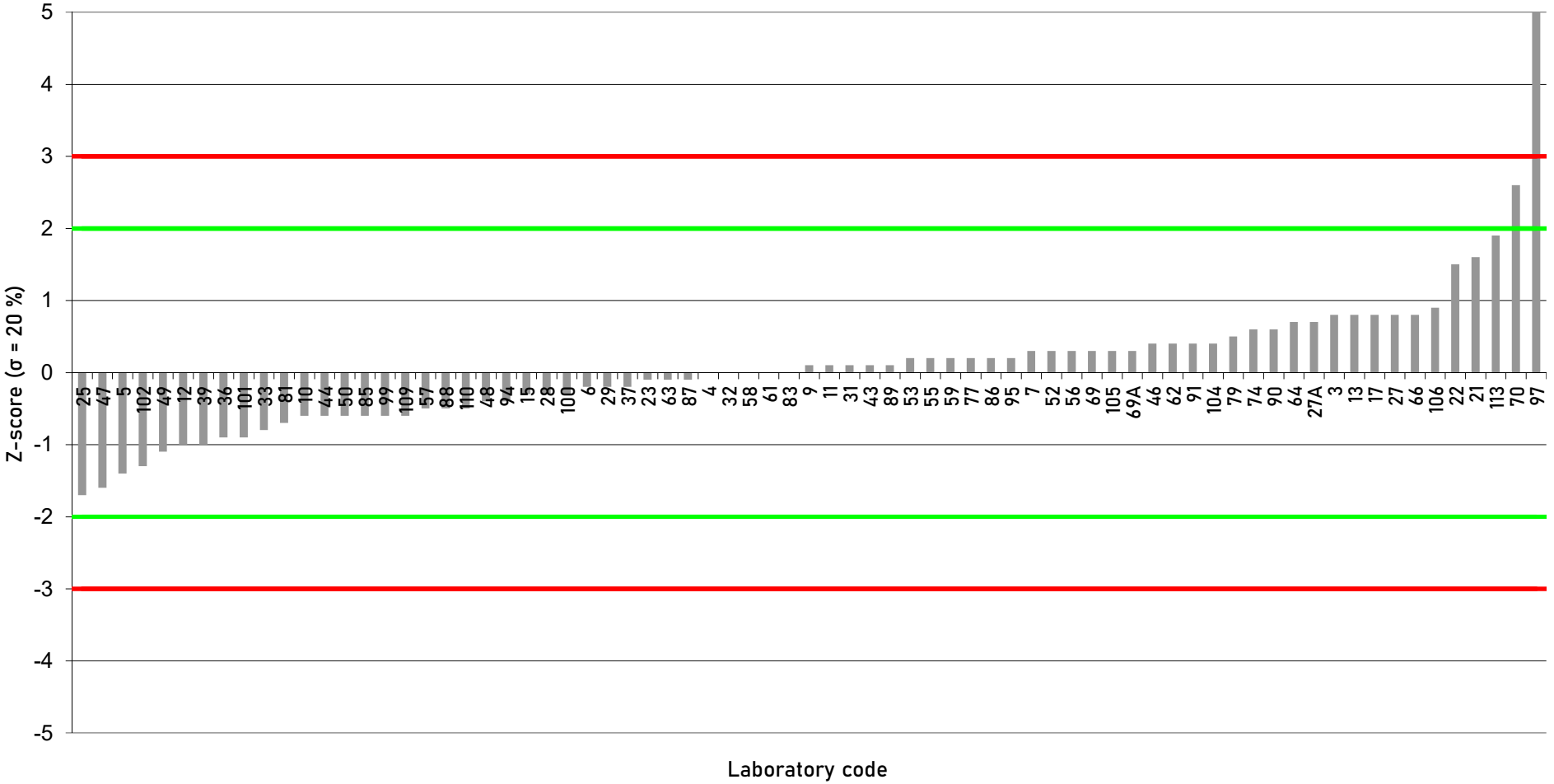
Assigned value: 21.2 ng/kg (12% moisture content)



Fish Meal (2203-FM)

PCB 77

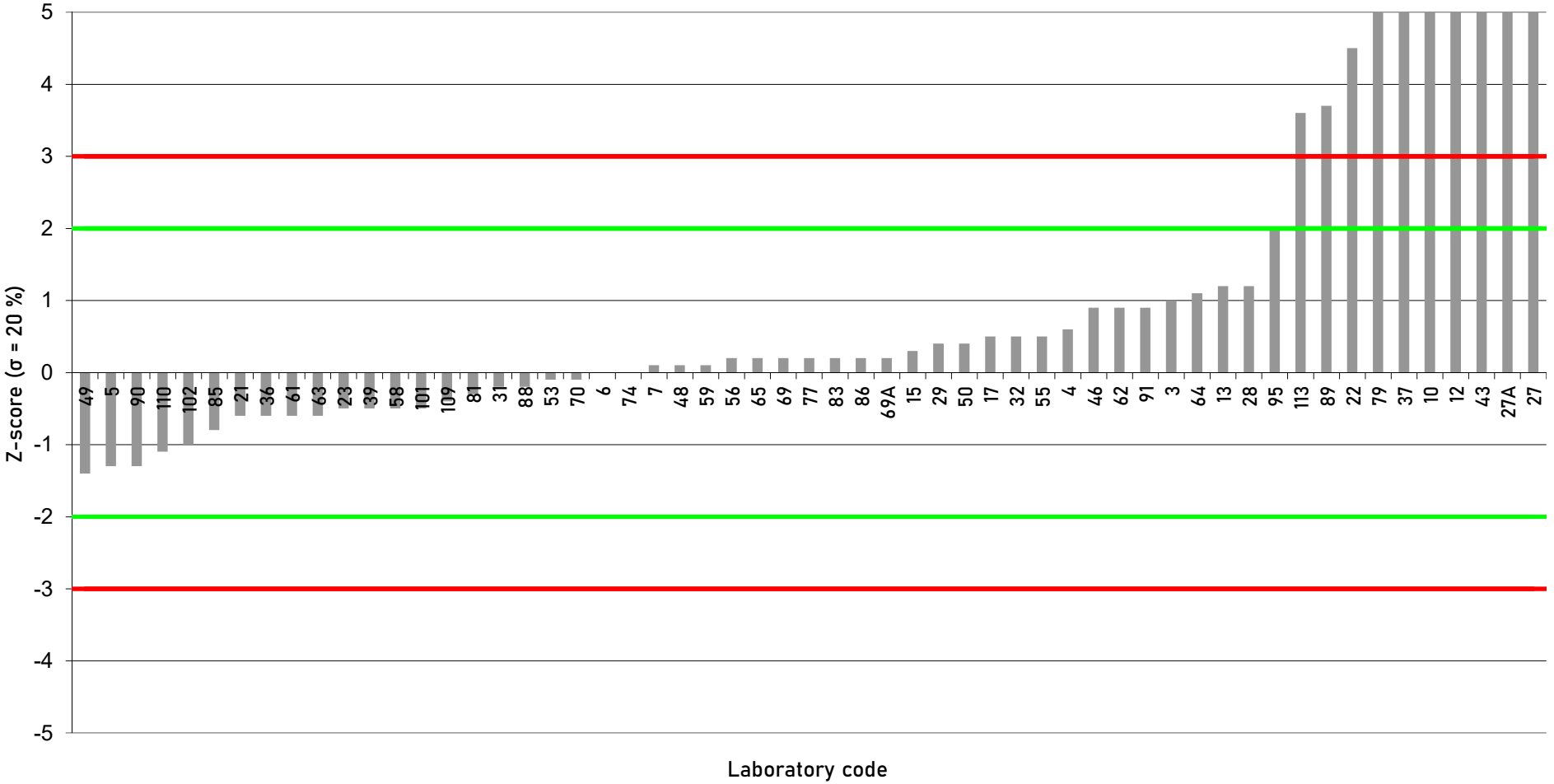
Assigned value: 11.3 ng/kg (12% moisture content)



Fish Meal (2203-FM)

PCB 81

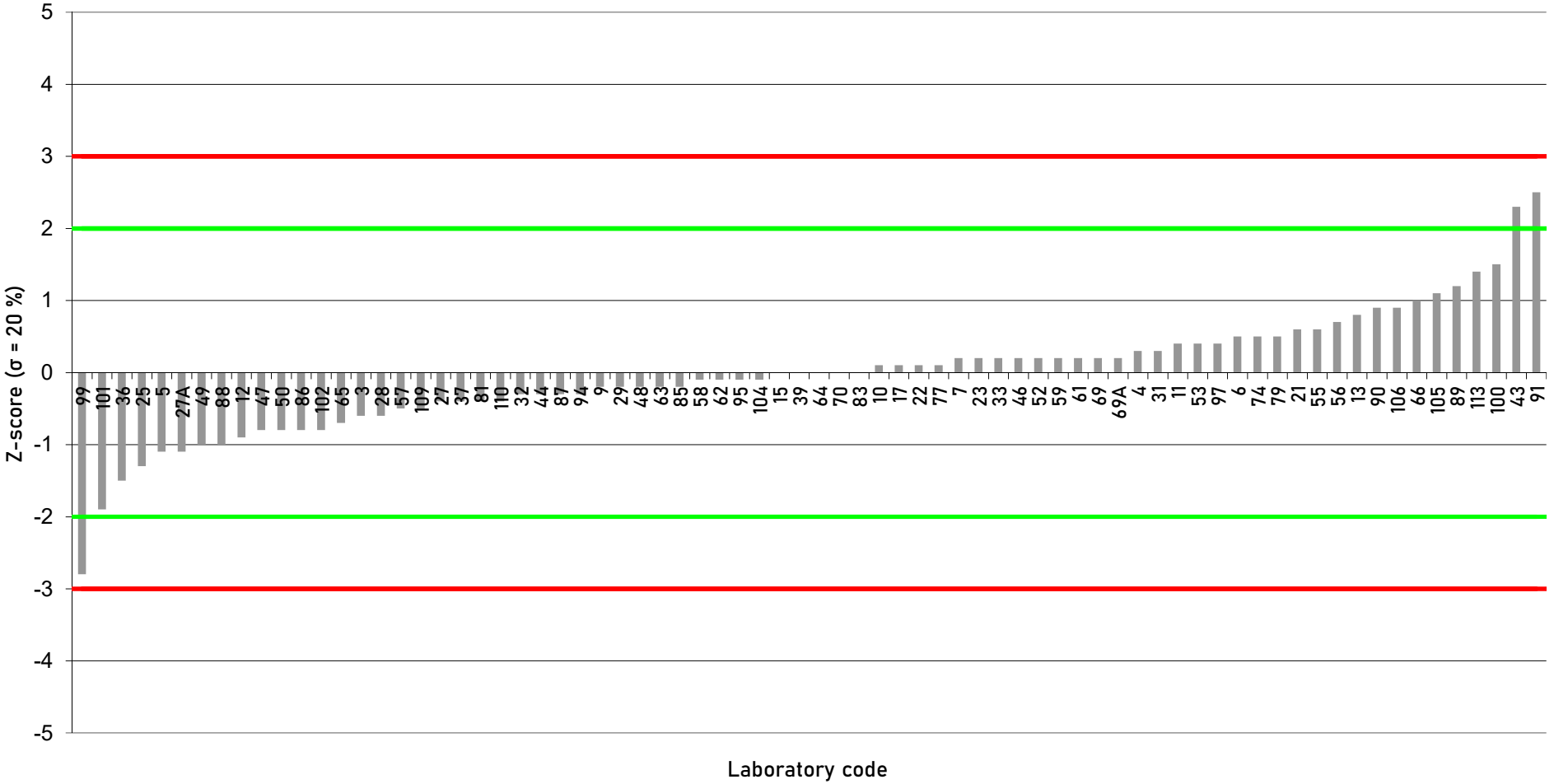
Assigned value: 0.298 ng/kg (12% moisture content)



Fish Meal (2203-FM)

PCB 126

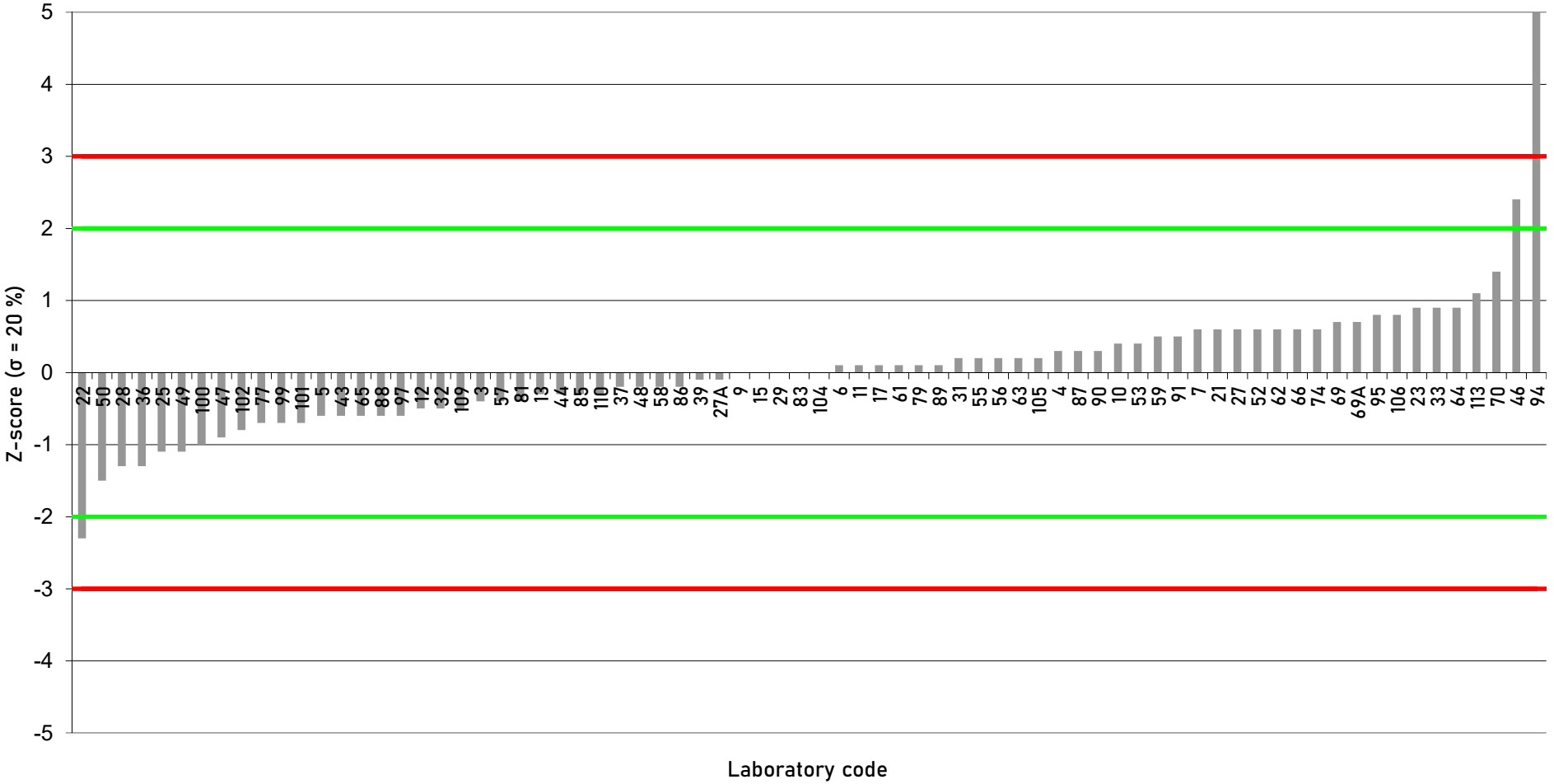
Assigned value: 5.92 ng/kg (12% moisture content)



Fish Meal (2203-FM)

PCB 169

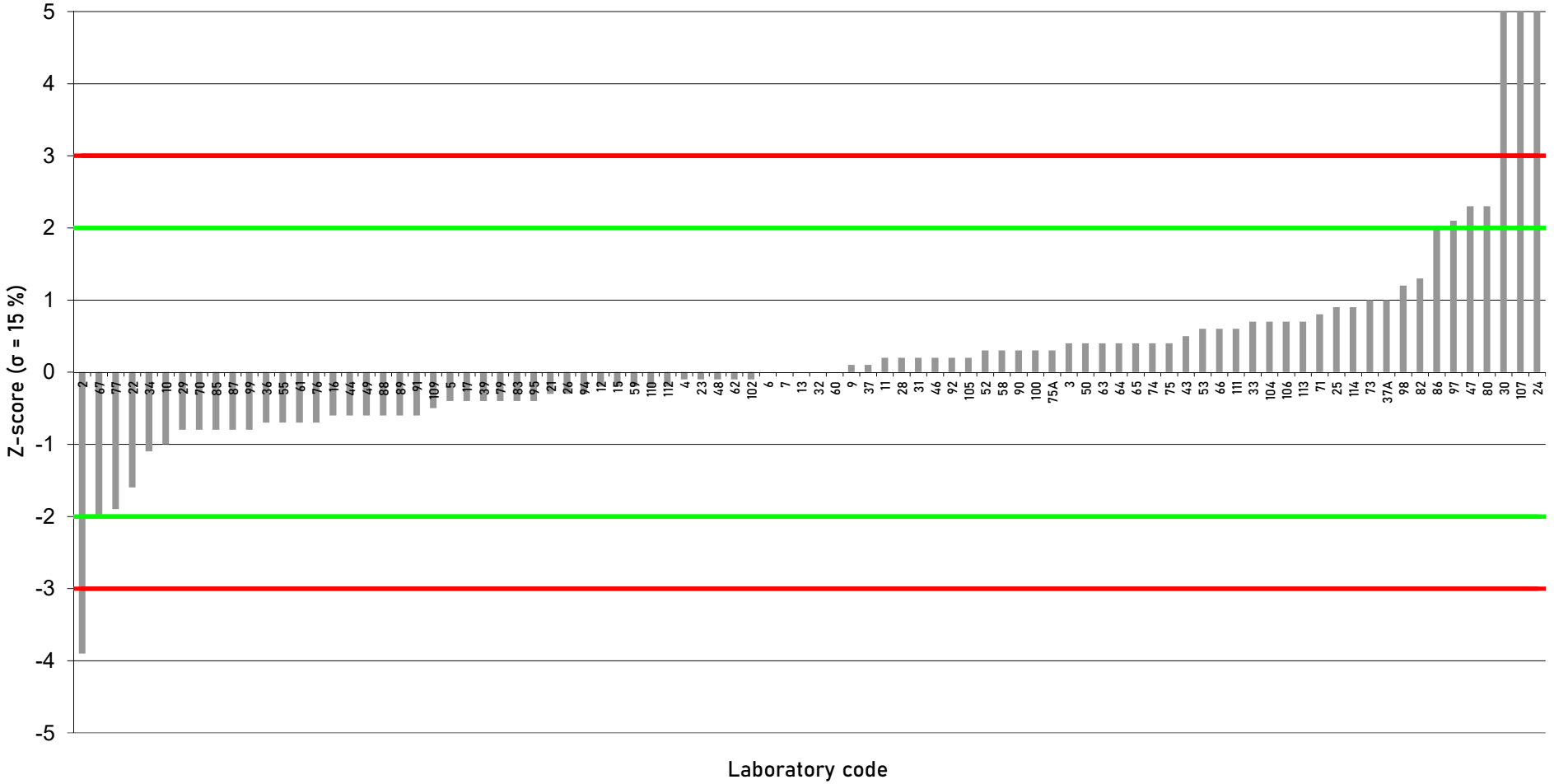
Assigned value: 2.96 ng/kg (12% moisture content)



Fish Meal (2203-FM)

Sum Indicator PCBs upper bound (reported)

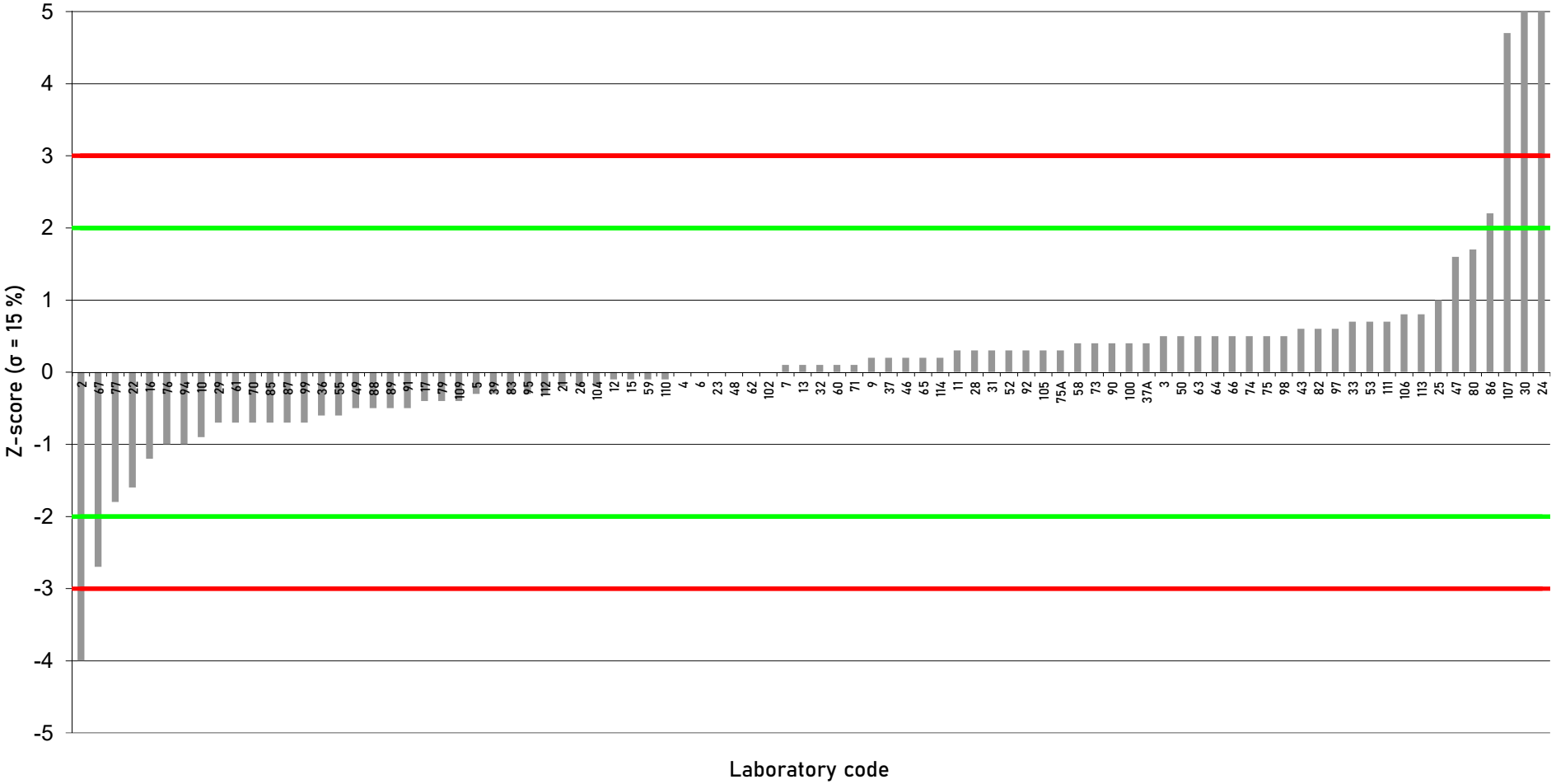
Assigned value: 8.66 µg/kg (12% moisture content)



Fish Meal (2203-FM)

Sum Indicator PCBs lower bound (reported)

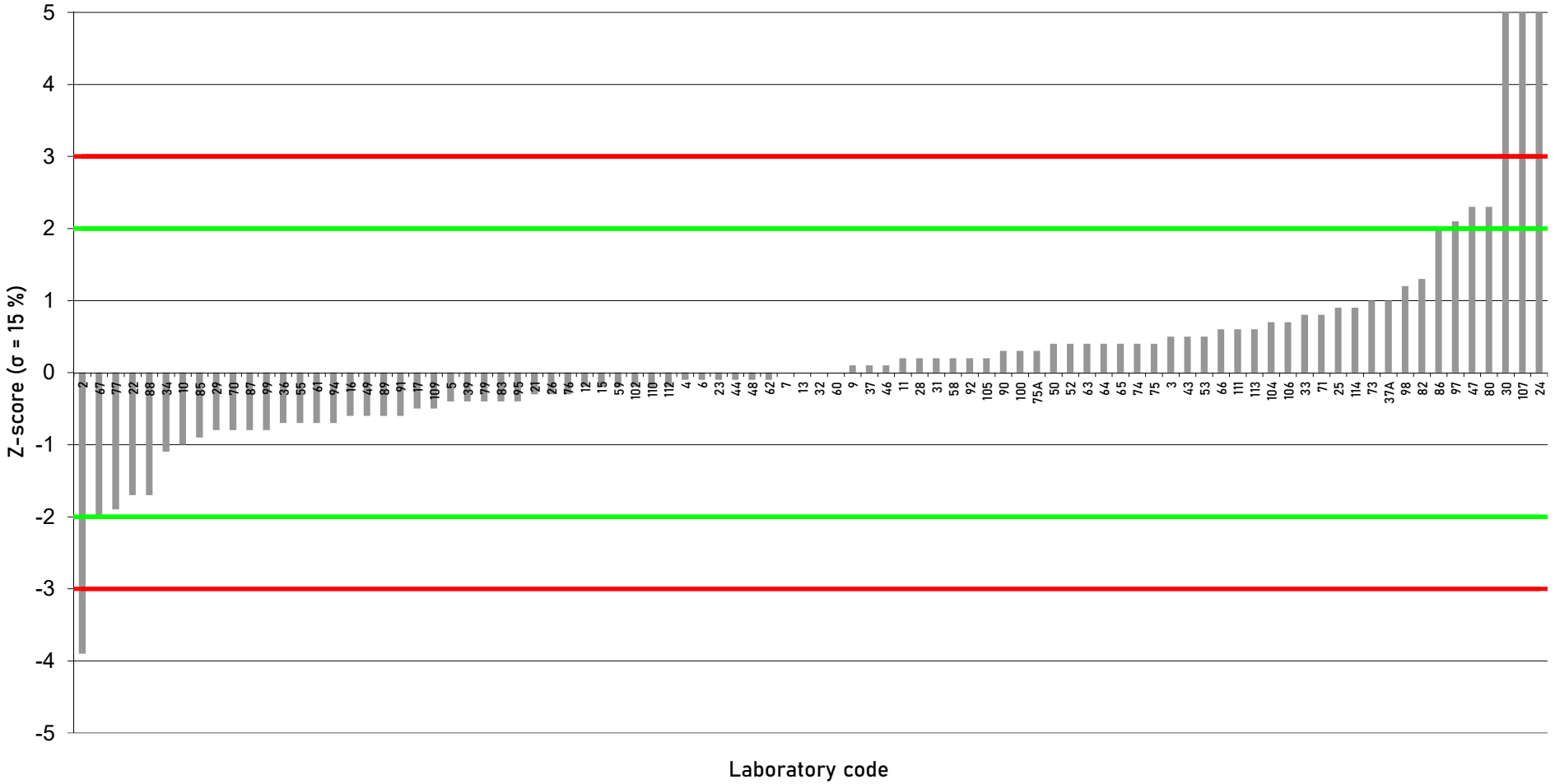
Assigned value: 8.54 µg/kg (12% moisture content)



Fish Meal (2203-FM)

Sum Indicator PCBs upper bound (calculated)

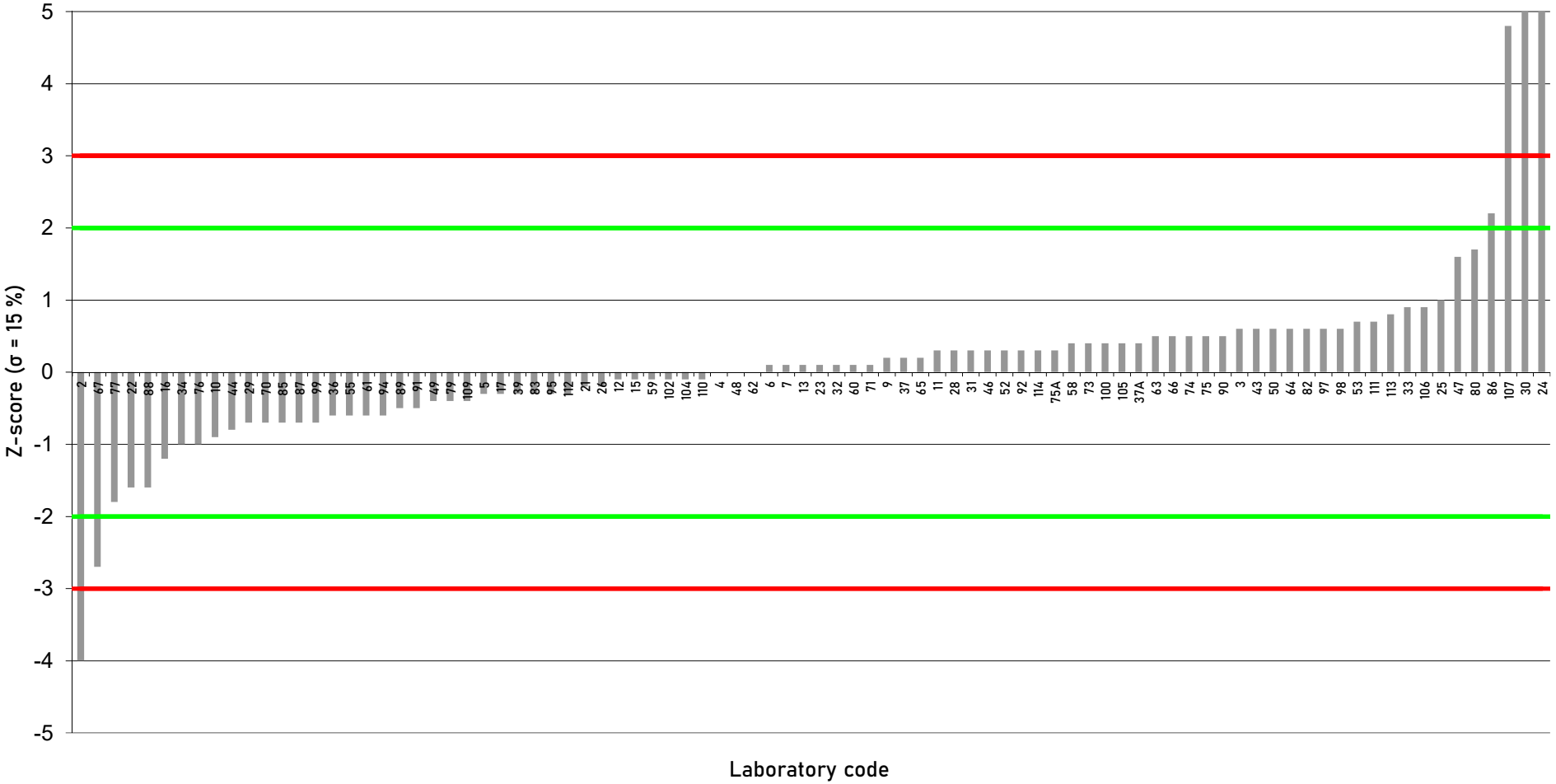
Assigned value: 8.67 µg/kg (12% moisture content)



Fish Meal (2203-FM)

Sum Indicator PCBs lower bound (calculated)

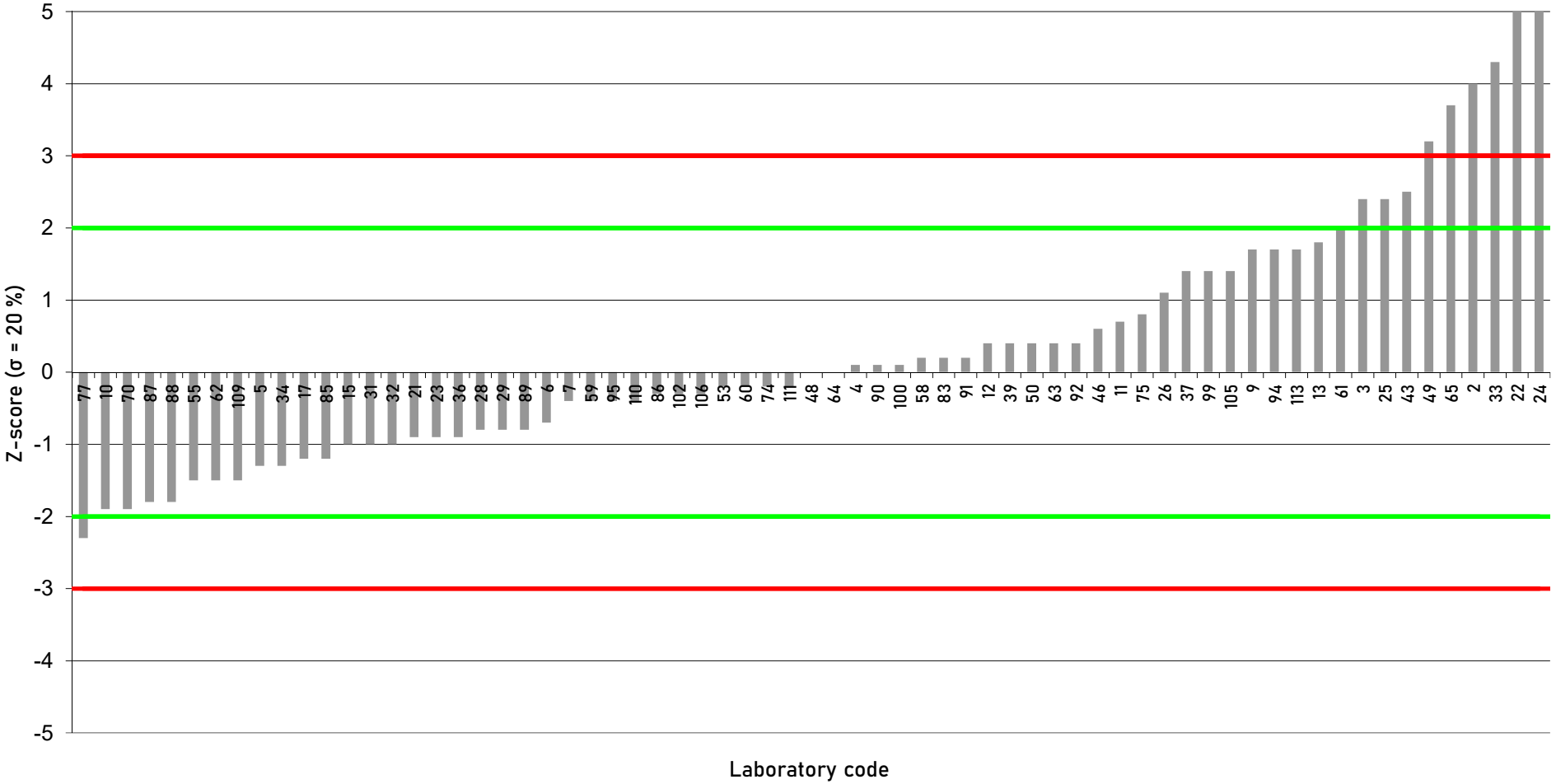
Assigned value: 8.51 µg/kg (12% moisture content)



Fish Meal (2203-FM)

PCB 28

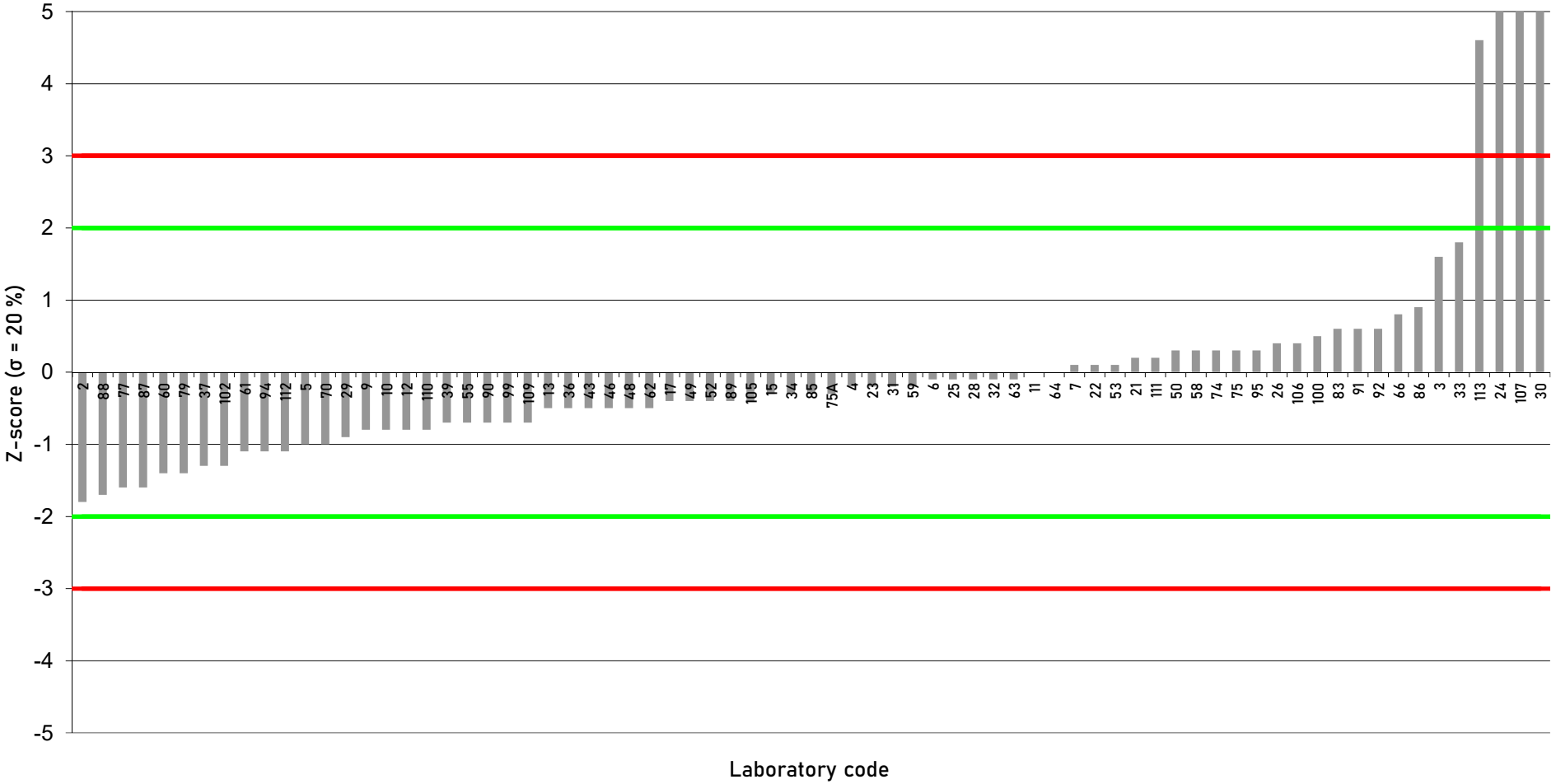
Assigned value: 0.156 µg/kg (12% moisture content)



Fish Meal (2203-FM)

PCB 52

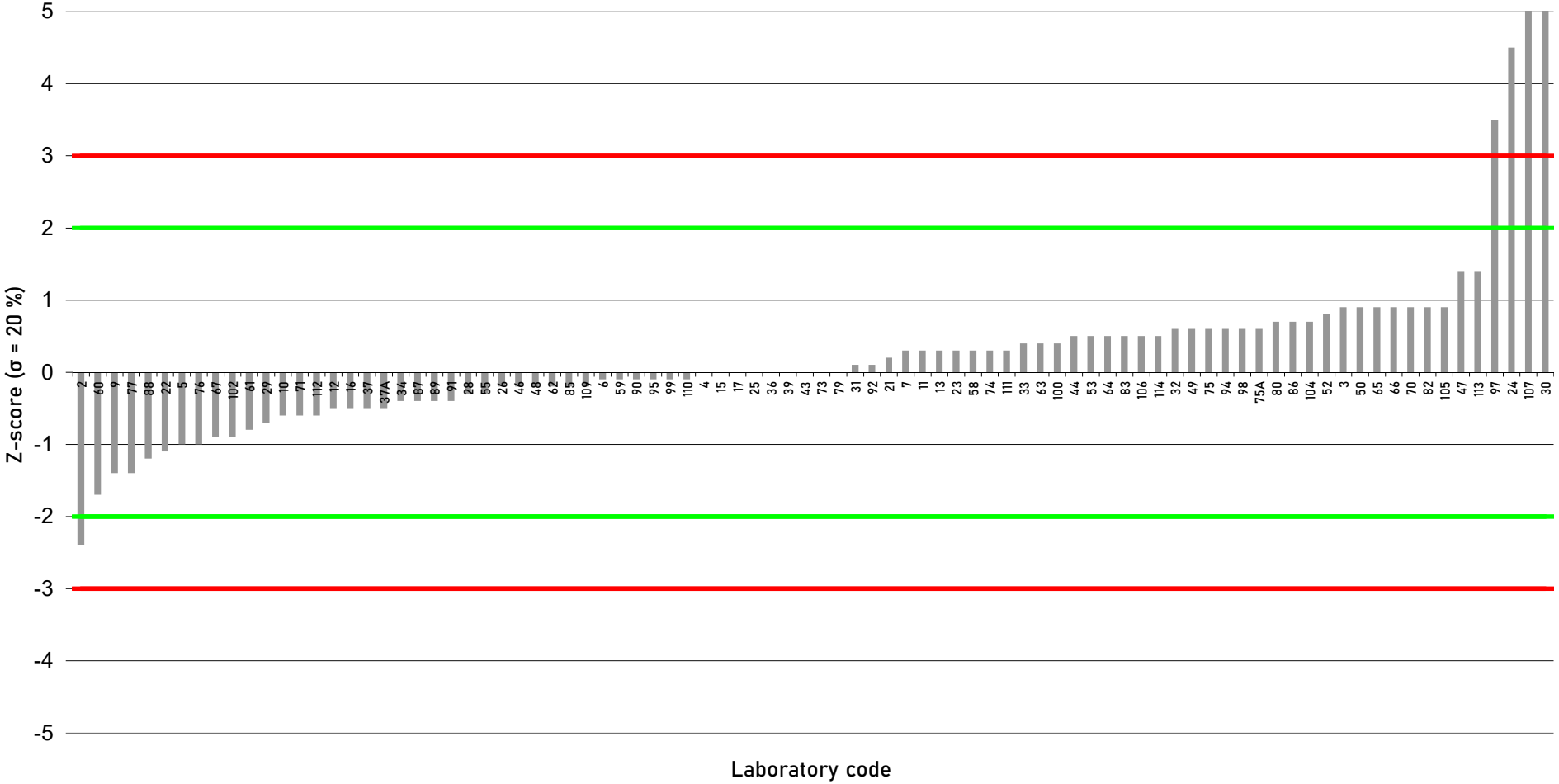
Assigned value: 0.348 µg/kg (12% moisture content)



Fish Meal (2203-FM)

PCB 101

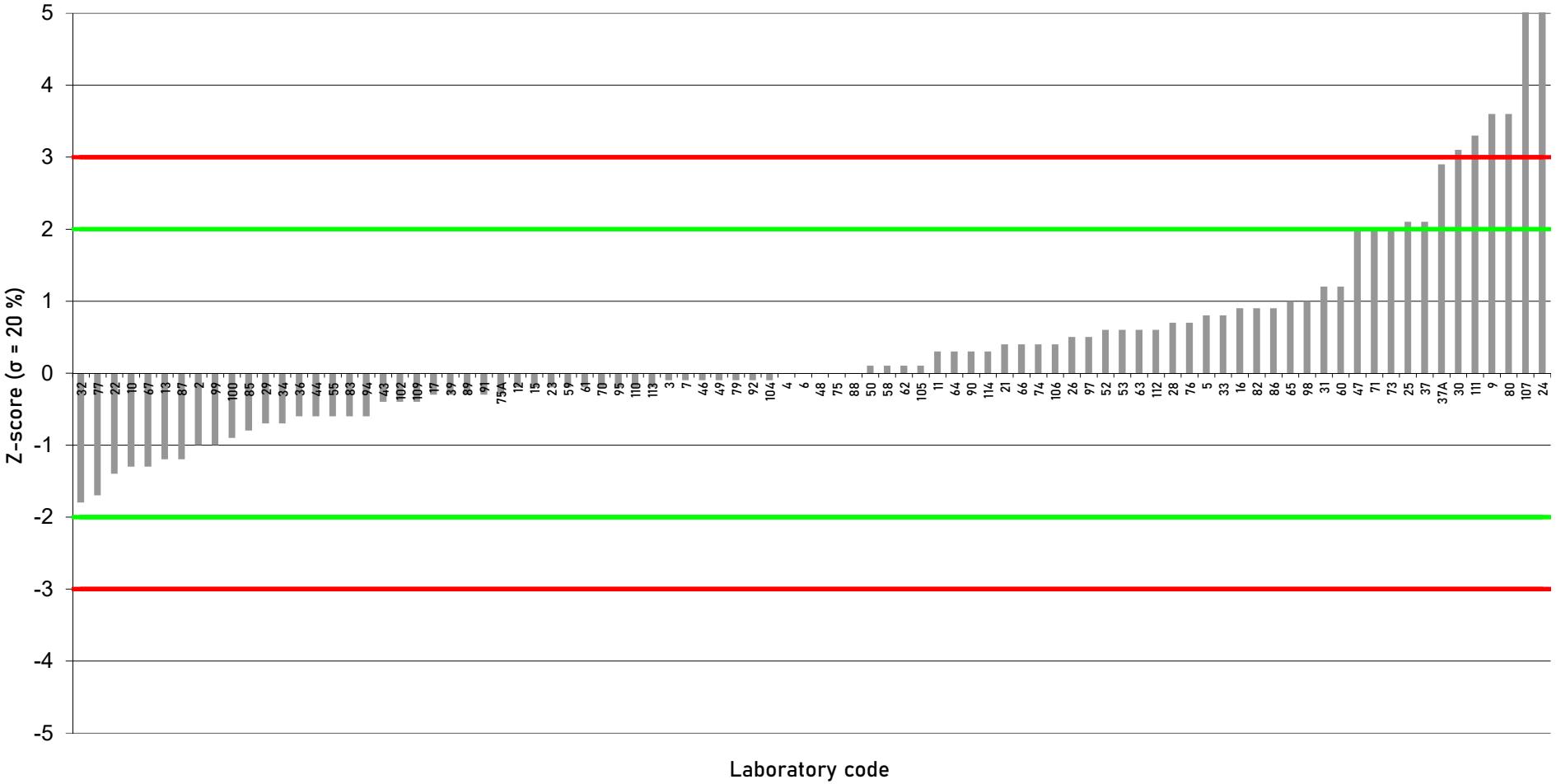
Assigned value: 1.11 µg/kg (12% moisture content)



Fish Meal (2203-FM)

PCB 138

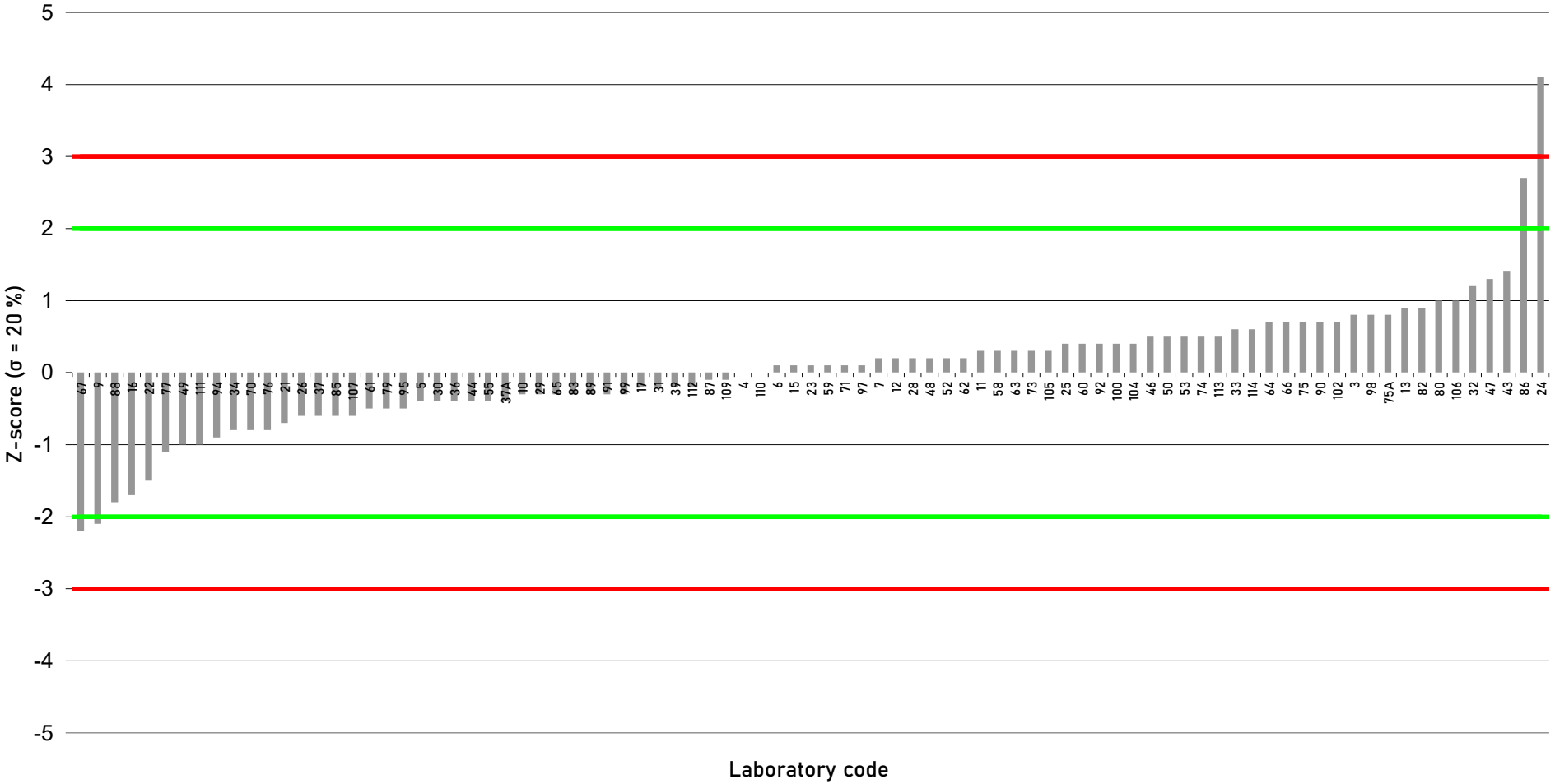
Assigned value: 2.34 µg/kg (12% moisture content)



Fish Meal (2203-FM)

PCB 153

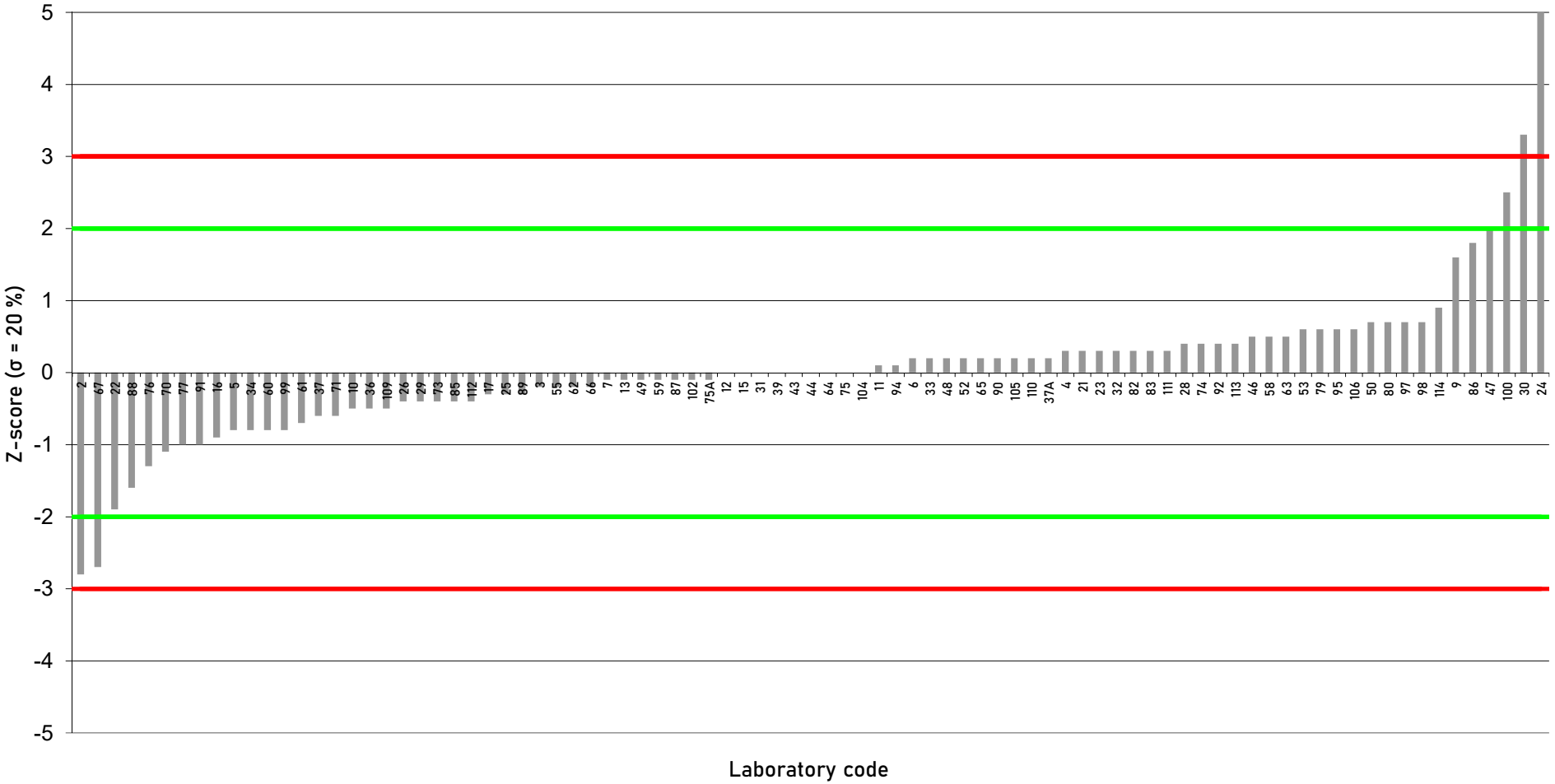
Assigned value: 3.39 µg/kg (12% moisture content)



Fish Meal (2203-FM)

PCB 180

Assigned value: 1.15 µg/kg (12% moisture content)



EURL Proficiency Study on the Determination of PCDD/Fs, PCBs, PBDEs, HBCDDs and PFASs in Fish Meal 2022 [EURL-PT-POP_2203-FM]

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Annex 5: Scoring system for PCDD/Fs and PCBs

Test sample - Fish Meal (2203-FM)

Positive scoring system

The "positive scoring system" gives one assessment for the PT sample covering all relevant PCDD/F and PCB sum parameters and congeners.
The criteria are applicable for sum parameter concentrations in the range (about 0.5 to 4 times) of the level of interest.

The total score for the positive scoring system is calculated according to the following general principles:

- Calculation of z-scores for sum parameters and evaluated individual congeners
- Calculation of the positive scores according to the following table:

Positive scoring system	| z-score | ≤ 2	2 < | z-score | < 3	| z-score | ≥ 3
Individual congeners	Positive score	Positive score	Positive score
Contribution to sum parameter* > 10 %	12	6	0
Contribution to sum parameter* 3 – 10 %	8	4	0
Contribution to sum parameter* < 3 %	6	3	0
Not evaluated congeners	0	0	0

*separately for the respective sum parameters WHO-PCDD/F-TEQ, WHO-PCB-TEQ and the sum of six indicator PCBs

- Calculation of maximum achievable scores (| z-score | ≤ 2) for PCDD/F and DL-PCB and indicator PCB congeners separately:
  Maximum score = Σmax. score(> 10 %) + Σmax. score(3-10 %) + Σmax. score(< 3 %)
- Calculation of the participant's scores for PCDD/F and DL-PCB and indicator PCB congeners separately:
  Participant's score = Σscore(> 10 %) + Σscore(3-10 %) + Σscore(< 3 %)
- Calculation of achieved scoring percentage for each participant:
  Participant's scoring percentage = Participant's score / Maximum score • 100

Criteria for successful participation:

Sum parameters:	≤ 1 parameter with |z-score| > 2, no parameter with |z-score| ≥ 3
PCDD/F congeners:	≥ 75 % of maximum score
DL-PCB congeners:	≥ 75 % of maximum score
Indicator PCB congeners:	≥ 75 % of maximum score
Difference between reported and calculated results for sum parameters	≤ 10 %

Successful participation for PCDD/Fs and PCBs, if all above mentioned criteria for the reported analytes are met.

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Fish Meal (2203-FM)
Summary Scoring system

LC	Sample	Scoring system	WHO-PCDD/F-PCB-TEQ z-score	WHO-PCDD/F-TEQ z-score	WHO-PCB-TEQ* z-score	Sum Indicator PCBs* z-score	Sum Parameters (≤ 1 parameter with |z-score| ≥ 2, no parameter with |z-score| ≥ 3)	PCDD/F congeners (≥ 75 % of max. score)	DL-PCB congeners* (≥ 75 % of max. score)	NDL-PCB congeners* (≥ 75 % of max. score)	Calculation of sum parameters (deviation ≤ 10 %)	Evaluation	Successful participation	Reason for not successful participation: Sum parameters	PCDD/F congeners	DL-PCB congeners	NDL-PCB congeners	Calculation sum param.
1	2203-FM																	
2	2203-FM					-3.9				64%	yes							
3	2203-FM		-0.3	-0.2	-1.2	0.4	Passed	95%	100%	95%	yes		**yes**					
4	2203-FM		0.7	0.7	0.5	-0.1	Passed	100%	96%	100%	yes		**yes**					
5	2203-FM		-2.9	-3.4	-2.1	-0.4	Failed	88%	100%	100%	yes		**no**	**x**				
6	2203-FM		0.2	-0.3	0.8	0.0	Passed	100%	100%	100%	yes		**yes**					
7	2203-FM		0.3	0.1	0.5	0.0	Passed	100%	100%	100%	yes		**yes**					
8	2203-FM																	
9	2203-FM		0.9	1.6	-0.4	0.1	Passed	93%	100%	71%	yes		**yes**					
10	2203-FM		-0.1	-0.3	0.1	-1.0	Passed	93%	93%	100%	yes		**yes**					
11	2203-FM		0.0	-0.5	0.7	0.2	Passed	100%	100%	100%	no		**no**					**x**
12	2203-FM		-2.4	-2.5	-1.7	-0.2	Passed	93%	93%	100%	yes		**yes**					
13	2203-FM		-0.2	-1.2	1.2	0.0	Passed	29%	100%	100%	yes		**no**		**x**			
14	2203-FM																	
15	2203-FM		-0.2	-0.4	-0.1	-0.2	Passed	100%	100%	100%	yes		**yes**					
16	2203-FM					-0.6				100%	yes							
17	2203-FM		0.6	0.9	0.1	-0.4	Passed	100%	100%	100%	yes		**yes**					
18	2203-FM																	
19	2203-FM																	
20	2203-FM																	
21	2203-FM		-0.1	-0.9	1.2	-0.3	Passed	100%	100%	100%	yes		**yes**					
22	2203-FM		-0.4	-0.5	-0.4	-1.6	Passed	97%	85%	90%	yes		**yes**					
23	2203-FM		0.1	-0.2	0.5	-0.1	Passed	90%	100%	100%	yes		**yes**					
24	2203-FM					7.8				0%	yes							
25	2203-FM		-3.4	-3.9	-2.7	0.9	Failed	84%	100%	85%	yes		**no**	**x**				
26	2203-FM					-0.3				100%	yes							
27	2203-FM		-0.6	-0.8	-0.5		Passed	100%	93%		yes		**yes**					
28	2203-FM		-0.3	0.4	-1.3	0.2	Passed	100%	100%	100%	yes		**yes**					
29	2203-FM		0.0	0.3	-0.5	-0.8	Passed	100%	100%	100%	yes		**yes**					
30	2203-FM					6.8				21%	yes							
31	2203-FM		-0.1	-0.6	0.6	0.2	Passed	100%	96%	100%	yes		**yes**					
32	2203-FM		-0.4	-0.2	-0.6	0.0	Passed	95%	100%	100%	yes		**yes**					
33	2203-FM		0.3	0.0	0.7	0.7	Passed	93%	100%	90%	yes		**yes**					
34	2203-FM					-1.1				100%	yes							
35	2203-FM																	
36	2203-FM		-1.2	-0.3	-2.7	-0.7	Passed	100%	100%	100%	yes		**yes**					
37	2203-FM		-0.4	-0.2	-0.8	0.1	Passed	72%	93%	90%	yes		**no**		**x**			
38	2203-FM																	
39	2203-FM		-0.3	-0.5	-0.1	-0.4	Passed	95%	100%	100%	yes		**yes**					
41	2203-FM																	
42	2203-FM																	
43	2203-FM		3.6	3.7	3.5	0.5	Failed	66%	78%	95%	yes		**no**	**x**	**x**			
44	2203-FM		0.4	1.1	-0.6	-0.6	Passed	91%	100%	100%	yes		**yes**					
45	2203-FM																	
46	2203-FM		1.2	1.3	1.0	0.2	Passed	100%	93%	100%	yes		**yes**					
47	2203-FM		-0.8	-0.3	-1.7	2.3	Passed	100%	100%	100%	yes		**yes**					
48	2203-FM		-0.7	-1.0	-0.4	-0.1	Passed	100%	100%	100%	yes		**yes**					
49	2203-FM		-1.0	-0.4	-2.0	-0.6	Passed	100%	100%	90%	yes		**yes**					
50	2203-FM		-0.8	-0.2	-1.7	0.4	Passed	97%	100%	100%	yes		**yes**					
51	2203-FM																	
52	2203-FM		0.2	0.0	0.4	0.3	Passed	100%	100%	100%	yes		**yes**					
53	2203-FM		15.4	24.8	0.8	0.6	Failed	10%	100%	100%	yes		**no**	**x**	**x**			
54	2203-FM																	
55	2203-FM		0.5	0.0	1.1	-0.7	Passed	100%	100%	100%	yes		**yes**					
56	2203-FM		1.4	1.4	1.1		Passed	100%	100%		yes		**yes**					
57	2203-FM		-0.2	0.3	-0.9		Passed	100%	100%		yes		**yes**					
58	2203-FM		1.0	1.8	-0.3	0.3	Passed	97%	100%	100%	yes		**yes**					
59	2203-FM		0.6	0.6	0.5	-0.2	Passed	100%	100%	100%	yes		**yes**					
60	2203-FM					0.0				100%	yes							
61	2203-FM		-0.2	-0.5	0.3	-0.7	Passed	100%	100%	100%	yes		**yes**					
62	2203-FM		0.7	1.2	-0.1	-0.1	Passed	100%	100%	100%	yes		**yes**					
63	2203-FM		-0.1	0.0	-0.3	0.4	Passed	100%	100%	100%	yes		**yes**					
64	2203-FM		0.1	0.0	0.3	0.4	Passed	100%	100%	100%	yes		**yes**					
65	2203-FM		-0.8	-0.2	-1.3	0.4	Passed	100%	100%	89%	yes		**yes**					
66	2203-FM		1.7	1.4	1.9	0.6	Passed	100%	100%	100%	yes		**yes**					
67	2203-FM					-2.0				75%	yes							
68	2203-FM																	
69	2203-FM		0.5	0.5	0.5		Passed	100%	100%		yes		**yes**					
70	2203-FM		-0.3	-0.8	0.4	-0.8	Passed	90%	96%	100%	yes		**yes**					
71	2203-FM					0.8				100%	yes							
72	2203-FM																	
73	2203-FM					1.0				100%	yes							
74	2203-FM		0.0	-0.7	1.1	0.4	Passed	100%	100%	100%	yes		**yes**					
75	2203-FM					0.4				100%	yes							

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EURL for halogenated Persistent Organic Pollutants (POPs) in Feed and Food

Fish Meal (2203-FM)
Summary Scoring system

LC	Sample	Scoring system	WHO-PCDD/F-PCB-TEQ z-score	WHO-PCDD/F-TEQ z-score	WHO-PCB-TEQ* z-score	Sum Indicator PCBs* z-score	Sum Parameters (≤ 1 parameter with |z-score| ≥ 2, no parameter with |z-score| ≥ 3)	PCDD/F congeners (≥ 75 % of max. score)	DL-PCB congeners* (≥ 75 % of max. score)	NDL-PCB congeners* (≥ 75 % of max. score)	Calculation of sum parameters (deviation ≤ 10 %)	Evaluation	Successful participation	Reason for not successful participation: Sum parameters	PCDD/F congeners	DL-PCB congeners	NDL-PCB congeners	Calculation sum param.
76	2203-FM					-0.7				100%	yes							
77	2203-FM		-0.3	-0.4	-0.1	-1.9	Passed	86%	100%	95%	yes		**yes**					
78	2203-FM																	
79	2203-FM		0.5	0.3	0.9	-0.4	Passed	100%	93%	100%	yes		**yes**					
80	2203-FM					2.3				75%	yes							
81	2203-FM		-0.2	0.3	-0.9		Passed	100%	100%		yes		**yes**					
82	2203-FM					1.3				100%	yes							
83	2203-FM		0.0	0.0	-0.1	-0.4	Passed	100%	100%	100%	yes		**yes**					
84	2203-FM																	
85	2203-FM		-0.4	-0.5	-0.4	-0.8	Passed	100%	100%	100%	yes		**yes**					
86	2203-FM		-0.6	-0.3	-1.3	2.0	Passed	100%	100%	90%	yes		**yes**					
87	2203-FM		-0.4	-0.4	-0.4	-0.8	Passed	100%	100%	100%	yes		**yes**					
88	2203-FM		-2.2	-2.4	-1.8	-0.6	Failed	100%	100%	100%	no		**no**	**x**				**x**
89	2203-FM		2.9	3.5	2.1	-0.6	Failed	69%	85%	100%	yes		**no**	**x**	**x**			
90	2203-FM		1.0	0.2	2.1	0.3	Passed	100%	100%	100%	yes		**yes**					
91	2203-FM		3.2	2.6	4.1	-0.6	Failed	86%	93%	100%	yes		**no**	**x**				
92	2203-FM					0.2				100%	yes							
93	2203-FM																	
94	2203-FM		0.1	-0.8	1.4	-0.3	Passed	93%	84%	100%	yes		**yes**					
95	2203-FM		0.4	0.6	-0.1	-0.4	Passed	100%	100%	100%	yes		**yes**					
96	2203-FM																	
97	2203-FM		0.3	-0.1	0.8	2.1	Passed	100%	78%	75%	yes		**yes**					
98	2203-FM					1.2				100%	yes							
99	2203-FM		-3.0	-1.8	-4.9	-0.8	Passed	96%	91%	100%	yes		**yes**					
100	2203-FM		0.5	-0.5	2.2	0.3	Passed	100%	100%	90%	yes		**yes**					
101	2203-FM		-0.6	0.4	-2.5		Passed	79%	89%		yes		**yes**					
102	2203-FM		-2.9	-3.8	-1.6	-0.1	Failed	84%	100%	100%	yes		**no**	**x**				
103	2203-FM										yes							
104	2203-FM		0.1	0.2	-0.2	0.7	Passed	96%	100%	100%	yes		**yes**					
105	2203-FM		1.5	1.2	1.9	0.2	Passed	97%	100%	100%	yes		**yes**					
106	2203-FM		0.8	0.0	1.8	0.7	Passed	100%	100%	100%	yes		**yes**					
107	2203-FM					6.9				27%	yes							
108	2203-FM										yes							
109	2203-FM		0.1	0.7	-0.9	-0.5	Passed	100%	100%	100%	yes		**yes**					
110	2203-FM		-1.0	-1.2	-0.9	-0.2	Passed	100%	100%	100%	yes		**yes**					
111	2203-FM					0.6				81%	yes							
112	2203-FM					-0.2				100%	yes							
113	2203-FM		1.4	0.4	2.6	0.7	Passed	100%	78%	87%	yes		**yes**					
114	2203-FM					0.9				100%	yes							
27A	2203-FM		-0.8	0.0	-2.0		Passed	100%	93%		yes		**yes**					
37A	2203-FM					1				88%	yes							
57A	2203-FM			0.9			Passed	100%			yes		**yes**					
69A	2203-FM		0.4	0.3	0.6		Passed	100%	100%		yes		**yes**					
75A	2203-FM					0.3				100%	yes							

*Sum parameters outside the range of 0.5 to 4 times of the level of interest / no legal limits defined; results not included in overall assessment

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Annex 6: Test for sufficient homogeneity for PCDD/Fs and PCBs

Test sample - Fish Meal (2203-FM)

EURL Proficiency Test on the Determination of PCDD/Fs, PCBs, PBDEs, HBCDDs and PFASs in Fish Meal 2022 [EURL-PT-POP_2203-FM]
EURL for halogenated Persistent Organic Pollutants (POPs) in Feed and Food

Fish Meal (2203-FM)
Sum parameters - Homogeneity test - Data

Analyte	Result ng/kg (12% Moisture Content)	**Mean** (n = 10, duplicate analysis)	**Median** (n = 10, duplicate analysis)	**Relative standard deviation** [%]
WHO-PCDD/F-PCB-TEQ upper bound		1.80	1.80	4%
WHO-PCDD/F-PCB-TEQ middle bound		1.80	1.80	4%
WHO-PCDD/F-PCB-TEQ lower bound		1.80	1.80	4%

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Fish Meal (2203-FM)
PCDD/F - Homogeneity test - Data

Analyte	Result ng/kg (12% Moisture Content)	**Mean** (n = 10, duplicate analysis)	**Median** (n = 10, duplicate analysis)	**Relative standard deviation** [%]
WHO-PCDD/F-TEQ upper bound		1.09	1.09	6%
WHO-PCDD/F-TEQ middle bound		1.09	1.09	6%
WHO-PCDD/F-TEQ lower bound		1.08	1.08	7%
2,3,7,8-TCDD		0.0855	0.0847	9%
1,2,3,7,8-PeCDD		0.210	0.207	9%
1,2,3,4,7,8-HxCDD		0.0232	0.0228	18%
1,2,3,6,7,8-HxCDD		0.204	0.204	5%
1,2,3,7,8,9-HxCDD		0.0243	0.0245	18%
1,2,3,4,6,7,8-HpCDD		0.0808	0.0797	8%
1,2,3,4,6,7,8,9-OCDD		0.186	0.180	11%
2,3,7,8-TCDF		1.44	1.44	6%
1,2,3,7,8-PeCDF		0.284	0.283	10%
2,3,4,7,8-PeCDF		1.95	1.93	8%
1,2,3,4,7,8-HxCDF		0.0676	0.0681	10%
1,2,3,6,7,8-HxCDF		0.0964	0.0956	6%
2,3,4,6,7,8-HxCDF		0.108	0.107	9%
1,2,3,7,8,9-HxCDF		< 0.00459		
1,2,3,4,6,7,8-HpCDF		0.0272	0.0268	16%
1,2,3,4,7,8,9-HpCDF		0.00281	0.00277	18%
1,2,3,4,6,7,8,9-OCDF		0.00981	0.00975	14%

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Fish Meal (2203-FM)
DL-PCB - Homogeneity test - Data

Analyte	Result ng/kg (12% Moisture Content)	**Mean** (n = 10, duplicate analysis)	**Median** (n = 10, duplicate analysis)	**Relative standard deviation** [%]
WHO-PCB-TEQ upper bound		0.721	0.720	6%
WHO-PCB-TEQ middle bound		0.721	0.720	6%
WHO-PCB-TEQ lower bound		0.721	0.720	6%
PCB 105		320	320	6%
PCB 114		30.1	29.1	11%
PCB 118		925	902	4%
PCB 123		7.46	7.76	20%
PCB 156		154	154	4%
PCB 157		33.7	33.0	8%
PCB 167		76.2	76.9	6%
PCB 189		19.6	19.1	11%
PCB 77		9.95	10.2	7%
PCB 81		0.243	0.245	12%
PCB 126		5.84	5.91	6%
PCB 169		2.95	2.89	10%

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Fish Meal (2203-FM)
NDL-PCB - Homogeneity test - Data

Analyte	Result µg/kg (12% Moisture Content)	**Mean** (n = 10, duplicate analysis)	**Median** (n = 10, duplicate analysis)	**Relative standard deviation** [%]
Sum Indicator PCBs upper bound		8.36	8.33	4%
Sum Indicator PCBs middle bound		8.36	8.33	4%
Sum Indicator PCBs lower bound		8.36	8.33	4%
PCB 28		0.118	0.115	10%
PCB 52		0.334	0.331	4%
PCB 101		1.15	1.14	6%
PCB 138		2.17	2.20	6%
PCB 153		3.45	3.43	7%
PCB 180		1.14	1.13	5%

EURL Proficiency Test on the Determination of PCDD/Fs, PCBs, PBDEs, HBCDDs and PFASs in Fish Meal 2022 [EURL-PT-POP_2203-FM]
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Fish Meal (2203-FM)
Selected congeners - Homogeneity test - Data

Sample	Replicate	Result ng/kg (12% Moisture Content)	2,3,7,8-TCDD	2,3,7,8-TCDF	WHO-PCDD/F-TEQ (ub)
33	1		0.0847	1.51	1.10
	2		0.0838	1.44	1.07
69	1		0.0856	1.43	1.04
	2		0.0841	1.52	1.09
95	1		0.0710	1.36	0.974
	2		0.0985	1.49	1.16
119	1		0.0834	1.44	1.06
	2		0.0865	1.51	1.09
137	1		0.0848	1.49	1.07
	2		0.0877	1.44	1.09
162	1		0.0930	1.53	1.18
	2		0.0769	1.34	1.01
166	1		0.0875	1.43	1.03
	2		0.0790	1.25	1.04
193	1		0.0777	1.45	1.14
	2		0.1003	1.44	1.17
221	1		0.0776	1.33	0.982
	2		0.0880	1.38	1.10
224	1		0.0826	1.37	1.03
	2		0.0966	1.67	1.25
Cochran's C-test					
C			0.393	0.455	0.377
$C_{critical}$ (α = 0.05, m = 2, n = 10)			0.602	0.602	0.602
$C_{critical}$ (α = 0.01, m = 2, n = 10)			0.718	0.718	0.718
$C < C_{critical}$			yes	yes	yes
Outliers			no evidence for analytical outliers	no evidence for analytical outliers	no evidence for analytical outliers
Homogeneity test					
General average $\bar{x}$			0.0855	1.44	1.08
Standard deviation of sample averages s_x			0.002	0.055	0.039
Wthin-sample standard deviation s_w			0.010	0.101	0.081
Between-sample standard deviation s_s			0.000	0.000	0.000
Standard deviation for proficiency assessment σ_{PT}			0.017	0.288	0.217
s_s / σ_{PT}			0.0	0.0	0.0
Test for homogeneity ($s_s \leq 0.3\ \sigma_{PT}$)			passed	passed	passed

EURL Proficiency Test on the Determination of PCDD/Fs, PCBs, PBDEs, HBCDDs and PFASs in Fish Meal 2022 [EURL-PT-POP_2203-FM]
EURL for halogenated Persistent Organic Pollutants (POPs) in Feed and Food

Fish Meal (2203-FM)
Selected congeners - Stability test - Data

Sample	Replicate	Result ng/kg (12% Moisture Content)	2,3,7,8-TCDD	2,3,7,8-TCDF	WHO-PCDD/F-TEQ (ub)
93	1		0.0944	1.67	1.13
	2		0.0898	1.31	1.05
154	1		0.0830	1.34	1.08
	2		0.0842	1.34	1.04
227	1		0.0944	1.43	0.970
	2		0.0829	1.36	1.03
Stability test					
General average (stability test) $\bar{y}$			0.0881	1.41	1.05
General average (homogeneity test) $\bar{x}$			0.0855	1.44	1.08
Standard deviation for proficiency assessment σPT			0.0171	0.288	0.217
$\lvert \bar{y} - \bar{x} \rvert$			0.00264	0.0324	0.0310
Test for stability ($\lvert \bar{y} - \bar{x} \rvert \leq 0.3$ σPT)			passed	passed	passed

EURL Proficiency Study on the Determination of PCDD/Fs, PCBs, PBDEs, HBCDDs and PFASs in Fish Meal 2022 [EURL-PT-POP_
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12 June 2023

Annex 7: Participants' methods for PCDD/Fs and PCBs

Test sample - Fish Meal (2203-FM)

EURL Proficiency Study on the Determination of PCDD/Fs, PCBs, PBDEs, HBCDDs and PFASs in Fish Meal 2022 [EURL-PT-POP_2203-FM]
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Fish Meal (2203-FM)
Physico-chemical Methods PCDD/Fs and PCBs - Internal standards

		Weighed sample	Use of isotope-labelled internal standards for all relevant …			Other internal standards		
LC	Sample	[g]	PCDD/F congeners (yes/no)	DL-PCB congeners (yes/no)	NDL-PCB congeners (yes/no)	PCDD/Fs	DL-PCBs	NDL-PCBs
1	2203-FM							
2	2203-FM	5			no			PCB 209
3	2203-FM	16	yes	yes	yes			
4	2203-FM	10	yes	yes	yes			
5	2203-FM	25.041	yes	yes	yes			
6	2203-FM	15.0	yes	yes	yes	all 13C-: CB70, CB111, CB138, CB178, 1378-TCDD, 12478-PeCDD, 123468-HxCDD, 1234679-HpCDD	moPCBs: all 13C-: CB60, CB70, CB111, CB127, CB159, CB170 (for noPCBs see PCDD/Fs)	all 13C-: CB60, CB70, CB111, CB127, CB159, CB170
7	2203-FM	10.2	yes	yes	yes			
8	2203-FM							
9	2203-FM	10	yes	yes				
10	2203-FM	20.3609	yes	yes	yes			
11	2203-FM	8.0	yes	yes	yes	yes (syringe standard)	yes (syringe standard)	yes (syringe standard)
12	2203-FM	35.60	No (were used 15 labelled congeners)	Yes	Yes			
13	2203-FM	20	yes	yes	yes	1,2,3,4TCDD (rec.stand)	1,2,3,4TCDD, PCB70 (rec.stand)	PCB70 (rec.stand)
14	2203-FM							
15	2203-FM	20.0	yes	yes	yes			
16	2203-FM	10			yes			PCB-111 (injection standard)
17	2203-FM	25	yes	yes	yes			
18	2203-FM							
19	2203-FM							
20	2203-FM							
21	2203-FM	30.08	YES	YES	YES			
22	2203-FM	5.028	yes	yes	yes	-	-	-
23	2203-FM	5.37	yes	yes	yes			
24	2203-FM	5			no			PCB 209
25	2203-FM	20	Yes	Yes	Yes	Recovery standards: 13C-1,2,3,4-TCDD; 13C-1,9-HxCDD	Recovery standards: 13C-PCB-101, 13C-PCB-138	
26	2203-FM	2.5	/	/	no	/	/	PCB 65, PCB 166
27	2203-FM	8	yes	yes				
28	2203-FM	15.12	yes	yes	yes			
29	2203-FM	3	yes	yes	yes			
30	2203-FM	5			no			PCB 209
31	2203-FM	25.25	yes	yes	yes	ISS. Well EPA1613-ISS	ISS. Well P48-RS	ISS. Well P48-RS
32	2203-FM	7.02	yes	yes	yes			
33	2203-FM	5	Yes	Yes	YES			
34	2203-FM	10			yes			no
35	2203-FM							
36	2203-FM	60	yes	yes	yes			
37	2203-FM	20.04	yes	yes	yes	1234-TCDD	1234-TCDD	1234-TCDD
38	2203-FM							
39	2203-FM	20	yes	yes	yes			
41	2203-FM							
42	2203-FM							
43	2203-FM	10.08	yes	yes	yes			
44	2203-FM							
45	2203-FM							
46	2203-FM	10	yes	yes	yes	1,2,3,4-TCDD	PCB 111	PCB 111
47	2203-FM							
48	2203-FM	10	yes	yes	yes			
49	2203-FM	39.81	Yes	Yes	Yes			
50	2203-FM	9.08	yes	yes	yes			
51	2203-FM							
52	2203-FM	20	yes	yes	yes			
53	2203-FM							
54	2203-FM							
55	2203-FM	20.00	yes	yes	yes			
56	2203-FM	25.3	Yes (15)	Yes (12)	No	Yes - 1,2,3,4-TCDD / 1,2,3,7,8,9 HxCDD	Yes - PCB 70 / 111 / 138 / 170	No
57	2203-FM	44.019	yes	yes	no	no	no	no
58	2203-FM							
59	2203-FM	9.359	Yes	Yes	Yes			
60	2203-FM	10						
61	2203-FM	20 (10)	yes (except 1,2,3,7,8,9-HxCDD and 1,2,3,4,6,7,8,9-OCDF)	yes	no			TCMX, PCB-209, trans-nonachlor
62	2203-FM	10.07	Yes	Yes	Yes			
63	2203-FM	20	yes	yes	yes			
64	2203-FM	20	yes	yes	yes			
65	2203-FM	12.5	YES	YES	YES	1,2,3,4-Tetrachlorodibenzo-p-dioxin (13C6,99%) / 1,2,3,4,6,9-Hexachlorodibenzofuran (13C12, 98,7%)	1,2,3,4-Tetrachlorodibenzo-p-dioxin (13C6,99%) / 1,2,3,4,6,9-Hexachlorodibenzofuran (13C12, 98,7%)	2,2',3,3',4,4',5-Heptachlorobiphenyl (PCB170, 13C12,99%)
66	2203-FM	30	yes	yes	yes			
67	2203-FM	2.5						
68	2203-FM							
69	2203-FM	25	yes	yes		13C-1,2,3,4-Cl4DD, 13C- 1,2,3,4,6-Cl5DF, 13C -1,2,3,4,6,9-Cl6DF, 13C-1,2,3,4,6,8,9-Cl7DF		
70	2203-FM	10	yes	yes	yes			
71	2203-FM	5			no			PCB 171, to check the extraction, not used for quantification
72	2203-FM							
73	2203-FM	5			yes			no

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Fish Meal (2203-FM)
Physico-chemical Methods PCDD/Fs and PCBs - Internal standards

LC	Sample	Weighed sample [g]	Use of isotope-labelled internal standards for all relevant …			Other internal standards		
			PCDD/F congeners (yes/no)	DL-PCB congeners (yes/no)	NDL-PCB congeners (yes/no)	PCDD/Fs	DL-PCBs	NDL-PCBs
74	2203-FM	15.18	yes	yes	yes			
75	2203-FM	6			yes			syringe standard, PCB 70, PCB 111, PCB 170
76	2203-FM	0.5		no				
77	2203-FM	10	yes	yes	yes			
78	2203-FM							
79	2203-FM	10	yes	yes	no			PCB-20, PCB-97
80	2203-FM	12			yes			
81	2203-FM	10	yes	yes				
82	2203-FM	5			yes			
83	2203-FM	10.0	yes	yes	yes			
84	2203-FM							
85	2203-FM	20	Yes	Yes	Yes			
86	2203-FM	30	YES	YES	YES			
87	2203-FM	3	YES	YES	YES			
88	2203-FM	30	yes	yes	yes			
89	2203-FM	11	Y	Y	Y	1234-TCDD; 123789-HxCDD	PCB 101; PCB 138; PCB 194	PCB 123
90	2203-FM	20	yes	yes	yes			
91	2203-FM	10.0468	yes	yes	no			77L for 28&52, 123L for 101, 167L for 138&153, 189L for 180
92	2203-FM	5			yes			SYRINGE STANDARD PCB-155-13C12
93	2203-FM							
94	2203-FM	5.32	Yes	Yes	Yes			
95	2203-FM	40.8131	Yes	Yes	Yes			
96	2203-FM							
97	2203-FM	10	yes	yes	yes			
98	2203-FM	1.2			yes			3,3',4,4',5-Pentachlorobiphényl 13C12
99	2203-FM	15.154	yes	yes	yes			
100	2203-FM	10.0	yes	yes	yes			
101	2203-FM	5	yes	yes	yes			
102	2203-FM	11.5	yes	yes	yes			
103	2203-FM							
104	2203-FM	12.5	yes	yes	yes			
105	2203-FM	2.6	yes	yes	yes	1,2,3,4-TCDD	1,2,3,4-TCDD	PCB159
106	2203-FM	51	yes	yes	yes			
107	2203-FM	5	no	no	no	mirex		
108	2203-FM							
109	2203-FM	30	yes	yes	yes			
110	2203-FM	7	Yes	Yes	Yes	-	-	-
111	2203-FM	3			yes			
112	2203-FM	20			yes			C13-PCB-178
113	2203-FM	30	yes	yes	yes			
114	2203-FM	10		no				yes
27A	2203-FM	10	yes	yes				
37A	2203-FM	25						
57A	2203-FM	44	yes	no	no	no	no	no
69A	2203-FM	25	yes	yes		13C-1,2,3,4-Cl4DD, 13C- 1,2,3,4,6-Cl5DF, 13C -1,2,3,4,6,9-Cl6DF, 13C-1,2,3,4,6,8,9-Cl7DF		
75A	2203-FM	6			yes			syringe standard, PCB 70, PCB 111, PCB 170

Fish Meal (2203-FM)
Physico-chemical Methods PCDD/Fs and PCBs - Extraction

		Extraction					
LC	Sample	Sample preparation/pre-treatment	Extraction technique	Extraction solvent	Extraction time [h]	Extraction temperature [ºC]	Extraction pressure [MPa]
1	2203-FM						
2	2203-FM	no	slury with silica/sulfuric acid	hexane			
3	2203-FM	none	Soxhlet	Toluene/Ethanol 30/70	8		
4	2203-FM	Mixed with sodium sulphate	ASE	Hexane/Acetone (70:30)	1	125	10.3
5	2203-FM	Homogenisation	SILICA GEL /SOLVENT EXTRACT- MANUAL	40:60 DCM:HEXANE	2-4HRS	AMBIENT	GRAVITY
6	2203-FM		PLE	EtOH:Tol (7:3)	2*20 min	100 degC	1500 psi (=10MPa)
7	2203-FM		ASE	1 cycle Toluol, 2 cycles Toluol/Ethanol (9/1)		100	10
8	2203-FM						
9	2203-FM		ASE	toluene; toluene/ethanol	45 min.	100	1500
10	2203-FM		automatic soxhlet	hexane/acetone (90/10)	0,30	150°C	1500 psi
11	2203-FM		Soxhlet	Hexane/acetone (88/12)	3		
12	2203-FM	sample mixed with sodium sulphate before extraction	Soxhlet	DCM:Hexane (50:50)	24 h		
13	2203-FM	no	Soxhlet	DCM	8		
14	2203-FM						
15	2203-FM	none	Soxhlet	Toluene/acetone 70:30	12	70-90 °C	0.1
16	2203-FM	no	ultra turrax	hexane/acetone 50/50 (v/v)	0,017	ambiente	ambiente
17	2203-FM	drying	ASE	Toluene:Ethanol			
18	2203-FM						
19	2203-FM						
20	2203-FM						
21	2203-FM		SOXHLET	PCDD/F DL-PCB TOLUENE/CYCLOHEXANE (1/1) NDL-PCB HEXANE/DCM (1/1)	24H		
22	2203-FM	No preparation	ASE	9:1 (Toluene/Acetone)	25 minutes	120	10,34
23	2203-FM		ASE	Hexane	5 min x2	100	10,3
24	2203-FM			ethyl acetate/cyclohexane 1/1	24	21	
25	2203-FM	Drying in 105 degrees celsius	Soxhlet (SoxtecTM)	Hexane/DCM (1/1)	1 h 30 min	130	
26	2203-FM	/	LSE	ethyl-acetate	10m	/	/
27	2203-FM		ASE	n-hexane:Dichloromethane	0,7	100	
28	2203-FM	-	ASE	hexane/dichloromethane 1/1	0,3	125	1500
29	2203-FM	drying	PLE	Tolune/Acetone (70/30)			
30	2203-FM			Acetone/Dichlormethane/Ethyl-acetate (1/1/1)	18	20-22	
31	2203-FM		Soxhlet	toluene	8	-	-
32	2203-FM	no	ASE	Toluen/Ethanol (90/10)	1	100	10.342
33	2203-FM	NO	Randall extraction	2 cycles: 1; Toluene, 2: 70/30 (Ethanol/Toluene)	2x 3h	Boiling temp. Solvent or azeotrope	
34	2203-FM	homogenization	ASE	toluene	2	140	11,7
35	2203-FM						
36	2203-FM	no	Soxhlet	Hexane:Acetone (41:59)	24		
37	2203-FM	drying 3 h	soxhlet	cyclohexane/toluene (1/1) and EtOH/toluene (7/3)	app. 12 h	70	
38	2203-FM						
39	2203-FM	drying	soxhlet	dcm:hex 1:1	6	boiling point of solvent mixture	normal
41	2203-FM						
42	2203-FM						
43	2203-FM	drying with sodium sulfate and isolute media	microwave	1:1 Methylene Chloride:Hexane	1 hour	100	NA
44	2203-FM						
45	2203-FM						
46	2203-FM		ASE	dichloromethane/hexane (50/50)	0,3	120	10
47	2203-FM						
48	2203-FM	mixing	Automatic solvent extraction	hexane: dichloromethane 50:50	2:59	n/a	n/a
49	2203-FM		Soxhlet	DCM	18	Boiling point	
50	2203-FM	Homogenisation	Liquid-liquid	n-hexane	1x60 min. + 2x30 min.	Ambient	Ambient
51	2203-FM						
52	2203-FM	NO	ASE	Toluene/Acetone 60/40	N.3 static	130	10
53	2203-FM						
54	2203-FM						
55	2203-FM		soxhlet	dichloromethane/n-hexane (50/50 v/v)	18		
56	2203-FM	None	ASE	Toluene	0.5	150	11.7
57	2203-FM		Soxhlet	Toluene:Cyclohexene	24 Hs	Boilling	
58	2203-FM						
59	2203-FM		ASE	Hexane:Aceton 1:1	1	100	10
60	2203-FM	homogenisation	shaking	water, n-Propanol, Hexan	1 hour, 2x 1/2 hours	abient	normal
61	2203-FM	thorough homogenization, drying with anhydrous Sodium Sulfate	Soxhlet (ultrasonic bath, agitate)	dichloromethane:acetone 3:1 (dichloromethane:acetone 2:1)	21 (2.5)	109 (20)	0.1
62	2203-FM		ASE	Toluene / Ethanol (80/20 V/V)	0.30 (including 2 static cycles of 5 mins)	100	10.3
63	2203-FM		ASE	15% ethanol/85 % toluene v/v	0.4	120	10.3
64	2203-FM	Homogenisation, drying (only for determination of moisture content).	ASE, Soxhlet	toluene, ethanol, hexane, acethone (ASE), toluene (Soxhlet)	45min/sample (ASE), 16h (Soxhlet)	100°C (ASE)	10MPa (ASE)
65	2203-FM	N/A	SOXTEC	TOLUENE	2	160	N/A
66	2203-FM	-	Soxhlet	hexane-dichloromethane 1:1	20h	boiling point of solvent mixture	-
67	2203-FM		QuEChERS exraction procedure	Acetonitrile/Water (1/1)		RT	
68	2203-FM						
69	2203-FM		Soxhlet	toluene/iso-propanol (23/77)	overnight	boiling	
70	2203-FM	milled	Twisselmann, ASE	Toluol/ Iso-Propanol (75/25), n-Hexan	8h, 0.5h	80, 120	atm, 10
71	2203-FM		shaking	acetone, petrolether	1	room temperature	
72	2203-FM						
73	2203-FM	no	ASE	Cyclohexan/Ethylacetat (1:1)	2x5min	100	10

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Fish Meal (2203-FM)
Physico-chemical Methods PCDD/Fs and PCBs - Extraction

		Extraction					
LC	Sample	Sample preparation/pre-treatment	Extraction technique	Extraction solvent	Extraction time [h]	Extraction temperature [ºC]	Extraction pressure [MPa]
74	2203-FM		ASE	Toluene:Ethanol (70:30)			
75	2203-FM	none	ASE	n-hexane	20	120	unknown
76	2203-FM	none	simple solvent extraction	Hexan/Aceton (2/1)	1 min	RT	normal
77	2203-FM	freeze drying	Twisselmann	Toluol	6	110,6	0,1
78	2203-FM						
79	2203-FM	homogenization using sea sand	Soxhlet	Toluol	16	110	ambient pressure
80	2203-FM	addition of water and sodium chloride	shaking	acetone/hexane 2/1	16	23	0,101
81	2203-FM	freeze drying	twisselman	Cyclohexan/Toluol (50/50)	8	150	
82	2203-FM		ASE	Ethylacetate/Cyclohexane (1:1 v/v)	0,25	100	10
83	2203-FM		Soxhlet	Toluene/Acetone 7/3	4		
84	2203-FM						
85	2203-FM	freeze drying	Twisselmann	Cyclohexane:Toluene (1:1, v/v)	6	boiling point	
86	2203-FM	drying	ASE	HEXANE/ACETONE 50/50	0.33	100	10.13
87	2203-FM		ASE	TOLUENE	0.5	135	1500
88	2203-FM	drying	Soxhlet (hot extraction)	Hexane/acetone 80/20	1	50	Atmospheric
89	2203-FM	DRYING	ASE	n-ESANO/ACETONE (4/1)	0:45 h	110 (°C)	11,7 (MPa)
90	2203-FM		ASE	Hexane/Acetone (80/20)	1	125	10
91	2203-FM	hydromatrix added in the extraction cell; sand added as dispersant	ASE350	Hexane:Acetone 5:1	0,333	100	10,34
92	2203-FM	OVEN DRYING (45°C)	ASE	ACETONE:HEXANE 1:1	1/3	100	10,34
93	2203-FM						
94	2203-FM	No	ASE	Toluene	45 minutes	135	
95	2203-FM		ASE	hex:acetone 3:2	1	110	1500 psi
96	2203-FM						
97	2203-FM	-	ASE	(1) Toluene - (2) Toluene:Ethanol 90:10	0.25	100°C	10.3
98	2203-FM	homogenisation		toluene/methanol 20/6 ml	2.5 h	RT	AP
99	2203-FM	-	Soxhlet	Toluene	2,5	250	-
100	2203-FM		Soxhlet	Toluene	12		
101	2203-FM		Bligh Dyer			ambient	
102	2203-FM	Drying by Steamroom	solid/liquid extraction	Hexane/IPA (60/40) + Toluène/Acétone (70/30)	/	/	/
103	2203-FM						
104	2203-FM	none	Soxtherm	toluene	3 h	110	ambient pressure
105	2203-FM	homogenated	Inhouse extraction method	Cyclohexane / IPA / salt water	0,1	room temperature	atmospheric
106	2203-FM	Homogenisation	Soxhlet	Toluene /ethanol 50 / 50	24	120	atm
107	2203-FM	acetone, diclormethan, petrolium ether	GPC ULTRA	ciclohexan:ethyl acetate 1:1	1	40	180 mbar, 200 mbar, 100 mbar
108	2203-FM						
109	2203-FM		Twisselman	Toluene / Ethanol (30/70)	6		
110	2203-FM	Drying	ASE	Toluene / Acetone (70/30)	0.25 h	120 °C	10 Mpa
111	2203-FM	80°C 72h	BUCHI	TOLUENE/ACETONE 70/30	0,75	120	100 bar
112	2203-FM	/	cold extraction	Hexaan	1	room temperature	atmospheric pressure
113	2203-FM		ASE				
114	2203-FM		liquid liquid, shaking	100 ml water, 25 g NaCl, 200 ml acetone, 150 ml petroleum ether	1,5	ambient	
27A	2203-FM		ASE	n-hexane:Dichloromethane	0,7	100	
37A	2203-FM			dichloromethane/n-hexane (10/40)	0,03 (2min)	room temperature	
57A	2203-FM		Soxhlet	Toluene:Cyclohexene	24 Hs	Boilling	
69A	2203-FM		Soxhlet	toluene/iso-propanol (23/77)	overnight	boiling	
75A	2203-FM	none	ASE	n-hexane	20	120	unknown

EURL Proficiency Study on the Determination of PCDD/Fs, PCBs, PBDEs, HBCDDs and PFASs in Fish Meal 2022 [EURL-PT-POP_2203-FM]
EURL for halogenated Persistent Organic Pollutants (POPs) in Feed and Food

Fish Meal (2203-FM)
Physico-chemical Methods PCDD/Fs and PCBs - Clean-up

LC	Sample	Clean-up: Gelchromatography	Silica/sulfuric acid column	Florisil column	Alumina column	Carbon column	Others	Final volume [µl]: PCDD/F	Final volume [µl]: DL-PCB (non-ortho-PCBs)	Final volume [µl]: DL-PCB (mono-ortho-PCBs)	Final volume [µl]: Indicator PCBs
1	2203-FM										
2	2203-FM	no	yes	no	no	no	no				100
3	2203-FM	no	yes	no	yes	yes	Silica/AgNO3	50	50	100	100
4	2203-FM	no	yes	no	yes	yes		20	20	40	40
5	2203-FM	NO	YES	NO	YES	YES		25	25	50	50
6	2203-FM	no	yes	no	yes	yes	Silver nitrate column	250 µl	250 µl	100 µl	100 µl
7	2203-FM	no	yes	no	yes	yes	silver nitrate column (MIURA)	20	20	20	20
8	2203-FM										
9	2203-FM	no	yes	no	yes	yes		20	20	500	500
10	2203-FM	no	yes	no	yes	no		20	50	50	50
11	2203-FM		yes		yes	yes	Silver nitrate silica gel	1,5 mL - evaporated to 20 uL	1,5 mL - evaporated to 20 uL	1,5 mL - evaporated to 20 uL	1,5 mL - evaporated to 20 uL
12	2203-FM	no	yes	no			basic set of "power-prep system" columns	20	40	40	40
13	2203-FM	no	yes	no	yes	no	SPM membrane	20	20	50	50
14	2203-FM										
15	2203-FM	no	yes	no	yes	yes	no	40	40	200	200
16	2203-FM	no	no	no	no	no	Silica without sulfuric acid				1000
17	2203-FM	no	yes	no	yes	no	no	50	50	1000	1000
18	2203-FM										
19	2203-FM										
20	2203-FM										
21	2203-FM	NO	YES	YES	YES	YES	NO	10	10	10	50
22	2203-FM	No	Yes	No	Yes	No	No	10	25	25	150
23	2203-FM	no	yes	no	yes	yes	Silver nitrate, AgNO3	20	20	65	65
24	2203-FM	yes									250
25	2203-FM	Yes	Yes	Yes	No	Yes	Sufuric acid treatment of the final extract	10	50	50	200
26	2203-FM	no	yes	no	no	no	/	/	/	/	500
27	2203-FM		yes		yes	yes		20	50	50	
28	2203-FM	no	yes	yes	yes	no	no	10	50	50	50
29	2203-FM	No	Yes	Yes	No	Yes		12	12	50	50
30	2203-FM	yes									1000
31	2203-FM	no	yes		yes	yes		10	15	20	20
32	2203-FM	no	yes	no	yes	yes		10	10	200	200
33	2203-FM	no	yes	no	yes	no		50	50	500	500
34	2203-FM	yes	yes	no	yes	no	no				20
35	2203-FM										
36	2203-FM	yes (only fraction of indicator PCB + mono-ortho dl-PCB)	yes	no	no	yes	no	15	15	75	75
37	2203-FM		yes	yes		yes		20	200	200	200
38	2203-FM										
39	2203-FM	yes	yes	no	no	yes		20	20	20	20
41	2203-FM										
42	2203-FM										
43	2203-FM	yes	yes	no	yes	no		20	20	20	20
44	2203-FM										
45	2203-FM										
46	2203-FM	no	yes	yes	no	yes		10	20	50	50
47	2203-FM										
48	2203-FM	no	yes	no	yes	yes	AgNO3 column	1500	1500	1500	1500
49	2203-FM	No	Yes	No	Yes	Yes	-	50.00	50.00	50.00	50.00
50	2203-FM	no	yes	yes	yes	yes		20	20	100	100
51	2203-FM										
52	2203-FM	no	yes	no	yes	yes	NA	10	20	20	20
53	2203-FM										
54	2203-FM										
55	2203-FM		yes	no	yes	yes	NaOH column/ AgNO3 column	10	10	10	20
56	2203-FM	No	Yes	No	Yes	Yes	None	10.00	10.00	30.00	N/A
57	2203-FM	no	yes	no	yes	yes	no	10	20	20	
58	2203-FM										
59	2203-FM	No	Yes	No	Yes	Yes	No	500	500	500	500
60	2203-FM	no	no	no	no	no	acid hydrolysis by sulfuric acid	0	0	0	500
61	2203-FM	yes	yes	no	yes	yes	basic silica, silver nitrate silica	15	15	50	1000
62	2203-FM	No	Yes - Miura	Yes - Miura	Yes - Miura	Yes - Miura	N/A	25 µl	25 µl	500 µl	500 µl
63	2203-FM	no	yes	no	yes	yes	no	15-20 ul	15-20 ul	500	500
64	2203-FM	no	yes	yes	yes	yes	PowerPrep FMS columns (basic-neutral silica, alumina, carbon)	10	10	20	20
65	2203-FM	NO	YES	NO	YES	YES		20	20	20	200
66	2203-FM	no	yes	yes	no	no	reverse extraction using dimethylsuphoxide	25	25	250	250
67	2203-FM						dSPE (PSA, C18)				
68	2203-FM										
69	2203-FM	no	yes (Dextech)	no	yes (Dextech)	yes (Dextech)		10	10	80	
70	2203-FM	no	yes	no	yes	yes		50	50	50	50
71	2203-FM		yes								1000
72	2203-FM										
73	2203-FM	yes	no	no	no	no	Silica 10% H2O				1000

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Physico-chemical Methods PCDD/Fs and PCBs - Clean-up

		Clean-up									
LC	Sample	Gelchromatography	Silica/sulfuric acid column	Florisil column	Alumina column	Carbon column	Others	Final volume [µl]: PCDD/F	Final volume [µl]: DL-PCB (non-ortho-PCBs)	Final volume [µl]: DL-PCB (mono-ortho-PCBs)	Final volume [µl]: Indicator PCBs
74	2203-FM	no	yes	yes	yes	yes	no	15	15	25	25
75	2203-FM	no	yes	no	no	no	no				1000
76	2203-FM	yes	no	no	no	no	BioBeads				1000
77	2203-FM						MiURA System	50	50	100	100
78	2203-FM										
79	2203-FM		yes		yes	yes		15	15	15	1000
80	2203-FM	yes	yes	no	no	no	GPC				300
81	2203-FM	no	yes	no	yes	yes	no	30	30	400	
82	2203-FM	yes	no	no	no	no	Silica 10% water				1000
83	2203-FM	no	yes	no	yes	yes		25	25	100	100
84	2203-FM										
85	2203-FM	yes	yes	yes	no	yes	no	20	60	500	500
86	2203-FM	NO	YES	YES	NO	YES	NO	30	non-ortho DL-PCBs are in the PCDD/F fraction	100	Indicator PCBs are in mono-ortho DL-PCB fraction
87	2203-FM	no	yes	no	yes	yes		10	80	80	80
88	2203-FM	no	yes	no	yes	yes		25	25	60	60
89	2203-FM	N	Y	Y	Y	Y	NT EXTRELUT	10	10	20	50
90	2203-FM	no	yes	yes	yes	yes		20	20	20	20
91	2203-FM	no	no	no	no	no	purification by automatic sample preparation system GO-2HT (Miura) using columns: silver nitrate silica gel, sulfuric acid silica gel, carbon, alumina	20	20	20	20
92	2203-FM	YES	YES	NO	NO	NO	SPE SILICA COLUMN 1g/6mL				250
93	2203-FM										
94	2203-FM	No	Yes	Yes	Yes	Yes		10	20	20	20
95	2203-FM	yes	yes	no	yes	yes		20	20	20	20
96	2203-FM										
97	2203-FM	no	yes	no	yes	yes	-	9	9	100	100
98	2203-FM	no	yes	no	no	no					100
99	2203-FM	no	yes	yes	yes	yes	-	20	20	20	20
100	2203-FM	no	yes	yes	yes	no		10	50	50	50
101	2203-FM		yes	yes	yes	yes					
102	2203-FM	no	yes	no	yes	yes	no	25	25	125	125
103	2203-FM										
104	2203-FM	no	yes	no	yes	yes	no	20	20	200	200
105	2203-FM	no	yes	no	yes	yes	no	20	20	20	20
106	2203-FM	no	yes	no	yes	yes		25	100	100	100
107	2203-FM	yes									4000
108	2203-FM										
109	2203-FM	no	yes	no	yes	yes	acidic treatment	25.00	25.00	50.00	50.00
110	2203-FM	No	Yes	Yes	No	Yes		10.00	10.00	50.00	50.00
111	2203-FM	no	yes	yes	no	no					50
112	2203-FM	no	yes	no	yes	no	no	/	/	/	500 µl
113	2203-FM		yes	yes		yes		10	10	50	500
114	2203-FM	yes	yes								1000
27A	2203-FM		yes		yes	yes		20	50	50	
37A	2203-FM	no	yes Silica, no sulfuric	no	no	no					3500
57A	2203-FM	no	yes	no	yes	yes	no	10			
69A	2203-FM	no	yes (PowerPrep)	no	yes (PowerPrep)	yes (PowerPrep)	small multilayer silica column for each fraction after powerprep clean up	10	10	80	
75A	2203-FM	no	no	no	no	no	In-Cell Cleanup (sulfuric acid silica 44%)				1000

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Fish Meal (2203-FM)
Physico-chemical Methods PCDD/Fs and PCBs - Detection

		PCDD/F				**Dioxin-like PCB (non-ortho-PCB)**				**Dioxin-like PCB (mono-ortho-PCB)**				**Indicator PCB**			
LC	Sample	GC injection	Injected volume [µl]	GC separation: Stationary phase	Detector	GC injection	Injected volume [µl]	GC separation: Stationary phase	Detector	GC injection	Injected volume [µl]	GC separation: Stationary phase	Detector	GC injection	Injected volume [µl]	GC separation: Stationary phase	Detector
1	2203-FM																
2	2203-FM													splitless	1	DB-5 Agilent	GC-MS/MS
3	2203-FM	PTV	8	DBDIOXIN, DB-5	HRMS	PTV	8	DBDIOXIN, DB-5	HRMS	PTV	2	DBDIOXIN, DB-5	HRMS	PTV	2	DBDIOXIN, DB-5	HRMS
4	2203-FM	splitless	1	ZB-5MS Plus 60m X 0.25mm X 0.1µm	HRMS	splitless	1	HT8-PCB 60m x0.25mm x 0.25µm	HRMS	splitless	1	HT8-PCB 60m x0.25mm x 0.25µm	HRMS	splitless	1	HT8-PCB 60m x0.25mm x 0.25µm	HRMS
5	2203-FM	PTV	10µl	DB5-MS 60m x 0.25mm x 0.25um	HRMS	PTV	10µl	DB5-MS 60m x 0.25mm x 0.25um	HRMS	PTV	10µl	DB5-MS 60m x 0.25mm x 0.25um	HRMS	PTV	5µl	DB5 60m x 0.25mm x 0.25um	LRMS
6	2203-FM	PTV	100 µl	Rtx-Dioxin2	HRMS	PTV	100 µl	Rtx-Dioxin2	HRMS	PTV	5 µl	Rtx-Dioxin2	HRMS	Splitless	1 µl	Ht8	HRMS
7	2203-FM	PTV	5	DB-5MS	HRMS	PTV	5	DB-5MS	HRMS	splitless	1	HT8-PCB	HRMS	splitless	1	HT8-PCB	HRMS
8	2203-FM																
9	2203-FM	solvent vent	5	DB5-MS UI	MS/MS	solvent vent	5	DB5-MS UI	MS/MS	splitless	1	DB5-MS UI	MS/MS	solvent vent	5	DB5-MS UI	MS/MS
10	2203-FM	splitless	1 µl	5%polisilarilene 95%polidimetilsilossano	HRMS	splitless	1 µl	5%polisilarilene 95%polidimetilsilossano	HRMS	splitless	1 µl	5%polisilarilene 95%polidimetilsilossano	HRMS	splitless	1 µl	5%polisilarilene 95%polidimetilsilossano	HRMS
11	2203-FM	Splitless	1	DB 5	HRMS	Splitless	1	DB 5	HRMS								
12	2203-FM	Splitless	2	DB-5MS (60 m, 0.25 mm id, 0,25 mm film)	HRMS (Mat-95 XP)	Splitless	1	DB-5MS (60 m, 0.25 mm id, 0,25 mm film)	HRMS (Mat-95 XP)	Splitless	1	DB-5MS (60 m, 0.25 mm id, 0,25 mm film)	HRMS (Mat-95 XP)	Splitless	1	DB-5MS (60 m, 0.25 mm id, 0,25 mm film)	HRMS (Mat-95 XP)
13	2203-FM	splitless	2	DB5MS	MSMS	splitless	2	DB5MS	MSMS	splitless	2	DB5MS	MSMS	splitless	2	DB5MS	MSMS
14	2203-FM																
15	2203-FM	PTV	5	DB-5MS	MS/MS	PTV	5	DB-5MS	MS/MS	splitless	1	HT-8	MS/MS	splitless	1	HT-8	MS/MS
16	2203-FM													Splitless	1	Rxi-XLB	LRMS: GCMSMS
17	2203-FM	PTV	5	DB-5	HRMS	PTV	5	HT-8	HRMS	PTV	3	HT-8	HRMS	PTV	3	HT-8	HRMS
18	2203-FM																
19	2203-FM																
20	2203-FM																
21	2203-FM	SPLITLESS	2	DB5MS	HRMS	SPLITLESS	1	DB5MS	HRMS	SPLITLESS	1	DB5MS	HRMS	SPLITLESS	1	DBXLB	HRMS
22	2203-FM	splitless	3	5% fenil-metilpolisiloxano	MSMS	splitless	3	5% fenil-metilpolisiloxano	MSMS	splitless	3	5% fenil-metilpolisiloxano	MSMS	splitless	3	5% fenil-metilpolisiloxano	MSMS
23	2203-FM	Splitless	2	Rxi-5SIL MS (5% diphenyl/95% dimethyl polysiloxane)	HRMS: DFS	Splitless	2	Rxi-5SIL MS (5% diphenyl/95% dimethyl polysiloxane)	HRMS: DFS	Pulsed splitless	1	DB-XLB	Triple quadrupol (EI)	Pulsed splitless	1	DB-XLB	Triple quadrupol (EI)
24	2203-FM													splitless	2	VF-5ms; 5% phenyl 95% methyl polisiloxane	MS/MS
25	2203-FM	Splitless	1	ZB-5MS Plus 60 x 0.25 x 0.25	Autospec Premier HRMS	Splitless	1	ZB-5MS 60 x 0.25 x 0.25	Autospec Premier HRMS	Splitless	1	ZB-5MS 60 x 0.25 x 0.25	Autospec Premier HRMS	PTV	2	ZB-50 30 x 0.25 x 0.25	ThermoScientific TSQ Quantum XLS Ultra GC-MS/MS
26	2203-FM													PTV	8	HP-5MS	LRMS
27	2203-FM	splitless	2	TG-Dioxin	HRMS	splitless	1	TG-Dioxin	HRMS	splitless	1	TG-Dioxin	HRMS				
28	2203-FM	splitless	5	VFX ms 60m	HRMS	splitless	2	SLB 5ms	HRMS	splitless	2	SLB 5ms	HRMS	splitless	2	SLB 5ms	HRMS
29	2203-FM	Splitless	2	DB5MS	HRMS	Splitless	2	DB5MS	HRMS	Splitless	1	HT8PCB	HRMS	Splitless	1	HT8PCB	HRMS
30	2203-FM													splitless	1,0	VF-5ms	ECD
31	2203-FM	splitless	2	DB-5MS	HRMS	splitless	2	DB-XLB	HRMS	splitless	2	DB-XLB	HRMS	splitless	2	DB-XLB	HRMS
32	2203-FM	splitless	2	%5 phenyl %95 polydimethylsiloxane	HRMS	splitless	2	%5 phenyl %95 polydimethylsiloxane	HRMS	splitless	2	%5 phenyl %95 polydimethylsiloxane	HRMS	splitless	2	%5 phenyl %95 polydimethylsiloxane	HRMS
33	2203-FM	PTV Splittless	5	DB-5	HRMS	PTV Splittless	5	DB-5	HRMS	PTV Splittless	5	DB-5	HRMS	PTV Splittless	5	DB-5	HRMS
34	2203-FM													PTV	3	DB-5MS 60 m 0.25 film 0.1um	HRMS
35	2203-FM																
36	2203-FM	Splitless	2	RTX-5MS, BPX-DXN	HRMS	Splitless	2	RTX-5MS, HT8-PCB	HRMS	Splitless	2	RTX-5MS, HT8-PCB	HRMS	Splitless	2	RTX-5MS, HT8-PCB	HRMS
37	2203-FM	splitless	2	DB-5 MS	HRMS	splitless	1	DB-5 MS	HRMS	splitless	1	DB-5 MS	HRMS	splitless	1	DB-5 MS	HRMS
38	2203-FM																
39	2203-FM	cold splitless	1	DB-5MS UI	MS/MS (QQQ)	cold splitless	1	DB-5MS UI	MS/MS (QQQ)	cold splitless	1	DB-5MS-UI	MS/MS (QQQ)	cold splitless	1	DB-5MS UI	MS/MS (QQQ)
41	2203-FM																
42	2203-FM																
43	2203-FM	splitless	1	ZB-Dioxin	HRMS	splitless	1	ZB-Dioxin	HRMS	splitless	1	ZB-Dioxin	HRMS	splitless	1	ZB-Dioxin	HRMS
44	2203-FM																
45	2203-FM																
46	2203-FM	PTV splitless	2	DB-5MS	HRMS	PTV splitless	1	DB-5MS	HRMS	PTV splitless	1	DB-5MS, HT-8	HRMS	PTV splitless	1	DB-5MS, HT-8	HRMS
47	2203-FM																
48	2203-FM	splitless	2	5% (1,4-bis(dimethylsiloxy) phenylene/95% dimethyl polysiloxane	HRMS	splitless	2	5% (1,4-bis(dimethylsiloxy) phenylene/95% dimethyl polysiloxane	HRMS	splitless	2	5% (1,4-bis(dimethylsiloxy) phenylene/95% dimethyl polysiloxane	HRMS	splitless	2	5% (1,4-bis(dimethylsiloxy) phenylene/95% dimethyl polysiloxane	HRMS
49	2203-FM	Splitless	1.5	DB-5MS	HRMS, DFS	Splitless	1.5	DB-5MS	HRMS, DFS					Splitless	1.5	DB-5MS	HRMS, DFS
50	2203-FM	splitless	2	phenyl arylene polymer (J&W DB5-ms)	LRMS	splitless	2	phenyl arylene polymer (J&W DB5-ms)	LRMS	splitless	1	phenyl arylene polymer (J&W DB5-ms)	LRMS	splitless	1	phenyl arylene polymer (J&W DB5-ms)	LRMS
51	2203-FM																
52	2203-FM	splitless	1	DB 5MS	HRMS	splitless	1	DB 5MS	HRMS	splitless	1	DB 5MS	HRMS	splitless	1	DB 5MS	HRMS
53	2203-FM																
54	2203-FM																
55	2203-FM	splitless	2	5 MS	HRMS	splitless	2	5 MS	HRMS	splitless	2	5 MS	HRMS	splitless	2	5 MS	HRMS
56	2203-FM	Splitless	1	5%-Phenyl-Arylene-95% DimethylPolysiloxane (ZB5-MS)	Thermo Scientific DFS Magnetic Sector GC-HRMS	Splitless	1	5%-Phenyl-Arylene-95% DimethylPolysiloxane (ZB5-MS)	Thermo Scientific DFS Magnetic Sector GC-HRMS	Splitless	1	5%-Phenyl-Arylene-95% DimethylPolysiloxane (ZB5-MS)	Thermo Scientific DFS Magnetic Sector GC-HRMS	N/A	N/A	N/A	N/A
57	2203-FM	Splitless	2	DB-5MS	HRMS	Splitless	1	DB-5MS	HRMS								
58	2203-FM																
59	2203-FM	PTV	100	DB-5 MS	HRMS	Splitless	100	DB-5 MS	HRMS	Splitless	2	DB-5 MS	HRMS	Splitless	2	DB-5 MS	HRMS
60	2203-FM													splitless	2	crosslinked 5% PH ME Siloxane	ECD
61	2203-FM	splitless	2-3	DB-5MS	HRMS (R>10000)	splitless	1	DB-5MS	HRMS (R>10000)	splitless	1	DB-5MS	HRMS (R>10000)	splitless	1	HT-8	µECD
62	2203-FM	PTV in splitless mode	6 µl	DB-5MS	HRMS	PTV in splitless mode	6 µl	DB-5MS	HRMS	PTV in splitless mode	2 µl	HT 8/DB-5MS	HRMS	PTV in splitless mode	2 µl	HT 8/DB-5MS	HRMS
63	2203-FM	splitless	5	DB5-MS	MSMS	splitless	5	DB5-MS	MSMS	splitless	5	DB5-MS	MSMS	splitlöess	5	DB5-MS	MSMS
64	2203-FM	splitless	3	DB-5ms	HRMS	splitless	3	DB-5ms	HRMS	splitless	2	DB-5ms, HT8	HRMS	splitless	2	DB-5ms, HT8	HRMS
65	2203-FM	PTV	2.5	5% Diphenyl / 95% Dimethylpolysiloxan	LRMS	PTV	2.5	5% Diphenyl / 95% Dimethylpolysiloxan	LRMS	PTV	2.5	5% Diphenyl / 95% Dimethylpolysiloxan	LRMS	PTV	1	5% Diphenyl / 95% Dimethylpolysiloxan	LRMS
66	2203-FM	splitless	2	Rxi-5 Sil MS	HRMS	splitless	2	Rxi-5 Sil MS	HRMS	splitless	1	Rxi-5 Sil MS	HRMS	splitless	1	Rxi-5 Sil MS	HRMS
67	2203-FM													splitless	1	HP-5-MSui	MS/MS

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		PCDD/F				**Dioxin-like PCB (non-ortho-PCB)**				**Dioxin-like PCB (mono-ortho-PCB)**				**Indicator PCB**			
LC	Sample	GC injection	Injected volume [µl]	GC separation: Stationary phase	Detector	GC injection	Injected volume [µl]	GC separation: Stationary phase	Detector	GC injection	Injected volume [µl]	GC separation: Stationary phase	Detector	GC injection	Injected volume [µl]	GC separation: Stationary phase	Detector
68	2203-FM																
69	2203-FM	splitless	1,5	Thermo TR-Dioxin (5% diphenyl - 95% polysilphenylene siloxane)	HRMS	splitless	1,5	Thermo TR-Dioxin (5% diphenyl - 95% polysilphenylene siloxane)	HRMS	splitless	1,5	Thermo TR-Dioxin (5% diphenyl - 95% polysilphenylene siloxane)	HRMS				
70	2203-FM	PTV	2	DB 5 ms	HRMS	PTV	2	DB 5 ms	HRMS	PTV	1	XLB	HRMS	PTV	1	XLB	HRMS
71	2203-FM													splitless, PTV	1	HP5-MS UI, 30m x 0,250mm x 0,25µm	LRMS, single quadrupole
72	2203-FM																
73	2203-FM													splitless	1	HP5-MS-UI	MSD (single quad)
74	2203-FM	splitless	2,0	60 m DB-5 MS capillary column	HRMS	splitless	2,0	60 m DB-5 MS capillary column	HRMS	splitless	1,5	60 m DB-5 MS capillary column	HRMS	splitless	1,0	60 m HT8 capillary column	GCMSMS
75	2203-FM													PTV	1	SGE HT-8, 50 m, 0,22 mm, 0,25 µm	triplequad MS/MS
76	2203-FM													PTV	1	HP5	GC-MSMS
77	2203-FM	PTV	7	DB5-MS, Pheyl-Arylen-Polymer	HRMS	PTV	7	DB5-MS, Pheyl-Arylen-Polymer	HRMS	PTV	7	DB5-MS, Pheyl-Arylen-Polymer	HRMS	PTV	7	DB5-MS, Pheyl-Arylen-Polymer	HRMS
78	2203-FM																
79	2203-FM	splitless with PTV-injector	1	Macherey-Nagel OPTIMA 5 HT + integrated Guard Column, 60m x 0.25mm x 0.25µm	GC-MS/MS	splitless with PTV-injector	1	Macherey-Nagel OPTIMA 5 HT + integrated Guard Column, 60m x 0.25mm x 0.25µm	GC-MS/MS	splitless with PTV-injector	1	Macherey-Nagel OPTIMA 5 HT + integrated Guard Column, 60m x 0.25mm x 0.25µm	GC-MS/MS	splitless with PTV-injector	1	Macherey-Nagel OPTIMA 5 HT + integrated Guard Column, 60m x 0.25mm x 0.25µm	GC-MS/MS
80	2203-FM													PTV splitless	1	HP-5-MS	GC-MS/MS LRMS
81	2203-FM	PTV	5	DB5	HRMS (DFS)	PTV	5	DB5	HRMS (DFS)	PTV	2	DB5	HRMS (DFS)				
82	2203-FM													splitless	1	HP 5ms UI (5%Phenyl - 95% Dimethylpolysiloxan)	MSMS
83	2203-FM	splitless	2	DB 5 MS	HRMS	splitless	2	DB 5 MS	HRMS	splitless	2	HT 8	HRMS				
84	2203-FM																
85	2203-FM	PTV	5	DB5-MS	HRMS	PTV	5	DB5-MS	HRMS	SSL	1	HT8-PCB	HRMS	SSL	1	HT8-PCB	HRMS
86	2203-FM	PTV	2	5% DiPhenyl 95% Dimethyl Polysiloxane	HRMS	PTV	2	5% DiPhenyl 95% Dimethyl Polysiloxane	HRMS	PTV	1	5% DiPhenyl 95% Dimethyl Polysiloxane	HRMS	Splitless	1	8% Phenyl (equiv) Policarborane-siloxane Phase	LRMS/MS
87	2203-FM	Splitless	1	5% Phenyl (equiv) polysilphenylene-siloxane	HRMS	Splitless	1	TR-PCB 8 MS	HRMS	Splitless	1	TR-PCB 8 MS	HRMS	Splitless	1	TR-PCB 8 MS	HRMS
88	2203-FM	PTV	1	5% Polysilarylene - 95% Polydimethilsyloxane (Zebron-dioxins)	HRMS	PTV	1	5% Polysilarylene - 95% Polydimethilsyloxane (Zebron-dioxins)	HRMS	PTV	1	low polarity si-arylene column (Zebron-XLB)	HRMS	PTV	1	low polarity si-arylene column (Zebron-XLB)	HRMS
89	2203-FM	SPLITLESS	1	5% PHENYL	HRMS	SPLITLESS	1	5% PHENYL	HRMS	SPLITLESS	1	8% PHENYL	HRMS	SPLITLESS	1	8% PHENYL	HRMS
90	2203-FM	splitless	1	DB5	HRMS	splitless	1	DB5	HRMS					splitless	1	DB5	HRMS
91	2203-FM	splitless	1	DB5ms	HRMS	splitless	1	HT8	HRMS	splitless	1	HT8	HRMS	splitless	1	HT8	HRMS
92	2203-FM													SPLITLESS	1	HT8 SGE	GC-MS TRIPLE QUAD
93	2203-FM																
94	2203-FM	Splitless	1	DB5MS	HRMS	Splitless	1	DB5MS	HRMS	Splitless	1	DB5MS	HRMS	Splitless	1	DB5MS	HRMS
95	2203-FM	splitless	2	DB-5ms	HRMS	splitless	1	DB-XLB	HRMS	splitless	1	DB-XLB, DB-5ms	HRMS	splitless	1	DB-XLB	HRMS
96	2203-FM																
97	2203-FM	PTV	5	VF5-MS	HRMS	PTV	5	VF5-MS	HRMS	Splitless	2	HT-8	HRMS	Splitless	2	HT-8	HRMS
98	2203-FM													splitless	1	8% phenyl	GC-MSMS
99	2203-FM					splitless			MSMS								
100	2203-FM	Splitless	1	VF-Xms	LRMS	Splitless	1	Rxi 5Sil MS	LRMS	Splitless	1	Rxi 5Sil MS	LRMS	Splitless	1	Rxi 5Sil MS	LRMS
101	2203-FM	splitless	2	DB-5-MS	MSMS	splitless	2	DB-5-MS	MSMS	splitless	1	DB-5-MS	MSMS	splitless	1	DB-5-MS	MSMS
102	2203-FM	Splitless	2	DB5	APGC	Splitless	1	DB5	APGC	Splitless	1	DB5	APGC	Splitless	1	DB5	APGC
103	2203-FM																
104	2203-FM	PTV	4	DB-5MS	MSMS	PTV	4	DB-5MS	MSMS	PTV	4	DB-5MS	MSMS	PTV	4	DB-5MS	MSMS
105	2203-FM	PTV	5	Column: Agilent VF-5ms 60m x 0,25mm x 0,25µm	HRMS	PTV	5	Column: Agilent VF-5ms 60m x 0,25mm x 0,25µm	HRMS	PTV	5	Column: Agilent VF-5ms 60m x 0,25mm x 0,25µm	HRMS	PTV	5	Column: Agilent VF-5ms 60m x 0,25mm x 0,25µm	HRMS
106	2203-FM	splitless	1	DB5MS	APGC-MSMS and HRMS	splitless	1	DB5MS	APGC-MSMS and HRMS	splitless	1	DB5MS	APGC-MSMS and HRMS	splitless	1	DB5MS	APGC-MSMS and HRMS
107	2203-FM													splitless	1		MS
108	2203-FM																
109	2203-FM	splitless	1.8	DB-5MS	HRMS (Autospec Ultima Waters)	splitless	1.0	HT8-PCB	HRMS (Autospec Ultima Waters)	splitless	1.0	HT8-PCB	HRMS (Autospec Ultima Waters)	splitless	1.0	HT8-PCB	HRMS (Autospec Ultima Waters)
110	2203-FM	Splitless	2	RTX-PCB 40m	HRMS	Splitless	2	RTX-PCB 40m	HRMS	Splitless	2	RTX-PCB 40m	HRMS	Splitless	2	RTX-PCB 40m	HRMS
111	2203-FM													Splitless	2	HT8 PCB :8% phenyl polycarborane siloxane	MS MS
112	2203-FM	/	/	/	/	/	/	/	/	/	/	/	/	splitless	1 µl	XLB	LR-MS
113	2203-FM	splitless	2	TR - Dioxin, Thermo, 60m	HRMS	splitless	2	TR - Dioxin, Thermo, 60m	HRMS	splitless	2	TR - Dioxin, Thermo, 60m	HRMS	splitless	2	TR - Dioxin, Thermo, 60m	HRMS
114	2203-FM													PTV	2	HP5 MS, DB 608, 60 m	LRMS
27A	2203-FM	splitless	2	TG-Dioxin	HRMS	splitless	1	TG-Dioxin	HRMS	splitless	1	TG-Dioxin	HRMS				
37A	2203-FM													split ratio 7,0	1	Rxi®-5SIL MS w/Integra-Guard®	ECD
57A	2203-FM	Splitless	1	DB-5MS	HRMS												
69A	2203-FM	splitless	1,5	Thermo TR-Dioxin (5% diphenyl - 95% polysilphenylene siloxane)	HRMS	splitless	1,5	Thermo TR-Dioxin (5% diphenyl - 95% polysilphenylene siloxane)	HRMS	splitless	1,5	Thermo TR-Dioxin (5% diphenyl - 95% polysilphenylene siloxane)	HRMS				
75A	2203-FM													PTV	1	SGE HT-8, 50 m, 0,22 mm, 0,25 µm	triplequad MS/MS

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EURL for halogenated Persistent Organic Pollutants (POPs) in Feed and Food

Fish Meal (2203-FM)
Bioanalytical screening methods PCDD/Fs and PCBs - Clean-up and Separation

LC	Sample		Weighed sample [g]	Extraction: Sample preparation/pre-treatment	Extraction technique	Extraction solvent	Extraction time [h]	Extraction temperature [ºC]	Extraction pressure [Mpa]
44	2203-FM			homogenisation	shaking		3x 1 hour	25	
46	2203-FM		5	-	shaking	1. toluene:methanol 8:2 v/v 2.hexane	1	-	-
50	2203-FM		9.11	Homogenisation	Liquid-liquid	n-hexane	1x60 min. + 2x30 min.	Ambient	Ambient
59	2203-FM		5	homogenisation	shaking	hexane/diethyl ether 97/3 (after mixing of sample with methanol/water 85/15)	2x 1 hr	RT	
60	2203-FM		6	homogenisation	shaking	water, n-Propanol, Hexan	1 hour 2x 1/2 hour	ambient	normal
77	2203-FM		10	freeze drying	Twisselmann	Toluol	6h	110,6	0,1
78	2203-FM		5	Drying with Na2SO4	Column	n-hexane/acetone 2/1 v/v	2	18-22 (room ambient temperature)	-
83	2203-FM		4		Soxhlet	Toluene/Acetone 7/3	4		
101	2203-FM		5					ambient	
78A	2203-FM		5	Drying with Na2SO4	Column	n-hexane/acetone 2/1 v/v	2	18-22 (room ambient temperature)	-

			Clean-up (PCDD/Fs and PCBs)						Clean-up (Separate analysis of PCDD/Fs and PCBs)			
LC	Sample		Silica/sulfuric acid column	Alumina column	Florisil column	Carbon/celite column	Others	Separate analysis of PCDD/Fs and DL-PCBs	Alumina column	Florisil column	Carbon/celite column	Others
44	2203-FM		yes	yes	no	yes		no				
46	2203-FM		yes	no	no	yes	no	yes	no	no	yes	no
50	2203-FM		yes	no	no	no		yes	no	yes	no	
59	2203-FM		yes	no	no	no	no	no	no	no	no	no
60	2203-FM		yes	no	no	yes		no				
77	2203-FM						MiURA System	yes				MiURA System
78	2203-FM		yes	no	yes	no		no	no	no	no	
83	2203-FM		yes	no	no	no			no	no	no	
101	2203-FM		yes	no	no	yes		yes	no	no	yes	
78A	2203-FM		yes	no	yes	no		yes	no	yes	no	

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Fish Meal (2203-FM)
Bioanalytical screening methods PCDD/Fs and PCBs - Cell bioassay

LC	Sample	Name, type and provider of cell line	Method validated according to EU Regulation	Sample replicates on microtiter plate	Type of calibrators	Type of calibration function	Curve fitting method	Procedure blank correction	Recovery correction	Type of recovery reference sample(s)	Matrix of recovery reference sample(s)	Level(s) of recovery reference sample(s)		
												PCDD/F + DL-PCB	PCDD/F	DL-PCB
46	2203-FM	H1L6.1c3, XDS Inc.	yes	duplicates	TCDD, PCB 126	4-PL	SSR	yes	yes	naturally contaminated, GC/HRMS confirmed	fish meal	1,77	0,69	1,08
50	2203-FM	Rat hepatoma cellen (H4IIE), BioDetection Systems	Yes	Triplicates	TCDD		Linear	Yes	Yes	GC/HRMS confirmed	feedingstuff	45		
59	2203-FM	rat H4IIE (Wageningen University, now BDS)	yes	triplicates	reference samples	exponential	no	yes, automatically	yes, automatically	reference samples	chicken feed	0.02/0.29/0.48/0.70/1.57/3.35 ng TEQ/kg		
60	2203-FM	H4IIE PGudluc 1.1 rat hepatoma cell line from BDS	yes	triplicates	TCDD	linear	SSR	yes	yes	certified from BDS Holland		1,3 ng/kg BRM 03		
78	2203-FM	H4-II-E-C3/T, rat hepatome, from Helmholtz-Zentrum Neuherberg/Germany	Not for feed	triplicates	TCDD	S-Curve, 4-Parameter-Fit	WSSR	yes	yes	PT material	Spiked PT sample	1,25 ng WHO2005-PCDD/F+dlPCB-TEQ/kg product with a moisture content of 12%		0,78 ng WHO2005-dlPCB-TEQ/kg product with a moisture content of 12%
83	2203-FM	rat Hepatoma Typs H4L 1.1 c4 (University of California, Davis)	yes	triplicates	TCDD	curve model	WSSR regression	yes	yes	QC sample GC-HRMS confirmed	compound feed	80		
101	2203-FM	Snixoid	no	duplicates	TCDD and PCB126									
78A	2203-FM	H4-II-E-C3/T, rat hepatome, from Helmholtz-Zentrum Neuherberg/Germany	Not for feed	triplicates	TCDD	S-Curve, 4-Parameter-Fit	WSSR	yes	yes	PT material	Spiked PT sample	1,25 ng WHO2005-PCDD/F+dlPCB-TEQ/kg product with a moisture content of 12%		0,78 ng WHO2005-dlPCB-TEQ/kg product with a moisture content of 12%

LC	Sample	Bioassay cut-off value(s) calculated from				Other approach to bioassay cut-off value(s)
		matrix-matched calibration experiments (spiking) during initial validation	multiple analysis (n>6) of a sample contaminated at the GC/MS DL	multiple analysis (n>6) of a sample contaminated at 2/3 level of interest	matrix-matched calibration experiments (confirmed samples) during re-evaluation	
46	2203-FM	yes	no	no	no	no
50	2203-FM	no	no	no	no	2/3 of GCHRMS maximum limit
59	2203-FM	no	no	no	no	using AL for PCDD/Fs
60	2203-FM					2/3 limit of ML
78	2203-FM	no	no	no	no	Cut off = 2/3 of concentration of interest
83	2203-FM	no	yes	no	no	
101	2203-FM					
78A	2203-FM	no	no	no	no	Cut off = 2/3 of concentration of interest

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EURL for halogenated Persistent Organic Pollutants (POPs) in Feed and Food

Fish Meal (2203-FM)

Physico-chemical Methods PCDD/Fs and PCBs - Additional Information

LC	Sample		**Additional information** Physical-chemical methods		**Additional information** Bioanalytical methods
5	2203-FM		Moisture content analysis performed by an ISO 17025 accredited sub-contractor		
6	2203-FM		Treatment of the extract with MTBE after extraktion and prior to fat determination		
9	2203-FM		NDL-PCBs method under validation		
10	2203-FM		We did also acid/base breakdown as clean up before clean-up		
56	2203-FM		J&W DB-Dioxin column [44% methyl- 28% phenyl-20% cyanopropylpolysiloxane + 8% carbowax] used for confirmation of certain congeners.		
59	2203-FM				moisture content determined for GC/HRMS but considering high response not relevant; Sample extract tested in the bioassay contain PCDD/Fs + DL-PCBs
64	2203-FM		After analysis of PCDD/Fs and no-PCBs the two extracts from ASE (20g each) were combined and analysed as one extract (40g) for PCDD/Fs.		
69	2203-FM		additional purification with silica/sulfuric acid after extraction		
73	2203-FM		only indicator PCB		
91	2203-FM		method is accreditated for PCDD/Fs and DL-PCBs, and it is not accreditated for Indicator PCBs	after Miura purification there are obtained two fractiones: fraction (1) containig PCDD/Fs+mono-ortho-PCBs and fraction (2) containig other DL-PCBs; for analysis of the Indicator PCBs the two fractions obtained are united	
110	2203-FM			Automatic purification MIURA	
69A	2203-FM		additional purification with silica/sulfuric acid after extraction		