



EURL Proficiency Test on the Determination of PCDD/Fs, PCBs, PBDEs, HBCDDs and PFAS in Fish Fillet 2025

EURL-PT-POP_2501-FF

FOOD

Final Report PCDD/Fs and PCBs (Report Version 1.0)

28 January 2026



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Summary

Test sample	FOOD: Fish Fillet [2501-FF]
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 food business operators
Statistical evaluation	ISO 13528:2022 [1], IUPAC Protocol [2]
Report of final results	28 January 2026 (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 **PFAS** in **Fish Fillet** was organized by the EURL for halogenated POPs in Feed and Food to be performed between January and April 2025. The objective was to assess analytical performance of laboratories and interlaboratory comparability of results from analyses of PCDD/Fs, PCBs, PBDEs, HBCDDs and PFAS in one sample of **Fish Fillet**.

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 2025. 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.

First results were discussed by representatives of European Commission, NRLs and the EURL at the EURL/NRL workshop in May 2025 in Barcelona, Spain.

1.1. Samples and coding

The test sample is prepared from regular market food. It is **not fortified** with analytes of interest.

Fish Fillet	Sample no. 2501-FF-xxx
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Each participant received about **125 g** of the test sample as a fully preserved canned product.

1.2. Analytes of interest

Participants were requested to determine the following parameters:

- 17 2,3,7,8-substituted PCDD/Fs
- WHO-PCDD/F-TEQ (using WHO₂₀₀₅-TEF)
- 12 dioxin-like PCBs
- WHO-PCB-TEQ (using WHO₂₀₀₅-TEF)
- WHO-PCDD/F-PCB-TEQ (using WHO₂₀₀₅-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.

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 or action levels 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 **pg/g wet weight** for PCDD/Fs and dioxin-like PCBs and **ng/g wet weight** for non-dioxin-like PCBs. TEQ-based results have 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 / action level, 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 **pg BEQ/g wet weight**, for PCDD/Fs and DL- 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

79 laboratories registered for this proficiency test.

Table 1: Participating laboratories

Participating laboratories	Region	No. of participants
National Reference Laboratories	European Union	24
	Other Countries	3
Official Laboratories	European Union	52
	Total	79

2.1. Number of reported results

Table 2: Reported results for PCDD/F and PCB sum parameters and lipid 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]	Lipid content
All laboratories	53	55	53	74	5	56
NRLs	18	19	18	23	3	19

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

Fish Fillet	PCDD/Fs, PCBs [Physico-chemical methods]	PCDD/Fs, PCBs [Bioanalytical screening methods]
yes	73	8
no	4	2

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	38	39	38	30
MS/MS	8	8	10	26
LRMS	2	2	3	7
ECD	-	-	-	5

3. Test for sufficient homogeneity and stability

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 2501-FF 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 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 $\pm 50\%$ 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 was 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 $\pm 50\%$ 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, no assigned values could be calculated for:

- WHO-PCDD/F-TEQ (lb)
- 1,2,3,4,7,8-HxCDD
- 1,2,3,7,8,9-HxCDD
- 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
- 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 Fillet 2501-FF

Sum parameters	Assigned value All participants	Assigned value ISO/IEC 17025 accreditation	Deviation
	pg/g, ng/g (wet weight)	pg/g, ng/g (wet weight)	%
WHO-PCDD/F-PCB-TEQ ub rep	1.93	1.96	<2
WHO-PCDD/F-TEQ ub rep	0.252	0.245	<3
WHO-PCB-TEQ ub rep	1.68	1.72	<3
Sum Indicator PCBs ub rep	39.4	40.0	<2

4.1. PCDD/Fs and PCBs – Sum parameters

The assigned values for the test sample 2501-FF 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)
	pg/g (wet weight)			ng/g (wet weight)
Fish Fillet (2501-FF)	1.93	0.252	1.68	39.0

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)
	pg/g (wet weight)		
Fish Fillet (2501-FF)	1.9	0.25	1.7

4.2. PCDD/Fs and PCBs – Individual congeners

The assigned values of individual congeners for the test sample 2501-FF were calculated as a consensus of the participants' results, taking into account the calculation criteria described above (Figures 1-4; tabular summary in Annex 1). The contribution of the assigned values of individual congeners to the WHO-PCDD/F-TEQ and WHO-PCB-TEQ for the test sample 2501-FF is shown in Figures 5 and 6.

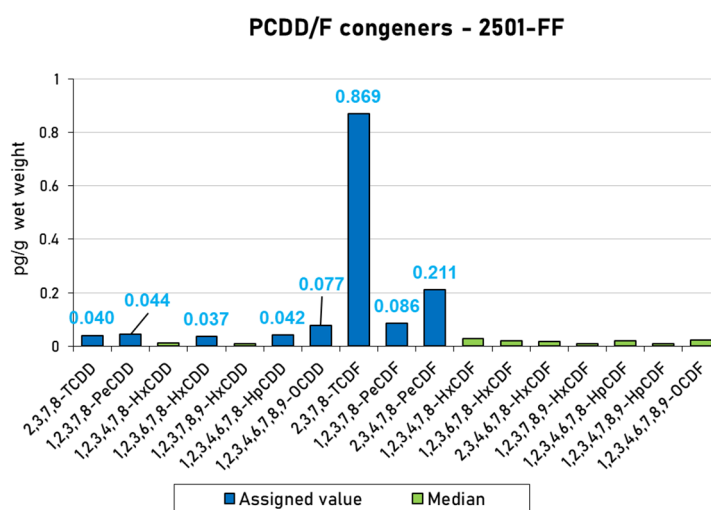


Figure 1: Assigned values (blue) and median values (green) for PCDD/F congeners for Fish Fillet (2501-FF) [pg/g (wet weight)]

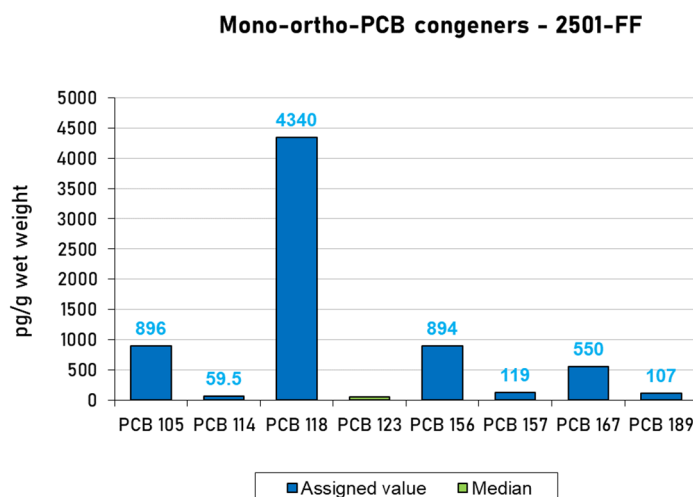


Figure 2: Assigned values (blue) for Mono-ortho-PCB congeners for Fish Fillet (2501-FF) [pg/g (wet weight)]

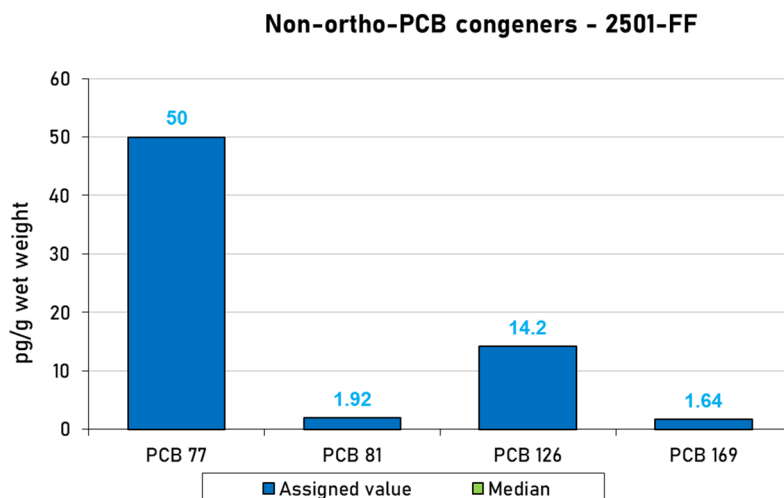


Figure 3: Assigned values (blue) and median values (green) for Non-ortho-PCB congeners for Fish Fillet (2501-FF) [pg/g (wet weight)]

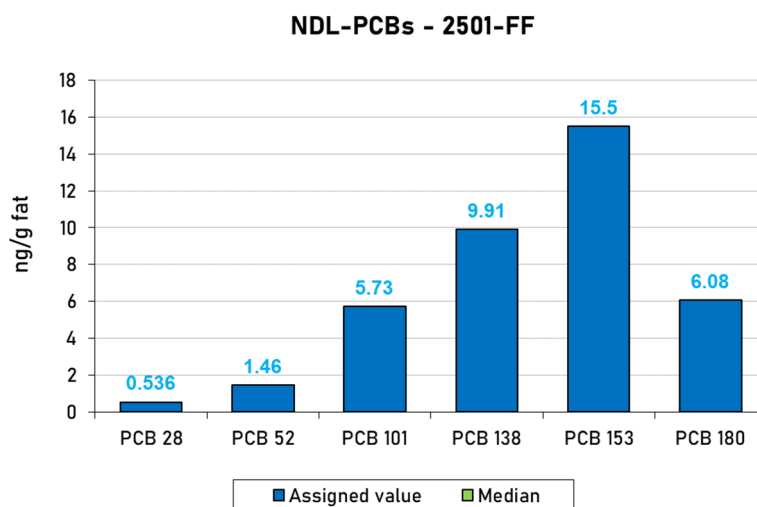


Figure 4: Assigned values (blue) for NDL-PCB congeners for Fish Fillet (2501-FF) [ng/g (wet weight)]

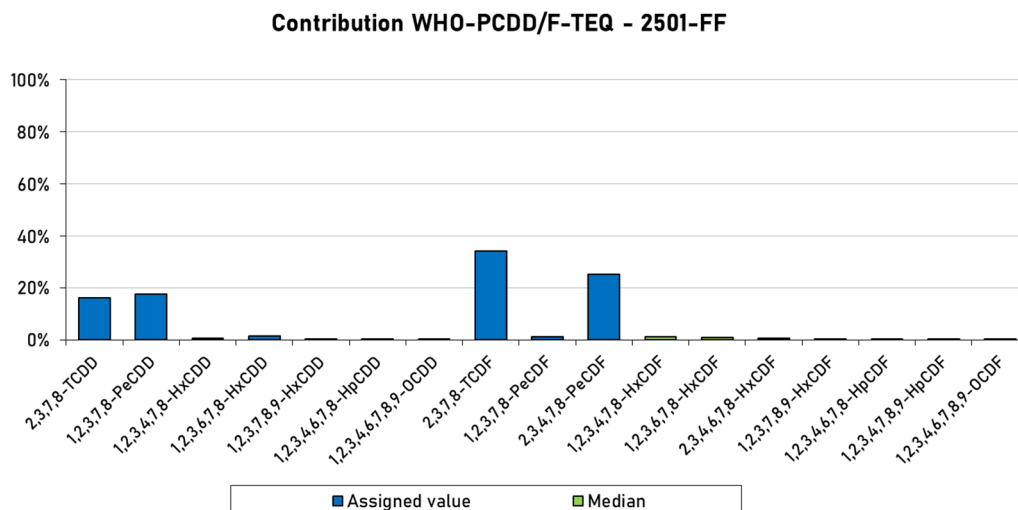


Figure 5: Contributions in % to WHO-PCDD/F-TEQ for PCDD/F assigned (blue) and median (green) values for Fish Fillet (2501-FF)

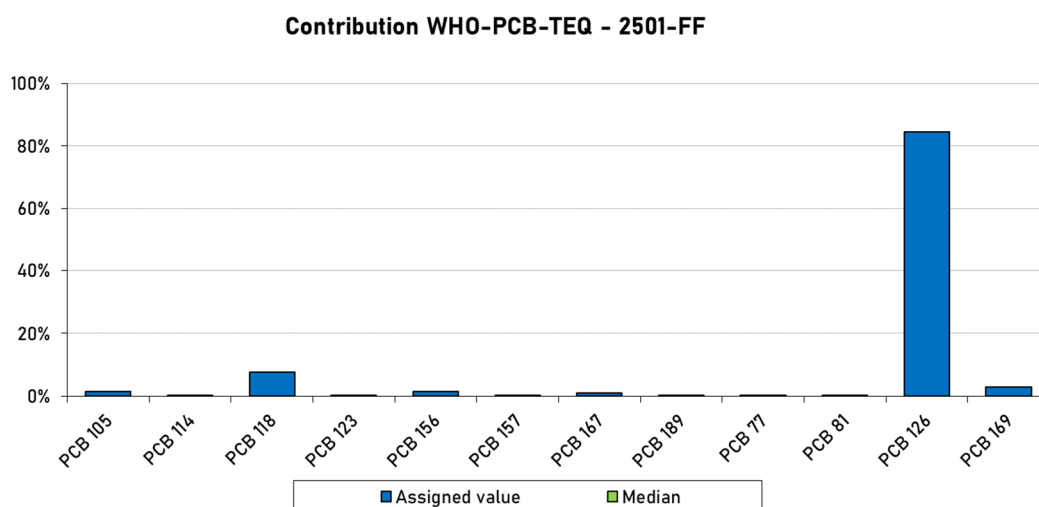


Figure 6: Contributions in % to WHO-PCB-TEQ for DL-PCB assigned (blue) and median (green) values for Fish Fillet (2501-FF)

4.3. Lipid content

For the lipid content an assigned value of **5.52%** for the test sample 2501-FF was calculated as a consensus of the participants' results, taking into account the calculation criteria described above (Figures 7 and 8).

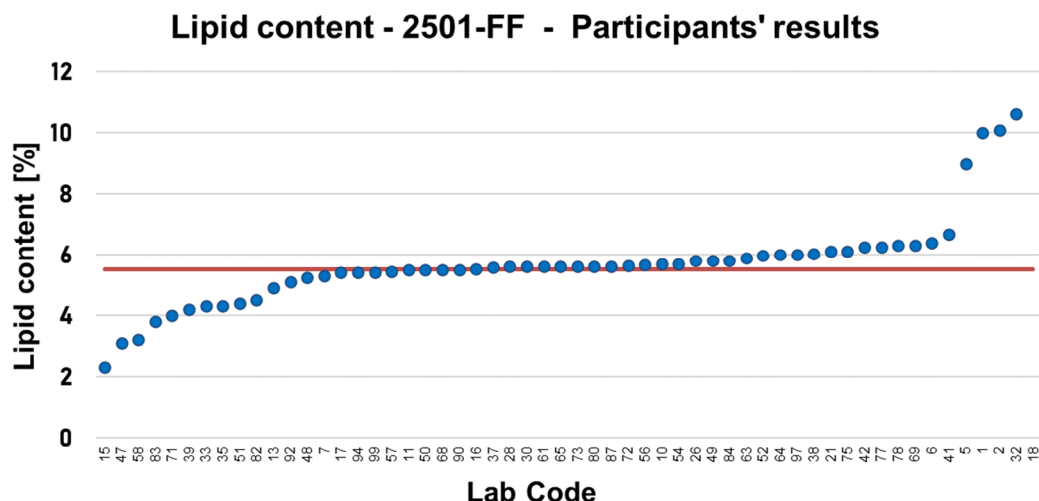


Figure 7: Participant's results (blue dots) compared to the assigned value (red line) of the lipid content in % for Fish Fillet (2501-FF)

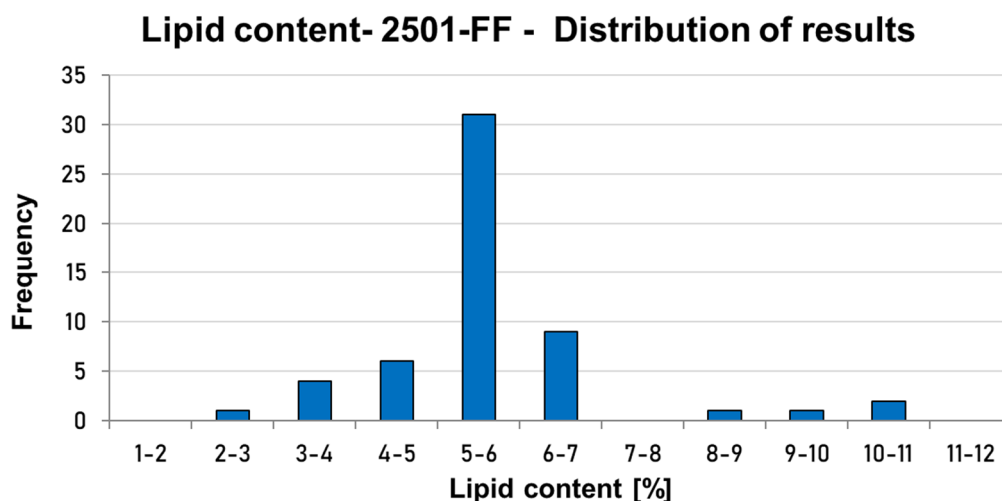


Figure 8: Frequencies of reported values for the lipid content in % for Fish Fillet (2501-FF)

4.4. Comparison of assigned values with legal limits

Maximum levels for food are defined in Commission Regulation (EC) No 2023/915 of 25 April 2023 setting maximum levels for certain contaminants in foodstuff. Maximum levels for Dioxins and PCBs in Foodstuffs can be found under Annex 1 Section 4.1. Action Level are defined in Commission Recommendation (2013) on the reduction of the presence of dioxins, furans and PCBs in feed and food, 2013/711/EU.

Table 8: Maximum levels according to Commission Regulation (EC) No 2023/915 of 25 April 2023 and Action Levels according to Commission Recommendation 2013/711/EU:

Annex 1 Section 4.1: Dioxins and PCBs 4.1.1.5 Fish	Unit	Maximum level	Action level*
WHO-PCDD/F-PCB-TEQ	pg/g wet weight	6.5	-
WHO-PCDD/F-TEQ	pg/g wet weight	3.5	1.5
WHO-PCB-TEQ	pg/g wet weight	-	2.5
Sum of 6 non-dioxin-like PCBs**	ng/g wet weight	75	-

* Commission Recommendation 2013/711/EU ** sum of PCB 28, 52, 101, 138, 153, 180

For the Fish Fillet test sample 2501-FF the assigned values for the sum parameters WHO-PCB-TEQ and sum of six ND-L-PCBs were in the range of 0.5 to 4 of the respective maximum levels and/or action levels. For the sum parameters WHO-PCDD/F-PCB-TEQ, WHO-PCDD/F-TEQ the assigned values were below that range (Figure 9).

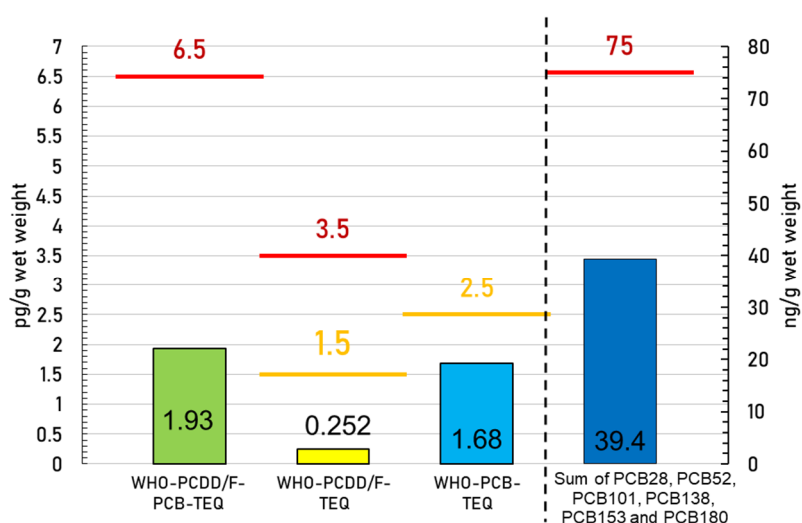


Figure 9: Comparison of the assigned values for sum parameters for Fish Fillet (2501-FF) with maximum levels (red lines) and action levels (yellow line) [pg/g and ng/g (wet weight)]

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:

$$Z = \frac{(x - x_a)}{\sigma_{p_{rel}} * x_a}$$

x : participant's result

x_a : assigned value

$\sigma_{p_{rel}}$: relative fitness-for-purpose-based "standard deviation for proficiency assessment"

For WHO-PCDD/F-TEQ, WHO-PCB-TEQ and WHO-PCDD/F-PCB-TEQ the relative standard deviation for proficiency assessment $\sigma_{p_{rel}}$ 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:

$ z\text{-score} \leq 2$	<i>satisfactory performance</i>
$2 < z\text{-score} < 3$	<i>questionable performance (warning signal)</i>
$ z\text{-score} \geq 3$	<i>unsatisfactory performance (action signal)</i>

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

The concentrations of the sum parameters WHO-PCDD/F-PCB-TEQ, WHO-PCDD/F-TEQ, WHO-PCB-TEQ and sum of six NDL-PCBs for the test samples 2501-FF were in the range (about 0.5 to 4 times) of the respective maximum levels and/or action levels (tabular summaries of participants' results and z-scores see annex 2 and 3).

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

Fish Fillet (2501-FF)	WHO-PCDD/F-PCB-TEQ	WHO-PCDD/F-TEQ	WHO-PCB-TEQ	Sum of six indicator PCBs
$ z\text{-score} \leq 2$	81%	64%	78%	89%
$2 < z\text{-score} < 3$	6%	11%	9%	4%
$ z\text{-score} \geq 3$	13%	25%	13%	7%

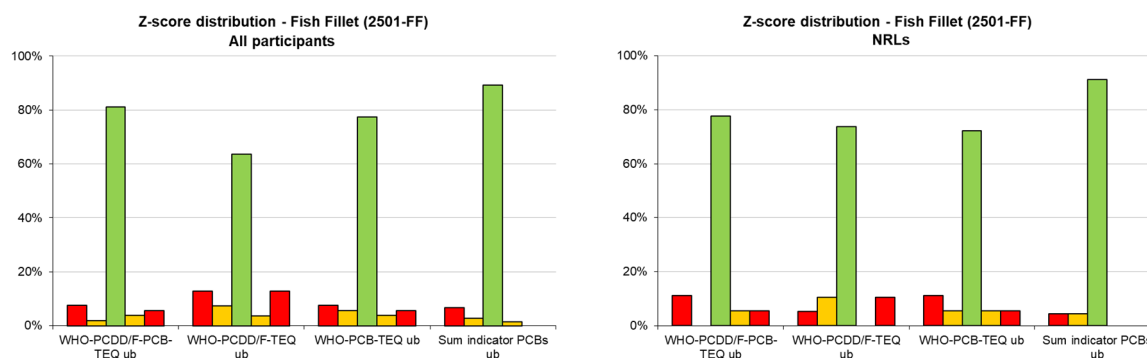


Figure 10: Distribution of all participants' z-scores and NRLs only for sum parameters for Fish Fillet (2501-FF) [Green bars: $-2 \leq z\text{-score} \leq 2$, orange bars: $-3 < z\text{-score} < -2$, $2 < z\text{-score} < 3$, red bars: $z\text{-score} \leq -3$, $z\text{-score} \geq 3$]

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). This applies only for the sum parameters WHO-PCB-TEQ and sum of six ND-L-PCBs as the assigned values for these parameters in the sample 2501-FF were in the range of 0.5 to 4 of the respective maximum levels and/or action levels.

Table 10: Difference between reported and calculated sum parameters for PCDD/Fs and PCBs for Fish Fillet (2501-FF) given in percentage of participants' results

Fish Fillet (2501-FF)	WHO-PCDD/F-PCB-TEQ	WHO-PCDD/F-TEQ	WHO-PCB-TEQ	Sum of six indicator PCBs
Deviation ≤ 10 %	94%	96%	94%	99%
Deviation > 10 %	6%	4%	6%	1%

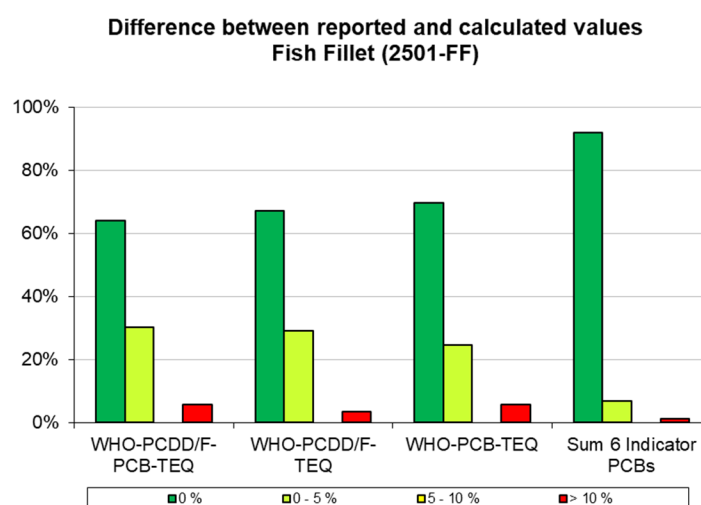


Figure 11: Difference between reported and calculated sum parameters for PCDD/Fs and PCBs for Fish Fillet (2501-FF) given in percentage of participants' results [Green bars: 0%, light green bars: 0-5 %, orange bars: 5-10 %, red bars: > 10 %]

The comparison of the reported values and the calculated values by the EURL showed no significant differences.

5.1.4. Difference between upper and lower bound calculation

According to Commission Regulation (EU) 2017/644 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 levels 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 2501-FF the assigned values for all sum parameters were below the respective maximum levels.

Table 11: Difference between upper and lower bound calculation for Fish Fillet (2501-FF) given in percentage of participants' results

Fish Fillet (2501-FF)	WHO-PCDD/F-PCB-TEQ	WHO-PCDD/F-TEQ	WHO-PCB-TEQ	Sum of six indicator PCBs
0 – 10 %*	91%	76%	96%	92%
10 – 20 %*	6%	2%	4%	5%
20 – 50 %*	4%	11%	-	1%
> 50 %*	-	11%	-	1%

* Difference between upper and lower bound calculation

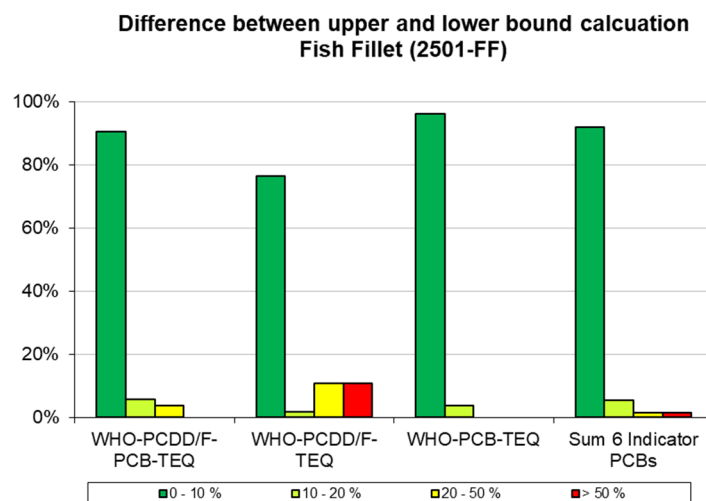


Figure 12: Difference between upper and lower bound calculation for Fish Fillet (2501-FF) given in percentage of participants' results [Green bars: 0 – 10 %, light green bars: 10 – 20 %, yellow bars: 20 – 50 %, red bars: > 50 %]

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 ($|z\text{-score}| \leq 2$) for PCDD/F and DL-PCB and non-dioxin-like PCB congeners separately:

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

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

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

- Calculation of achieved scoring percentage for each participant:

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

- Criteria for successful participation:

Sum parameters:	≤ 1 parameter with $ z\text{-score} > 2$, no parameter with $ z\text{-score} \geq 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.

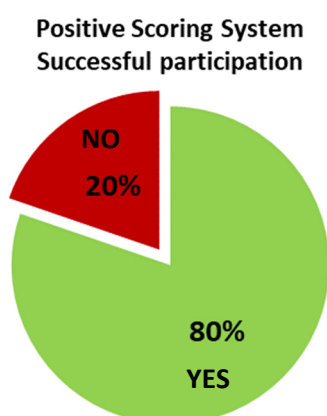


Figure 13: Positive Scoring System – Successful participation in green – no successful participation in red

5.2. Participants' results for bioanalytical screening methods

According to Commission Regulation (EU) No 2017/644, “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:

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

x : participant's result (BEQ from bioanalytical screening method)

x_a : assigned value (physical-chemical methods)

$\sigma_{BAp_{rel}}$: relative bioassay target standard deviation

For PCDD/F-BEQ, PCB-BEQ and PCDD/F-PCB-BEQ the relative bioassay target standard deviation $\sigma_{BAp_{rel}}$ 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 2501-FF 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" and the action level for WHO-PCDD/F-TEQ and WHO-PCB-TEQ".

Table 12: Evaluation of assigned values for Fish Fillet

	WHO-PCDD/F-PCB-TEQ	WHO-PCDD/F-TEQ	WHO-PCDD/F-TEQ	WHO-PCB-TEQ
2501-FF	< ML	< ML	< AL	< AL

Five laboratories reported results using CALUX bioassay for PCDD/F-PCB-BEQ and hereof two also for PCDD/F-BEQ and five for PCB-BEQ.

Table 13: Participants' assessment of analytical results using bioanalytical screening methods for 2501-FF

Laboratories' assessment of analytical results	WHO-PCDD/F-PCB-TEQ Maximum level	WHO-PCDD/F-TEQ Maximum level	WHO-PCDD/F-TEQ Action level	WHO-PCB-TEQ Action level
Suspected to be non-compliant	-	1	1	1
Compliant	5	1	1	1

5.2.2. Participants' bioassay-scores

Concentrations for WHO-PCDD/F-PCB-TEQ, WHO-PCDD/F-TEQ and WHO-PCB-TEQ in the test sample 2501-FF are in the range (about 0.5 to 2 times) of the respective maximum levels and/or action levels.

Table 14: Distribution of participants' bioassay-scores for BEQ parameters for Fish Fillet (2501-FF)

Percentage of participants' results	PCDD/F-PCB-BEQ	PCDD/F-BEQ	PCB/F-BEQ
$ \text{bioassay-score} \leq 2$	60%	-	100%
$2 < \text{bioassay-score} < 3$	40%	-	-
$ \text{bioassay-score} \geq 3$	-	100%	-

6. Participants' feedback

A questionnaire for feedback from participants of this EURL proficiency test was available as online survey between 16 April 2025 and 30 May 2025. 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, 10 laboratories (13 % of all PT participants) replied to this survey.

Table 15: Participating laboratories in the feedback survey

Type of laboratory	Answers
National Reference Laboratory (NRL)	3
Official Laboratory (OFL)	6
Commercial laboratory	1
Other (e.g. research and development)	0
No Answer	0

General aspects

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	

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



Comments (each from one lab):

-Levels of some analyte groups too low; EURL POPs: It was commercially available fish and not spiked to have a naturally contaminated sample. PCBs were in the appropriate range of the ML/AL.

-It would be very helpful if the assigned values and, where applicable, other relevant reference data were additionally provided in the form of an Excel file. This would greatly facilitate the evaluation and further processing of the results. EURL POPs: Unfortunately, Excel sheets are not compatible with accreditation requirements and quality control system.

-We suggest a publication organized by laboratory and not in tabular form; EURL POPs: Unfortunately, at the time being that is not an option to convert our assessment system and reporting system in that way

- Overall, it's an excellent PT. For its improvement, we suggest duplicate sample testing and repeatability calculation: EURL POPs: we do that in special interlaboratory studies for newer analyte groups but so far it is not planned for the proficiency tests

- Good work on getting the preliminary reports out so fast!

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).

All homogeneity and stability testing were performed under accreditation according to DIN EN ISO/IEC 17025:2018.

8. Results of participants

An overview of the PCDD/F and PCB results for the PT test sample Fish Fillet (2501-FF) are given in the following annexes. Laboratories are coded according to the laboratory codes sent after registration.

Complaints regarding the PT organisation, data evaluation and assessment of laboratories performance can be addressed directly to eurl-pops@cvuafr.bwl.de.

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 Fillet – 2501-FF	
1	Assigned and median values – PCDD/F, PCB and lipid content
2	Participants' results – Tables – PCDD/F, PCB and lipid content
3	Participants' z-scores / bioassay-scores – Tables – PCDD/F, PCB and lipid content
4	Participants' z-scores – Charts – PCDD/F, PCB
5	Scoring system – PCDD/F, PCB
6	Homogeneity and stability test – PCDD/F, PCB
7	Participants' methods – PCDD/F, PCB

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

Test sample - Fish Fillet (2501-FF)

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 exclusion of extreme outliers



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Fish Fillet (2501-FF)
Sum parameters - Results

Analyte	Result pg/g wet weight	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		1.93	0.278	0.050	48	1.99
WHO-PCDD/F-PCB-TEQ lower bound rep		1.91	0.288	0.051	49	1.98
WHO-PCDD/F-PCB-TEQ upper bound cal		1.94	0.278	0.050	49	1.97
WHO-PCDD/F-PCB-TEQ lower bound cal		1.92	0.297	0.053	50	1.97

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Fish Fillet (2501-FF)

PCDD/F - Assigned values

Analyte	Result pg/g wet weight	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		0.252	0.0510	0.0092	48	0.262
WHO-PCDD/F-TEQ lower bound rep						0.239
WHO-PCDD/F-TEQ upper bound cal		0.254	0.0486	0.0090	46	0.267
WHO-PCDD/F-TEQ lower bound cal						0.239
2,3,7,8-TCDD		0.0403	0.00924	0.0017	45	0.0403
1,2,3,7,8-PeCDD		0.0439	0.00885	0.0016	45	0.0460
1,2,3,4,7,8-HxCDD						0.0130
1,2,3,6,7,8-HxCDD		0.0371	0.00977	0.0019	43	0.0376
1,2,3,7,8,9-HxCDD						0.0100
1,2,3,4,6,7,8-HpCDD		0.0418	0.0104	0.0021	38	0.0490
1,2,3,4,6,7,8,9-OCDD		0.0771	0.0247	0.0051	36	0.0900
2,3,7,8-TCDF		0.869	0.142	0.026	45	0.865
1,2,3,7,8-PeCDF		0.0860	0.0171	0.0032	45	0.0892
2,3,4,7,8-PeCDF		0.211	0.0434	0.0078	49	0.213
1,2,3,4,7,8-HxCDF						0.0280
1,2,3,6,7,8-HxCDF						0.0200
2,3,4,6,7,8-HxCDF						0.0168
1,2,3,7,8,9-HxCDF						0.0100
1,2,3,4,6,7,8-HpCDF						0.0200
1,2,3,4,7,8,9-HpCDF						0.0100
1,2,3,4,6,7,8,9-OCDF						0.0220



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Fish Fillet (2501-FF)

Dioxin-like PCB - Assigned values

Analyte	Result pg/g wet weight	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		1.68	0.235	0.043	47	1.70
WHO-PCB-TEQ lower bound rep		1.68	0.235	0.043	47	1.70
WHO-PCB-TEQ upper bound cal		1.70	0.232	0.042	48	1.70
WHO-PCB-TEQ lower bound cal		1.69	0.242	0.044	48	1.70
PCB 105		896	143	26	49	887
PCB 114		59.5	14.1	2.7	43	56.3
PCB 118		4340	720	130	51	4300
PCB 123						51.6
PCB 156		894	110	19	50	886
PCB 157		119	18.5	3.3	48	118
PCB 167		550	82.2	15	49	545
PCB 189		107	14.1	2.5	49	107
PCB 77		50.0	9.02	1.6	49	51.6
PCB 81		1.92	0.359	0.070	41	1.94
PCB 126		14.2	2.01	0.37	47	14.2
PCB 169		1.64	0.279	0.053	43	1.62



EURL Proficiency Study on the Determination of PCDD/Fs, PCBs, PBDEs, HBCDDs and PFAS in Fish Fillet 2025 [EURL-PT-POP_2501-FF]

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Fish Fillet (2501-FF)

Non dioxin-like PCB - Assigned values

Analyte	Result ng/g wet weight	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		39.4	6.81	1.0	69	39.4
Sum Indicator PCBs lower bound rep		39.0	6.25	0.95	68	39.4
Sum Indicator PCBs upper bound cal		39.5	6.76	1.0	70	39.5
Sum Indicator PCBs lower bound cal		39.0	6.25	0.95	68	39.0
PCB 28		0.536	0.130	0.023	51	0.568
PCB 52		1.46	0.292	0.046	64	1.51
PCB 101		5.73	0.940	0.14	68	5.73
PCB 138		9.91	1.91	0.29	69	10.0
PCB 153		15.5	3.00	0.46	67	15.5
PCB 180		6.08	1.10	0.17	68	6.05



EURL Proficiency Study on the Determination of PCDD/Fs, PCBs, PBDEs, HBCDDs and PFAS in Fish Fillet 2025 [EURL-PT-POP_2501-FF]
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Fish Fillet (2501-FF)
WHO-TEQ - Assigned values - Bioanalytical screening methods

Analyte	Result pg BEQ/g wet weight	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 ub rep		1.9	0.28	0.050	48	2.0
WHO-PCDD/F-TEQ ub rep		0.25	0.051	0.0092	48	0.26
WHO-PCB-TEQ ub rep		1.7	0.24	0.043	47	1.7



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Fish Fillet (2501-FF)
Lipid 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]
Lipid content		5.52	0.617	0.11	50	5.60



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

Test sample - Fish Fillet (2501-FF)

* 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 PFAS in Fish Fillet 2025 [EURL-PT-POP_2501-FF]

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

Fish Fillet (2501-FF)

Sum parameters - Results

LC	Sample	Result	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		Result	Sum 6 Indicator PCBs reported		Sum 6 Indicator PCBs calculated	
		pg/g wet weight	upper bound	lower bound	upper bound	lower bound	upper bound	lower bound	upper bound	lower bound	upper bound	lower bound	upper bound	lower bound	ng/g wet weight	upper bound	lower bound	upper bound	lower bound
1	2501-FF		1.95	1.8	1.96	1.8	0.3	0.14	0.296	0.143	1.66	1.66	1.66	1.66		39.4	39.4	39.4	39.4
2	2501-FF															46.3	46.3	46.4	46.4
5	2501-FF		1.21	1.18	1.21	1.18	0.612	0.582	0.612	0.582	0.598	0.595	0.598	0.595		7.07	7.07	7.07	7.07
6	2501-FF		2.13	2.13	2.12	2.12	0.274	0.273	0.274	0.273	1.85	1.85	1.85	1.85		48.5	48.5	48.5	48.5
7	2501-FF		2.1	2.1	2.1	2.1	0.253	0.252	0.253	0.252	1.85	1.85	1.85	1.85		37.3	37.3	37.3	37.3
8	2501-FF															24.6	22.6	24.6	22.6
9	2501-FF															49	45	49.1	45.1
10	2501-FF		2.02	2.02	2.02	2.02	0.24	0.235	0.239	0.236	1.78	1.78	1.78	1.78		36.1	36.1	36.1	36.1
11	2501-FF															23.6	23.6	23.6	23.6
12	2501-FF		1.97	1.93	1.97	1.93	0.3	0.26	0.295	0.257	1.67	1.67	1.67	1.67		42.1	42.1	42.1	42.1
13	2501-FF		1.68	1.68	1.69	1.69	0.22	0.22	0.225	0.225	1.46	1.46	1.46	1.46		31.1	31.1	31	31
15	2501-FF		2.1	2.1	2.1	2.1	0.25	0.245	0.25	0.245	1.85	1.85	1.85	1.85		41.5	41.5	41.5	41.5
16	2501-FF		1.94	1.94	1.93	1.93	0.198	0.197	0.198	0.197	1.74	1.74	1.73	1.73		44.7	44.7	44.8	44.8
17	2501-FF		2.26	2.26	2.27	2.26	0.26	0.26	0.269	0.255	2	2	2	2		44.2	44.2	44.2	44.2
18	2501-FF		2.12	1.97	2.12	1.98	0.3	0.16	0.299	0.157	1.82	1.81	1.82	1.82		39.1	39.1	39.1	39.1
20	2501-FF		1.86	1.84	1.87	1.85	0.279	0.26	0.279	0.259	1.58	1.58	1.59	1.59		17	17	16.8	16.8
21	2501-FF															36.8	35.8	36.8	35.8
22	2501-FF		3.3	2.9	3.27	2.9	0.5	0.2	0.496	0.22	2.8	2.7	2.77	2.68		43.1	43.1	43.1	43.1
23	2501-FF		2.09	2.09	2.09	2.09	0.155	0.155	0.155	0.155	1.93	1.93	1.93	1.93		41.1	41.1	41.2	41.2
24	2501-FF		2.82	2.54	2.82	2.54	0.486	0.212	0.486	0.212	2.33	2.33	2.33	2.33		33.6	33.6	33.6	33.6
26	2501-FF		1.9	1.9	1.9	1.89	0.235	0.233	0.235	0.233	1.66	1.66	1.66	1.66		41.6	41.6	41.7	41.7
27	2501-FF															18.3	18.3	18.3	18.3
28	2501-FF															38.8	38.8	38.8	38.8
30	2501-FF		2.29	1.98	2.3	1.98	0.426	0.12	0.425	0.119	1.87	1.87	1.87	1.86		30.3	26.3	30.3	26.3
32	2501-FF		2.03	2.03	2.04	2.04	0.36	0.36	0.357	0.355	1.67	1.67	1.68	1.68		31.7	31.7	31.7	31.7
33	2501-FF															32	31	31.9	30.9
34	2501-FF						0.268	0.258	0.771	0.76									
35	2501-FF															32.4	32.9	32.9	32.4
37	2501-FF		1.73	1.73	1.73	1.73	0.242	0.239	0.242	0.239	1.49	1.49	1.49	1.49		42.6	42.6	42.6	42.6
38	2501-FF															40.4	40.4	40.3	40.3
39	2501-FF		2.12	2.12	2.13	2.13	0.267	0.266	0.267	0.266	1.86	1.86	1.86	1.86		48.7	48.7	48.8	48.8
41	2501-FF		1.56	1.56	1.56	1.56	0.25	0.25	0.249	0.249	1.31	1.31	1.31	1.31		47	47	47.1	47.1
42	2501-FF		2	2	1.97	1.97	0.28	0.28	0.279	0.278	1.7	1.7	1.69	1.69		42	42	41.5	41.5
44	2501-FF															39.4	39.4	39.4	39.4
45	2501-FF															20.4	8.4	20.4	8.4
46	2501-FF		2.04	2.04	2.03	2.03	0.234	0.233	0.234	0.233	1.81	1.81	1.8	1.8		38.8	38.8	38.8	38.8
47	2501-FF		1.56	1.47	1.56	1.48	0.24	0.16	0.244	0.157	1.32	1.32	1.32	1.32		30.2	30.2	30.3	30.3
48	2501-FF															49.2	48.3	43.7	42.8
49	2501-FF															48	44	48.7	44.7
50	2501-FF		1.76	1.75	1.75	1.74	0.262	0.25	0.262	0.25	1.5	1.5	1.49	1.49		41.4	37	41.4	37
51	2501-FF		1.99	1.99	1.98	1.98	0.284	0.284	0.284	0.284	1.7	1.7	1.7	1.7		37.9	37.9	37.9	37.9
52	2501-FF															44.9	43.9	44.9	43.9
54	2501-FF		1.59	1.59	1.59	1.59	0.15	0.15	0.149	0.147	1.44	1.44	1.44	1.44					
56	2501-FF															44.5	44.5	44.5	44.5
57	2501-FF		1.62	1.61	1.63	1.61	0.136	0.123	0.136	0.123	1.49	1.49	1.49	1.49		33.4	33.4	33.4	33.4
58	2501-FF		0.74	0.6	0.735	0.597	0.19	0.05	0.19	0.052	0.55	0.55	0.545	0.545		12.5	12.5	12.5	12.5
59	2501-FF		2.15	2.02	2.13	1.99	0.279	0.143	0.278	0.142	1.87	1.87	1.85	1.85		40.3	40.3	40.3	40.3
61	2501-FF															32.4	32.4	32.4	32.4
62	2501-FF		1.73	1.59	1.73	1.59	0.276	0.14	0.276	0.14	1.45	1.45	1.45	1.45		35.5	35.5	35.5	35.5
63	2501-FF		2.15	2.15	2.15	2.15	0.275	0.275	0.275	0.275	1.87	1.87	1.87	1.87		40.3	40.3	40.3	40.3
64	2501-FF		1.99	1.98	1.98	1.98	0.284	0.279	0.284	0.28	1.7	1.7	1.7	1.7		44.8	44.8	44.7	44.7
65	2501-FF		1.95	1.95	1.95	1.95	0.271	0.271	0.271	0.271	1.68	1.68	1.68	1.68		36	36	36	36
66	2501-FF																	48	48
68	2501-FF		0.449	0.276	0.0917	0.00435	0.179	0.0337	0.0879	0.00337	0.27	0.242	0.00379	0.000976		33.1	33.1	33.1	33.1
69	2501-FF		2.05	2.04	2.04	2.04	0.26	0.255	0.26	0.255	1.79	1.79	1.78	1.78		41.8	41.8	41.8	41.8
70	2501-FF		1.82	1.82	1.81	1.81	0.15	0.15	0.15	0.15	1.67	1.67	1.66	1.66		31.7	31.7	31.7	31.7
71	2501-FF		1.34	1.34	1.34	1.33	0.174	0.173	0.176	0.174	1.16	1.16	1.16	1.16		27.5	27.5	27.6	27.6
72	2501-FF		2.16	2.16	2.16	2.16	0.273	0.271	0.273	0.271	1.89	1.89	1.89	1.89		46.8	46.8	46.7	46.7
73	2501-FF															39.4	39.4	39.4	39.4
74	2501-FF		2.13	2.12	2.13	2.13	0.259	0.257	0.257	0.255	1.87	1.87	1.87	1.87		28.2	27.5	28.2	27.5
75	2501-FF		2.05	2.05	2.05	2.05	0.291	0.289	0.291	0.289	1.76	1.76	1.76	1.76		41.7	41.7	41.7	41.7
77	2501-FF		2.38	2.38	2.39	2.39	0.281	0.28	0.281	0.28	2.1	2.1	2.11	2.11		40	40	40.7	38.7
78	2501-FF																		
80	2501-FF		1.55	1.55	1.55	1.55	0.134	0.134	0.134	0.134	1.42	1.42	1.42	1.42		30.6	30.6	30.6	30.6
82	2501-FF		1.58	1.45	1.84	1.41	0.321	0.189	0.323	0.192	1.26	1.26	1.52	1.22		33.5	33.5	33.5	33.5
83	2501-FF															46.2	41.2	46.2	41.2
84	2501-FF															46.4	46.4	46.4	46.4
86	2501-FF		1.8	1.7	1.78	1.75	0.36	0.33	0.359	0.325	1.4	1.4	1.42	1.42		35	35	34.9	34.9



EURL Proficiency Study on the Determination of PCDD/Fs, PCBs, PBDEs, HBCDDs and PFAS in Fish Fillet 2025 [EURL-PT-POP_2501-FF]
EURL for halogenated Persistent Organic Pollutants (POPs) in Feed and Food

Fish Fillet (2501-FF)
Sum parameters - Results

LC	Sample	Result pg/g wet weight	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		Result ng/g wet weight	Sum 6 Indicator PCBs reported		Sum 6 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
87	2501-FF		2	2	1.97	1.97	0.26	0.26	0.256	0.256	1.7	1.7	1.71	1.71					
88	2501-FF		2.45	2.43	2.45	2.43	0.37	0.35	0.367	0.351	2.08	2.08	2.08	2.08		44.7	44.7	44.8	44.8
90	2501-FF		1.53	1.53	1.53	1.53	0.113	0.112	0.113	0.112	1.42	1.42	1.42	1.42		36.7	36.7	36.7	36.7
92	2501-FF		1.65	1.65	1.66	1.65	0.193	0.189	0.195	0.191	1.46	1.46	1.46	1.46					
93	2501-FF															43.1	37.1	43.1	37.1
94	2501-FF		1.8	1.8	1.8	1.8	0.232	0.231	0.232	0.231	1.57	1.57	1.57	1.57		39.5	39.5	39.5	39.5
96	2501-FF															45.4	45.4	45.4	45.4
97	2501-FF		2.11	2.11	2.11	2.11	0.28	0.278	0.28	0.278	1.83	1.83	1.83	1.83		44.3	44.3	44.3	44.3
99	2501-FF															38.9	38.9	38.9	38.9
100	2501-FF															54.1	42.1	54.1	42.1
102	2501-FF		2.69	2.68	2.7	2.69	0.207	0.197	0.207	0.199	2.49	2.49	2.49	2.49		44.4	44.4	44.6	15.5
34*	2501-FF						0.268	0.258	0.27	0.26									
82*	2501-FF		1.84	1.45	1.58	1.45	0.321	0.192	0.323	0.192	1.52	1.22	1.26	1.26		33.5	33.5	33.5	33.5

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
1	2501-FF						26.6	24.5	27	21.7
2	2501-FF									30
5	2501-FF						30	30	30	30
6	2501-FF						18.9	18	19	19
7	2501-FF						21.3	20.5	20.8	30
8	2501-FF									30
9	2501-FF									20
10	2501-FF						20	20	20	20
11	2501-FF									20
12	2501-FF						30	30	30	30
13	2501-FF						18.9	19.6	18.6	21.8
15	2501-FF						17	23	34	27
16	2501-FF						22.02	14.3	16.74	22.67
17	2501-FF						17	25	17	6
18	2501-FF						15	15	15	20
20	2501-FF						19.3	18.9		23.1
21	2501-FF									16
22	2501-FF						1.6	0.2	1.4	21.5
23	2501-FF						33.9	32.3	36.5	9.9
24	2501-FF						25	25	25	25
26	2501-FF						20	20	20	20
27	2501-FF									23.5
28	2501-FF									19
30	2501-FF						29.9	30.5	29.8	35.2
32	2501-FF						0.242	0.046	0.216	8.45
33	2501-FF									30
34	2501-FF							0.1		
35	2501-FF									26.3
37	2501-FF						15	15	15	15
38	2501-FF									50
39	2501-FF						50	31.4	39.6	31.6
41	2501-FF						24.17	22	10	10
42	2501-FF						20	30	20	25
44	2501-FF									30
45	2501-FF									28
46	2501-FF						26.7	25	30	30
47	2501-FF	X			X	x	15	15	15	15
48	2501-FF									62.01
49	2501-FF									17
50	2501-FF						21.9	19.7	22.3	26.4
51	2501-FF						17	20	17	23
52	2501-FF									40
54	2501-FF						25	25	25	
56	2501-FF									25
57	2501-FF						30	35	25	20
58	2501-FF						30	30	30	30
59	2501-FF						20	20	20	20
61	2501-FF									60
62	2501-FF									
63	2501-FF						14	22.1	15.8	12.5
64	2501-FF						41	31	26	31
65	2501-FF						30	30	30	30
66	2501-FF									
68	2501-FF						35	35	35	35
69	2501-FF						30	30	30	25
70	2501-FF						15	14	16	19
71	2501-FF						13.4	15.1	20.2	15.3
72	2501-FF						21.8	33	20.6	20.4
73	2501-FF									25
74	2501-FF						38	38	38	30
75	2501-FF						16	17	16	13
77	2501-FF						20	16	17	20
78	2501-FF									
80	2501-FF						30	30	30	30
82	2501-FF						0.6	0.122	0.48	12.73
83	2501-FF									10
84	2501-FF									30
86	2501-FF							20	20	20

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
87	2501-FF						30	30	30	
88	2501-FF						24	43	37	21
90	2501-FF						20	20	20	20
92	2501-FF						44	44	44	
93	2501-FF									30
94	2501-FF						21	13	16	7
96	2501-FF									50
97	2501-FF						20	20	20	20
99	2501-FF									25
100	2501-FF									20
102	2501-FF						1.185	0.091	1.1	19.55

Fish Fillet (2501-FF)
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 (deviation ≤ 10 %)	Difference between reported and calculated lower bound sum parameters [%]				Correct calculation (deviation ≤ 10 %)
		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		WHO-PCDD/F-PCB-TEQ	WHO-PCDD/F-TEQ	WHO-PCB-TEQ	Sum 6 Indicator PCBs	
1	2501-FF	7.7	53.3	0.0	0.0	1	1	0	0	yes	0	2	0	0	yes
2	2501-FF				0.0				0	yes				0	yes
5	2501-FF	2.5	4.9	0.5	0.0	0	0	0	0	yes	0	0	0	0	yes
6	2501-FF	0.0	0.4	0.0	0.0	0	0	0	0	yes	0	0	0	0	yes
7	2501-FF	0.0	0.4	0.0	0.0	0	0	0	0	yes	0	0	0	0	yes
8	2501-FF				8.1				0	yes				0	yes
9	2501-FF				8.2				0	yes				0	yes
10	2501-FF	0.0	2.1	0.0	0.0	0	0	0	0	yes	0	0	0	0	yes
11	2501-FF				0.0				0	yes				0	yes
12	2501-FF	2.0	13.3	0.0	0.0	0	2	0	0	yes	0	1	0	0	yes
13	2501-FF	0.0	0.0	0.0	0.0	1	2	0	0	yes	1	2	0	0	yes
15	2501-FF	0.0	2.0	0.0	0.0	0	0	0	0	yes	0	0	0	0	yes
16	2501-FF	0.0	0.5	0.0	0.0	1	0	1	0	yes	1	0	1	0	yes
17	2501-FF	0.0	0.0	0.0	0.0	0	3	0	0	yes	0	2	0	0	yes
18	2501-FF	7.1	46.7	0.5	0.0	0	0	0	0	yes	1	2	1	0	yes
20	2501-FF	1.1	6.8	0.0	0.0	1	0	1	1	yes	1	0	1	1	yes
21	2501-FF				2.7				0	yes				0	yes
22	2501-FF	12.1	60.0	3.6	0.0	1	1	1	0	yes	0	9	1	0	yes
23	2501-FF	0.0	0.0	0.0	0.0	0	0	0	0	yes	0	0	0	0	yes
24	2501-FF	9.9	56.4	0.0	0.0	0	0	0	0	yes	0	0	0	0	yes
26	2501-FF	0.0	0.9	0.0	0.0	0	0	0	0	yes	1	0	0	0	yes
27	2501-FF				0.0				0	yes				0	yes
28	2501-FF				0.0				0	yes				0	yes
30	2501-FF	13.5	71.8	0.0	13.2	0	0	0	0	yes	0	1	1	0	yes
32	2501-FF	0.0	0.0	0.0	0.0	0	1	1	0	yes	0	1	1	0	yes
33	2501-FF				3.1				0	yes				0	yes
34	2501-FF		3.7				65			no		66			no
35	2501-FF				-1.5				2	yes				2	yes
37	2501-FF	0.0	1.2	0.0	0.0	0	0	0	0	yes	0	0	0	0	yes
38	2501-FF				0.0				0	yes				0	yes
39	2501-FF	0.0	0.4	0.0	0.0	0	0	0	0	yes	0	0	0	0	yes
41	2501-FF	0.0	0.0	0.0	0.0	0	0	0	0	yes	0	0	0	0	yes
42	2501-FF	0.0	0.0	0.0	0.0	2	0	1	1	yes	2	1	1	1	yes
44	2501-FF				0.0				0	yes				0	yes
45	2501-FF				58.8				0	yes				0	yes
46	2501-FF	0.0	0.4	0.0	0.0	0	0	1	0	yes	0	0	1	0	yes
47	2501-FF	5.8	33.3	0.0	0.0	0	2	0	0	yes	1	2	0	0	yes
48	2501-FF				1.8				13	no				13	no
49	2501-FF				8.3				1	yes				2	yes
50	2501-FF	0.6	4.6	0.0	10.6	1	0	1	0	yes	1	0	1	0	yes
51	2501-FF	0.0	0.0	0.0	0.0	1	0	0	0	yes	1	0	0	0	yes
52	2501-FF				2.2				0	yes				0	yes
54	2501-FF	0.0	0.0	0.0		0	1	0		yes	0	2	0		yes
56	2501-FF				0.0				0	yes				0	yes
57	2501-FF	0.6	9.6	0.0	0.0	1	0	0	0	yes	0	0	0	0	yes
58	2501-FF	18.9	73.7	0.0	0.0	1	0	1	0	yes	1	4	1	0	yes
59	2501-FF	6.0	48.7	0.0	0.0	1	0	1	0	yes	2	1	1	0	yes
61	2501-FF				0.0				0	yes				0	yes
62	2501-FF	8.1	49.3	0.0	0.0	0	0	0	0	yes	0	0	0	0	yes
63	2501-FF	0.0	0.0	0.0	0.0	0	0	0	0	yes	0	0	0	0	yes
64	2501-FF	0.5	1.8	0.0	0.0	1	0	0	0	yes	0	0	0	0	yes
65	2501-FF	0.0	0.0	0.0	0.0	0	0	0	0	yes	0	0	0	0	yes
66	2501-FF														
68	2501-FF	38.5	81.2	10.4	0.0	390	104	7024	0	no	6245	900	24695	0	no

Fish Fillet (2501-FF)
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 (deviation ≤ 10 %)	Difference between reported and calculated lower bound sum parameters [%]				Correct calculation (deviation ≤ 10 %)
		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		WHO-PCDD/F-PCB-TEQ	WHO-PCDD/F-TEQ	WHO-PCB-TEQ	Sum 6 Indicator PCBs	
69	2501-FF	0.5	1.9	0.0	0.0	0	0	1	0	yes	0	0	1	0	yes
70	2501-FF	0.0	0.0	0.0	0.0	1	0	1	0	yes	1	0	1	0	yes
71	2501-FF	0.0	0.6	0.0	0.0	0	1	0	0	yes	1	1	0	0	yes
72	2501-FF	0.0	0.7	0.0	0.0	0	0	0	0	yes	0	0	0	0	yes
73	2501-FF				0.0				0	yes				0	yes
74	2501-FF	0.5	0.8	0.0	2.5	0	1	0	0	yes	0	1	0	0	yes
75	2501-FF	0.0	0.7	0.0	0.0	0	0	0	0	yes	0	0	0	0	yes
77	2501-FF	0.0	0.4	0.0	0.0	0	0	0	2	yes	0	0	0	3	yes
78	2501-FF														
80	2501-FF	0.0	0.0	0.0	0.0	0	0	0	0	yes	0	0	0	0	yes
82	2501-FF	8.2	41.1	0.0	0.0	14	1	17	0	no	3	2	3	0	yes
83	2501-FF				10.8				0	yes				0	yes
84	2501-FF				0.0				0	yes				0	yes
86	2501-FF	5.6	8.3	0.0	0.0	1	0	1	0	yes	3	2	1	0	yes
87	2501-FF	0.0	0.0	0.0		2	2	1		yes	2	2	1		yes
88	2501-FF	0.8	5.4	0.0	0.0	0	1	0	0	yes	0	0	0	0	yes
90	2501-FF	0.0	0.9	0.0	0.0	0	0	0	0	yes	0	0	0	0	yes
92	2501-FF	0.0	2.1	0.0		1	1	0		yes	0	1	0		yes
93	2501-FF				13.9				0	yes				0	yes
94	2501-FF	0.0	0.4	0.0	0.0	0	0	0	0	yes	0	0	0	0	yes
96	2501-FF				0.0				0	yes				0	yes
97	2501-FF	0.0	0.7	0.0	0.0	0	0	0	0	yes	0	0	0	0	yes
99	2501-FF				0.0				0	yes				0	yes
100	2501-FF				22.2				0	yes				0	yes
102	2501-FF	0.4	4.8	0.0	0.0	0	0	0	0	yes	0	1	0	186	no
34*	2501-FF		3.7				1			yes		1			yes
82*	2501-FF	21.2	40.2	19.7	0.0	16	1	21	0	no	0	0	3	0	yes

Fish Fillet (2501-FF)

PCDD/F - Results

LC	Sample	Result pg/g wet weight	WHO-PCDD/F-TEQ reported		WHO-PCDD/F-TEQ calculated		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	2501-FF		0.3	0.14	0.296	0.143	< 0.04	< 0.04	< 0.1	< 0.1	< 0.1	< 0.1	< 0.2	0.8	0.09	0.2	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.2
2	2501-FF																						
5	2501-FF		0.612	0.582	0.612	0.582	< 0.02	0.262	0.188	0.304	< 0.05	0.375	0.7	0.551	0.188	0.441	0.264	0.251	0.195	< 0.05	0.239	< 0.04	< 0.1
6	2501-FF		0.274	0.273	0.274	0.273	0.0534	0.0538	0.0169	0.0449	0.0103	0.0398	0.0688	0.835	0.0861	0.221	0.0253	0.0192	0.0145	< 0.00468	0.00983	< 0.00936	< 0.0234
7	2501-FF		0.253	0.252	0.253	0.252	0.042	0.04	0.018	0.04	< 0.01	0.049	0.164	0.92	0.096	0.208	0.025	0.019	0.015	< 0.005	0.018	< 0.005	< 0.03
8	2501-FF																						
9	2501-FF																						
10	2501-FF		0.24	0.235	0.239	0.236	0.031	0.0454	0.015	0.0326	< 0.0166	0.0706	0.215	0.824	0.0892	0.209	0.0253	0.021	0.0108	< 0.0144	0.0767	< 0.014	< 0.027
11	2501-FF																						
12	2501-FF		0.3	0.26	0.295	0.257	0.046	0.05	< 0.05	< 0.05	< 0.05	< 0.1	< 0.3	0.92	0.096	0.22	< 0.05	< 0.05	< 0.05	< 0.05	< 0.1	< 0.1	< 0.3
13	2501-FF		0.22	0.22	0.225	0.225	0.034	0.032	0.011	0.036	0.008	0.041	0.071	0.85	0.088	0.2	0.022	0.014	0.013	0.004	0.011	0.001	0.008
15	2501-FF		0.25	0.245	0.25	0.245	0.049	0.039	0.011	0.037	0.01	< 0.03	< 0.11	0.865	0.066	0.193	0.031	0.022	< 0.02	< 0.02	< 0.01	< 0.01	< 0.01
16	2501-FF		0.198	0.197	0.198	0.197	0.027	0.031	0.007	0.036	0.006	0.052	0.081	0.792	0.074	0.157	0.026	0.014	0.013	< 0.004	< 0.017	< 0.006	< 0.049
17	2501-FF		0.26	0.26	0.269	0.255	0.0434	0.0424	< 0.0193	0.0389	< 0.0176	0.0509	0.116	0.937	0.103	0.225	< 0.027	< 0.0239	< 0.0269	< 0.0231	< 0.0239	< 0.0162	0.0474
18	2501-FF		0.3	0.16	0.299	0.157	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.2	< 2	0.878	0.118	0.218	< 0.05	< 0.05	< 0.05	< 0.05	< 0.2	< 0.2	< 2
20	2501-FF		0.279	0.26	0.279	0.259	0.04	0.0547	< 0.03	0.0349	< 0.03	< 0.05	< 0.1	0.901	0.0967	0.227	< 0.03	< 0.03	< 0.03	< 0.03	< 0.05	< 0.05	< 0.1
21	2501-FF																						
22	2501-FF		0.5	0.2	0.496	0.22	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	1.3	< 0.1	0.3	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
23	2501-FF		0.155	0.155	0.155	0.155	0.0254	0.0263	0.00965	0.0302	0.00401	0.026	0.0509	0.477	0.087	0.142	0.0249	0.0179	0.0115	< 0.00569	0.00677	< 0.00511	< 0.00471
24	2501-FF		0.486	0.212	0.486	0.212	< 0.0487	< 0.108	< 0.176	< 0.162	< 0.169	< 0.205	< 0.166	1.24	0.23	0.27	< 0.104	< 0.109	< 0.14	< 0.259	< 0.112	< 0.213	< 1.03
26	2501-FF		0.235	0.233	0.235	0.233	0.037	0.042	0.012	0.03	< 0.01	0.038	0.063	0.822	0.107	0.181	0.022	0.057	0.011	< 0.01	0.057	< 0.01	< 0.01
27	2501-FF																						
28	2501-FF																						
30	2501-FF		0.426	0.12	0.425	0.119	< 0.08	< 0.08	< 0.2	< 0.2	< 0.2	< 0.2	< 0.4	0.662	0.0879	0.168	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.4
32	2501-FF		0.36	0.36	0.357	0.355	0.058	0.051	0.014	0.045	< 0.009	0.094	1.47	1.36	0.107	0.303	0.032	0.021	0.035	< 0.01	0.028	< 0.007	0.022
33	2501-FF																						
34	2501-FF		0.268	0.258	0.771	0.76	0.556	0.0457	< 0.02	0.0305	< 0.02	0.04	0.09	0.865	0.099	0.194	0.0754	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.05
35	2501-FF																						
37	2501-FF		0.242	0.239	0.242	0.239	0.0403	0.0438	< 0.008	0.0308	< 0.0085	0.0286	< 0.045	0.819	0.139	0.2	0.0307	0.0148	0.0132	< 0.008	0.00585	< 0.005	< 0.005
38	2501-FF																						
39	2501-FF		0.267	0.266	0.267	0.266	0.036	0.0457	0.0129	0.0367	0.00993	0.0473	0.0946	0.983	0.0819	0.239	0.0234	0.0169	0.0112	< 0.00655	0.0107	< 0.00655	< 0.0131
41	2501-FF		0.25	0.25	0.249	0.249	0.0415	0.0348	0.00937	0.0361	0.0161	0.0134	0.0883	0.882	0.101	0.221	0.0395	0.0194	0.0107	0.00937	0.012	0.0321	0.0729
42	2501-FF		0.28	0.28	0.279	0.278	0.044	0.049	< 0.0086	0.042	0.0092	0.0345	0.0625	1	0.105	0.235	0.024	0.0155	0.0145	< 0.0037	< 0.012	< 0.0052	< 0.012
44	2501-FF																						
45	2501-FF																						
46	2501-FF		0.234	0.233	0.234	0.233	0.0349	0.0473	0.0116	0.0315	0.00789	0.0364	0.0447	0.776	0.0799	0.199	0.025	0.0163	0.0128	< 0.00801	0.00867	< 0.00539	< 0.0115
47	2501-FF		0.24	0.16	0.244	0.157	0.0322	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.1	0.642	0.0898	0.194	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.1
48	2501-FF																						
49	2501-FF																						
50	2501-FF		0.262	0.25	0.262	0.25	0.0398	0.0462	< 0.01	0.0423	< 0.01	< 0.203	< 1.34	0.814	0.153	0.225	0.0431	0.0234	< 0.023	< 0.022	< 0.172	< 0.089	< 0.662
51	2501-FF		0.284	0.284	0.284	0.284	0.0455	0.0483	0.0148	0.0423	0.00845	0.0337	0.0965	1.02	0.0932	0.243	0.0285	0.019	0.0092	< 0.00128	0.0104	< 0.00364	< 0.00386
52	2501-FF																						
54	2501-FF		0.15	0.15	0.149	0.147	0.03	0.03	0.01	0.02	< 0.01	0.03	0.07	0.4	0.1	0.12	0.02	0.01	0.01	< 0.01	0.02	< 0.01	< 0.01
56	2501-FF																						
57	2501-FF		0.136	0.123	0.136	0.123	0.0325	< 0.011	< 0.00495	0.0376	< 0.00366	0.0301	0.0661	0.407	0.0499	0.135	0.0288	0.00945	< 0.00263	< 0.00303	0.0124	< 0.00209	< 0.00331
58	2501-FF		0.19	0.05	0.19	0.052	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.31	< 0.05	0.07	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
59	2501-FF		0.279	0.143	0.278	0.142	< 0.05	< 0.05	<														

Fish Fillet (2501-FF)
PCDD/F - Results

LC	Sample	Result pg/g wet weight	WHO-PCDD/F-TEQ reported		WHO-PCDD/F-TEQ calculated		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
			upper bound	lower bound	upper bound	lower bound																	
74	2501-FF		0.259	0.257	0.257	0.255	0.034	0.048	< 0.0071	0.043	< 0.0088	0.055	0.093	0.951	0.089	0.213	0.028	0.022	0.015	< 0.0066	< 0.0091	< 0.0097	< 0.0095
75	2501-FF		0.291	0.289	0.291	0.289	0.05	0.034	< 0.009	0.064	< 0.005	0.064	0.047	1.03	0.088	0.276	0.045	0.026	0.02	< 0.006	< 0.005	< 0.007	< 0.007
77	2501-FF		0.281	0.28	0.281	0.28	0.045	0.03	0.013	0.06	< 0.0026	0.12	< 0.0034	1.09	0.06	0.255	0.045	0.025	0.025	< 0.0025	< 0.0021	< 0.0025	< 0.0031
78	2501-FF																						
80	2501-FF		0.134	0.134	0.134	0.134	0.019	0.027	0.009	0.02	0.005	0.029	0.057	0.394	0.053	0.121	0.024	0.017	0.016	0.007	0.021	0.005	0.007
82	2501-FF		0.321	0.189	0.323	0.192	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.089	1.12	0.133	0.224	0.085	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
83	2501-FF																						
84	2501-FF																						
86	2501-FF		0.36	0.33	0.359	0.325	0.069	0.065	< 0.019	0.06	< 0.066	< 1.2	< 0.82	1	0.086	0.25	< 0.024	< 0.05	0.07	< 0.054	< 0.051	< 0.041	< 0.28
87	2501-FF		0.26	0.26	0.256	0.256	0.045	0.047	0.013	0.037	0.0095	0.036	0.079	0.9	0.08	0.2	0.021	0.016	0.012	< 0.0022	0.01	< 0.0028	0.018
88	2501-FF		0.37	0.35	0.367	0.351	< 0.01	0.15	< 0.01	< 0.01	< 0.01	0.12	0.38	0.91	0.15	0.3	< 0.01	< 0.01	< 0.01	0.13	0.15	< 0.01	0.23
90	2501-FF		0.113	0.112	0.113	0.112	0.0176	0.0234	0.00733	0.0223	0.00273	0.0323	0.0514	0.308	0.0588	0.106	0.0161	0.0112	0.0066	< 0.00206	0.00817	< 0.00413	< 0.00826
92	2501-FF		0.193	0.189	0.195	0.191	0.0504	< 0.00116	0.0354	0.025	< 0.00182	0.0388	0.116	0.734	0.103	0.182	0.0278	< 0.00782	< 0.00901	< 0.0102	0.0161	< 0.000756	< 0.000903
93	2501-FF																						
94	2501-FF		0.232	0.231	0.232	0.231	0.0433	0.0428	0.0118	0.027	0.007	0.049	0.0774	0.743	0.0821	0.193	0.0215	0.0147	0.0122	< 0.01	< 0.015	< 0.01	< 0.015
96	2501-FF																						
97	2501-FF		0.28	0.278	0.28	0.278	0.036	0.052	0.013	0.031	< 0.016	0.036	0.171	1.01	0.157	0.241	0.047	0.011	0.009	< 0.007	< 0.019	< 0.02	< 0.015
99	2501-FF																						
100	2501-FF																						
102	2501-FF		0.207	0.197	0.207	0.199	0.03	0.039	< 0.02	0.021	< 0.02	0.022	< 0.065	0.755	0.071	0.152	0.023	0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.041
34*	2501-FF		0.268	0.258	0.27	0.26	0.0556	0.0457	< 0.02	0.0305	< 0.02	0.04	0.09	0.865	0.099	0.194	0.0754	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.05
82*	2501-FF		0.321	0.192	0.323	0.192	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.089	1.12	0.133	0.224	0.085	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05

Fish Fillet (2501-FF)
Dioxin-like PCB - Results

LC	Sample	Result pg/g wet weight	WHO-PCB-TEQ reported		WHO-PCB-TEQ calculated		PCB 105	PCB 114	PCB 118	PCB 123	PCB 156	PCB 157	PCB 167	PCB 189	PCB 77	PCB 81	PCB 126	PCB 169
			upper bound	lower bound	upper bound	lower bound												
1	2501-FF		1.66	1.66	1.66	1.66	881	51.6	4000	34.4	957	108	620	91.8	52.3	2.05	14	1.81
2	2501-FF																	
5	2501-FF		0.598	0.595	0.598	0.595	156	< 0.1	737	< 0.1	128	16.5	< 0.1	12.6	8.4	< 0.1	5.63	< 0.1
6	2501-FF		1.85	1.85	1.85	1.85	1080	81.7	5050	60.1	1020	135	663	127	64.5	< 0.971	15.4	2.03
7	2501-FF		1.85	1.85	1.85	1.85	938	62.9	4360	60.3	901	149	561	118	55.9	2.13	15.7	1.99
8	2501-FF																	
9	2501-FF																	
10	2501-FF		1.78	1.78	1.78	1.78	888	60	4210	58	795	149	570	104	56	1.97	15.2	1.56
11	2501-FF																	
12	2501-FF		1.67	1.67	1.67	1.67	943	52.3	4390	41	908	119	545	111	51.9	1.85	14	1.62
13	2501-FF		1.46	1.46	1.46	1.46	780	42.9	3600	41.1	823	103	540	90.8	40.8	1.78	12.3	1.48
15	2501-FF		1.85	1.85	1.85	1.85	911	55.3	4440	46.3	919	125	649	112	52.5	1.94	15.8	1.71
16	2501-FF		1.74	1.74	1.73	1.73	880	78.6	4420	50	989	137	622	103	44.5	1.81	14.6	1.72
17	2501-FF		2	2	2	2	1150	81.6	5740	127	978	127	608	116	74.7	3.66	16.6	1.99
18	2501-FF		1.82	1.81	1.82	1.82	936	54.3	4080	60.8	890	124	559	112	53.8	< 10	15.5	1.92
20	2501-FF		1.58	1.58	1.59	1.59	792	50.7	3420	34	815	112	497	97.6	46.9	1.22	13.6	1.56
21	2501-FF																	
22	2501-FF		2.8	2.7	2.77	2.68	2120	71.9	4810	252	957	123	559	114	53.5	21.6	24	< 3
23	2501-FF		1.93	1.93	1.93	1.93	1100	80.6	5320	103	1090	188	795	170	49.6	1.74	16.1	1.7
24	2501-FF		2.33	2.33	2.33	2.33	1220	164	6360	117	1110	189	1090	133	53.3	2.38	19.3	2.75
26	2501-FF		1.66	1.66	1.66	1.66	904	67.8	5160	79.1	909	119	500	108	53.9	2	13.7	1.68
27	2501-FF																	
28	2501-FF																	
30	2501-FF		1.87	1.87	1.87	1.86	764	49.7	4690	37.4	817	73.4	439	84.3	36.2	< 10	16.2	1.06
32	2501-FF		1.67	1.67	1.68	1.68	786	70.1	4360	69.5	970	136	589	115	51.6	2.27	14.1	1.61
33	2501-FF																	
34	2501-FF																	
35	2501-FF																	
37	2501-FF		1.49	1.49	1.49	1.49	864	65.2	3550	258	849	124	461	97.8	45.9	1.89	12.5	1.46
38	2501-FF																	
39	2501-FF		1.86	1.86	1.86	1.86	1170	70.4	5350	114	1120	136	674	122	56.9	1.79	15.5	1.23
41	2501-FF		1.31	1.31	1.31	1.31	1130	78.9	5120	587	1190	154	688	131	29.2	1.36	10.1	0.856
42	2501-FF		1.7	1.7	1.69	1.69	960	52	4700	140	980	140	595	110	49.5	2	14	1.8
44	2501-FF						714	51	3990	43	738	117	486	96				
45	2501-FF																	
46	2501-FF		1.81	1.81	1.8	1.8	922	49.9	3940	50.6	883	99.4	586	113	56.4	2.12	15.4	1.96
47	2501-FF		1.32	1.32	1.32	1.32	833	63	3500	131	772	95.6	444	149	39.7	1.43	11	1.17
48	2501-FF																	
49	2501-FF								5000									
50	2501-FF		1.5	1.5	1.49	1.49	1030	103	4470	51.6	843	117	522	93.2	60.5	2.58	12.3	1.31
51	2501-FF		1.7	1.7	1.7	1.7	769	56.3	3520	50.7	706	104	438	96.3	50.2	1.94	14.7	1.89
52	2501-FF																	
54	2501-FF		1.44	1.44	1.44	1.44	784	45	3780	60	865	106	476	100	38	1.7	12	1.7
56	2501-FF																	
57	2501-FF		1.49	1.49	1.49	1.49	729	64.5	3870	43.5	886	113	529	92.1	40.6	1.72	12.5	1.57
58	2501-FF		0.55	0.55	0.545	0.545	278	18.1	1270	13.4	245	34.7	167	28.7	19.5	0.92	4.65	0.53
59	2501-FF		1.87	1.87	1.85	1.85	950	55	4120	65	810	104	464	129	54	1.9	16	1.4
61	2501-FF								3.93									
62	2501-FF		1.45	1.45	1.45	1.45	789	31.3	3590	92.2	748	105	477	69.7	32.8	1.21	12.3	1.3
63	2501-FF		1.87	1.87	1.87	1.87	854	66.6	5150	13.5	875	127	500	110	56	1.61	15.9	1.59
64	2501-FF		1.7	1.7	1.7	1.7	887	114	4150	301	925	130	645	124	57.4	2.14	14.2	1.81
65	2501-FF		1.68	1.68	1.68	1.68	965	69.5	4360	48.8	932	118	560	113	47.5	1.89	14.1	1.76
66	2501-FF																	
68	2501-FF		0.27	0.242	0.00379	0.000976	0.0239	0.00159	0.129	< 0.0000399	0.0272	0.00344	0.0183	0.00295	0.00356	< 0.000084	< 0.0281	0.0323
69	2501-FF		1.79	1.79	1.78	1.78	965	66.3	4920	53.2	997	141	580	106	51.9	2.54	14.9	1.72
70	2501-FF		1.67	1.67	1.66	1.66	704	113	3390	36.4	694	82.4	536	89.2	41.7	2.03	14.4	1.61
71	2501-FF		1.16	1.16	1.16	1.16	609	37.7	2700	33.6	634	86	368	75.9	41.9	1.61	9.79	1.45
72	2501-FF		1.89	1.89	1.89	1.89	814	< 0.496	4560	50.8	921	129	554	119	52	2.22	16.1	1.89



EURL Proficiency Study on the Determination of PCDD/Fs, PCBs, PBDEs, HBCDDs and PFAS in Fish Fillet 2025 [EURL-PT-POP_2501-FF]
EURL for halogenated Persistent Organic Pollutants (POPs) in Feed and Food

Fish Fillet (2501-FF)
Dioxin-like PCB - Results

LC	Sample	Result pg/g wet weight	WHO-PCB-TEQ reported		WHO-PCB-TEQ calculated		PCB 105	PCB 114	PCB 118	PCB 123	PCB 156	PCB 157	PCB 167	PCB 189	PCB 77	PCB 81	PCB 126	PCB 169
			upper bound	lower bound	upper bound	lower bound												
73	2501-FF																	
74	2501-FF		1.87	1.87	1.87	1.87	890	52.8	4000	398	908	131	606	107	60.6	20.8	14.2	7.34
75	2501-FF		1.76	1.76	1.76	1.76	1040	159	4780	55	974	125	588	113	54.7	2.34	14.5	2.18
77	2501-FF		2.1	2.1	2.11	2.11	1150	86.3	5940	142	980	170	729	117	58	2.18	17.5	2.32
78	2501-FF																	
80	2501-FF		1.42	1.42	1.42	1.42	725	54.5	3790	40.9	824	103	523	102	33.9	1.5	11.8	1.61
82	2501-FF		1.26	1.26	1.52	1.22	757	53	3510	< 10	668	102	355	91	33.1	< 10	10.5	< 10
83	2501-FF																	
84	2501-FF																	
86	2501-FF		1.4	1.4	1.42	1.42	880	39	3200	41	850	110	480	100	53	2	12	1.6
87	2501-FF		1.7	1.7	1.71	1.71	982	72.8	4230	53.2	996	122	492	99	51.5	1.9	14.4	1.6
88	2501-FF		2.08	2.08	2.08	2.08	1120	72.8	5040	54.5	1110	157	667	127	64.4	2.71	17.4	2.75
90	2501-FF		1.42	1.42	1.42	1.42	702	42.9	3680	45.6	804	99.4	547	101	36.7	1.85	11.9	1.48
92	2501-FF		1.46	1.46	1.46	1.46	891	51.9	4640	46.6	835	114	525	107	45	< 0.01	12.4	< 0.00453
93	2501-FF																	
94	2501-FF		1.57	1.57	1.57	1.57	893	50.2	4300	30.9	883	105	497	110	50.5	1.69	13.1	1.6
96	2501-FF																	
97	2501-FF		1.83	1.83	1.83	1.83	846	77.4	4390	45.7	835	107	502	100	59.2	2.52	15.6	1.91
99	2501-FF																	
100	2501-FF																	
102	2501-FF		2.49	2.49	2.49	2.49	851	50	4860	454	923	118	582	111	50.4	3.19	22.1	1.14
82*	2501-FF		1.52	1.22	1.26	1.26	757	53	3510	< 10	668	102	355	91	33.1	1.26	10.5	1.39

Fish Fillet (2501-FF)
Non dioxin-like PCB - Results

LC	Sample	Result ng/g wet weight	Sum 6 Indicator PCBs reported		Sum 6 Indicator PCBs calculated		PCB 28	PCB 52	PCB 101	PCB 138	PCB 153	PCB 180
			upper bound	lower bound	upper bound	lower bound						
1	2501-FF		39.4	39.4	39.4	39.4	0.39	1.06	5.8	9.37	17	5.77
2	2501-FF		46.3	46.3	46.4	46.4	0.484	1.58	6.63	12.6	17.5	7.61
5	2501-FF		7.07	7.07	7.07	7.07	0.179	0.396	1.11	2.2	2.37	0.816
6	2501-FF		48.5	48.5	48.5	48.5	0.698	1.72	6.77	11.7	20	7.6
7	2501-FF		37.3	37.3	37.3	37.3	0.47	1.41	5.43	8.93	15.3	5.76
8	2501-FF		24.6	22.6	24.6	22.6	< 1	< 1	2.77	7.47	8.94	3.38
9	2501-FF		49	45	49.1	45.1	< 2	< 2	6.62	14.4	17.3	6.74
10	2501-FF		36.1	36.1	36.1	36.1	0.572	1.52	5.57	8.47	14.5	5.43
11	2501-FF		23.6	23.6	23.6	23.6	0.799	0.913	3.54	5.42	8.86	4.06
12	2501-FF		42.1	42.1	42.1	42.1	0.57	1.61	6.02	9.99	17	6.89
13	2501-FF		31.1	31.1	31	31	0.45	1.26	4.54	7.48	12.1	5.18
15	2501-FF		41.5	41.5	41.5	41.5	0.634	1.7	6.01	10.5	16.3	6.34
16	2501-FF		44.7	44.7	44.8	44.8	0.837	1.49	5.85	9.7	20	6.88
17	2501-FF		44.2	44.2	44.2	44.2	0.869	2.35	7.09	10.6	17.2	6.08
18	2501-FF		39.1	39.1	39.1	39.1	0.575	1.5	5.97	9.79	15.2	6.06
20	2501-FF		17	17	16.8	16.8	0.31	0.498	1.89	5.11	7.24	1.8
21	2501-FF		36.8	35.8	36.8	35.8	< 0.98	1.08	3.36	11.6	14.3	5.43
22	2501-FF		43.1	43.1	43.1	43.1	0.82	1.8	6.83	18.8	11.9	2.95
23	2501-FF		41.1	41.1	41.2	41.2	0.535	1.62	5.64	10.2	15.6	7.6
24	2501-FF		33.6	33.6	33.6	33.6	0.22	0.89	6.94	10.7	6.36	8.52
26	2501-FF		41.6	41.6	41.7	41.7	0.55	1.64	6.09	10.2	16.5	6.72
27	2501-FF		18.3	18.3	18.3	18.3	0.26	0.73	2.43	5.49	6.88	2.48
28	2501-FF		38.8	38.8	38.8	38.8	0.55	1.59	5.36	9.52	15.7	6.08
30	2501-FF		30.3	26.3	30.3	26.3	< 2	< 2	5.64	8.25	6.57	5.83
32	2501-FF		31.7	31.7	31.7	31.7	0.496	1.43	5.74	7.91	10.3	5.83
33	2501-FF		32	31	31.9	30.9	< 1	1.4	4.3	7.85	12.8	4.5
34	2501-FF											
35	2501-FF		32.4	32.9	32.9	32.4	< 0.5	1.24	4.69	8.26	13.4	4.8
37	2501-FF		42.6	42.6	42.6	42.6	0.525	1.53	5.18	9.93	19.8	5.64
38	2501-FF		40.4	40.4	40.3	40.3	0.55	1.55	6.19	11.9	15	5.15
39	2501-FF		48.7	48.7	48.8	48.8	0.54	1.55	6.95	11.6	20.6	7.58
41	2501-FF		47	47	47.1	47.1	1.28	1.94	8.09	14.7	12.5	8.55
42	2501-FF		42	42	41.5	41.5	0.535	1.5	6.2	11	15.5	6.75
44	2501-FF		39.4	39.4	39.4	39.4	0.37	1.23	5.2	10	16.4	6.2
45	2501-FF		20.4	8.4	20.4	8.4	< 3	< 3	< 3	3.8	4.6	< 3
46	2501-FF		38.8	38.8	38.8	38.8	0.541	1.61	5.54	9.64	14.9	6.55
47	2501-FF		30.2	30.2	30.3	30.3	0.771	1.22	4.66	7.41	11.6	4.6
48	2501-FF		49.2	48.3	43.7	42.8	< 0.86	1.33	6.07	10.7	18.1	6.63
49	2501-FF		48	44	48.7	44.7	< 2	< 2	6.7	11	20	7
50	2501-FF		41.4	37	41.4	37	< 1.36	< 3.05	6.71	8.86	15.5	5.93
51	2501-FF		37.9	37.9	37.9	37.9	0.425	1.28	4.91	10.3	15.6	5.4
52	2501-FF		44.9	43.9	44.9	43.9	< 1	1.85	6.61	10.8	17.9	6.74
54	2501-FF											
56	2501-FF		44.5	44.5	44.5	44.5	0.58	1.45	5.93	11.8	18.4	6.31
57	2501-FF		33.4	33.4	33.4	33.4	0.397	1.23	4.44	8.24	13.6	5.45
58	2501-FF		12.5	12.5	12.5	12.5	0.26	0.63	1.88	3.38	4.69	1.7
59	2501-FF		40.3	40.3	40.3	40.3	0.658	1.65	5.84	9.39	15.4	7.37
61	2501-FF		32.4	32.4	32.4	32.4	0.35	1.12	4.54	8.54	13.1	4.76
62	2501-FF		35.5	35.5	35.5	35.5	0.36	1.27	4.87	8.5	16	4.5
63	2501-FF		40.3	40.3	40.3	40.3	0.51	1.74	7.76	11	10.9	8.37
64	2501-FF		44.8	44.8	44.7	44.7	0.622	1.66	6.23	14	16.2	6.03
65	2501-FF		36	36	36	36	0.561	1.51	5.47	8.58	14.1	5.78
66	2501-FF				48	48	1.06	1.94	5.99	12.7	19.5	6.79
68	2501-FF		33.1	33.1	33.1	33.1	0.784	1.49	5.72	10.7	8.37	6.07



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Fish Fillet (2501-FF)
Non dioxin-like PCB - Results

LC	Sample	Result ng/g wet weight	Sum 6 Indicator PCBs reported		Sum 6 Indicator PCBs calculated		PCB 28	PCB 52	PCB 101	PCB 138	PCB 153	PCB 180
			upper bound	lower bound	upper bound	lower bound						
69	2501-FF		41.8	41.8	41.8	41.8	0.473	1.51	5.8	11.7	16.2	6.13
70	2501-FF		31.7	31.7	31.7	31.7	0.538	1.46	5.32	7.95	11.2	5.22
71	2501-FF		27.5	27.5	27.6	27.6	0.331	0.983	3.99	6.23	11.9	4.12
72	2501-FF		46.8	46.8	46.7	46.7	0.565	1.54	6.86	11.3	20	6.47
73	2501-FF		39.4	39.4	39.4	39.4	0.3	1.03	5.36	10.4	16.1	6.25
74	2501-FF		28.2	27.5	28.2	27.5	< 0.7	1.3	4.2	7.2	11.2	3.6
75	2501-FF		41.7	41.7	41.7	41.7	0.604	1.59	5.94	10.4	17.1	6.03
77	2501-FF		40	40	40.7	38.7	< 1	< 1	5.54	9.54	17.2	6.46
78	2501-FF											
80	2501-FF		30.6	30.6	30.6	30.6	0.258	0.893	4.35	7.58	12.6	4.92
82	2501-FF		33.5	33.5	33.5	33.5	0.95	1.35	5.14	9.14	12.5	4.43
83	2501-FF		46.2	41.2	46.2	41.2	< 2.5	< 2.5	2.73	16.1	16.1	6.25
84	2501-FF		46.4	46.4	46.4	46.4	0.524	1.6	6.03	11.9	18.3	8
86	2501-FF		35	35	34.9	34.9	0.54	1.3	5.3	8.4	14	5.4
87	2501-FF											
88	2501-FF		44.7	44.7	44.8	44.8	0.585	1.63	6.75	11.3	17.4	7.1
90	2501-FF		36.7	36.7	36.7	36.7	0.358	1.31	5.75	8.85	14.7	5.75
92	2501-FF											
93	2501-FF		43.1	37.1	43.1	37.1	< 3	< 3	5.2	13.1	13.9	4.9
94	2501-FF		39.5	39.5	39.5	39.5	0.443	1.45	5.83	9.65	15.5	6.65
96	2501-FF		45.4	45.4	45.4	45.4	0.67	1.8	6.58	12.2	17.6	6.51
97	2501-FF		44.3	44.3	44.3	44.3	0.645	1.7	6.4	10.2	18.2	7.12
99	2501-FF		38.9	38.9	38.9	38.9	0.422	1.29	5.13	10.4	15.9	5.75
100	2501-FF		54.1	42.1	54.1	42.1	< 9	< 3	6.7	12	16.9	6.5
102	2501-FF		44.4	44.4	44.6	15.5	0.578	1.67	6.35	< 11	< 18.1	6.88

LC	Sample	Result pg BEQ/g wet weight	PCDD/Fs + DL-PCBs	PCDD/Fs	DL-PCBs		Assessment of analytical results Sample suspected to be noncompliant with ...				Reporting Limit				Maximum Level on which evaluation is based on			Action Level on which evaluation is based on				Bioassay Cut-off Maximum Level		Bioassay Cut-off Action Level	
							Maximum Level PCDD/Fs+DL-PCBs	Maximum Level PCDD/Fs	Action Level PCDD/Fs	Action Level DL-PCBs	PCDD/Fs+ DL-PCBs	PCDD/Fs	DL-PCBs		PCDD/Fs+ DL-PCBs	PCDD/Fs	DL-PCBs	PCDD/Fs+ DL-PCBs	PCDD/Fs	DL-PCBs		PCDD/Fs+ DL-PCBs	PCDD/Fs	PCDD/Fs	DL-PCBs
10	2501-FF		0.9	0.44	1.7		no				0.5														
16	2501-FF		2.2					no	no	no	1.5	0.44	1.06	6.5	3.5					4.88	2.63				
21	2501-FF		1.4					no			0.16			6.5			4			4.33					
37	2501-FF		0.86					no	n.a.	n.a.	n.a.	0.05			6.5	3.5				2.3	2.3				
78	2501-FF		2					no	yes	yes	yes	0.44			6.5	3.5	-	-	1.5	2.5	4.3	2.3	1	1.7	



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Fish Fillet (2501-FF)
Lipid content - Results

LC	Sample	Result %	Lipid content	Lipid content	Lipid content
			Physico-chemical methods	Bioanalytical methods	Mean
1	2501-FF		10.0		10.0
2	2501-FF		10.1		10.1
5	2501-FF		9.0		9.0
6	2501-FF		6.4		6.4
7	2501-FF		5.3		5.3
8	2501-FF				
9	2501-FF				
10	2501-FF		5.7	5.7	5.7
11	2501-FF		5.5		5.5
12	2501-FF				
13	2501-FF		4.9		4.9
15	2501-FF		2.3		2.3
16	2501-FF		5.5	5.5	5.5
17	2501-FF		5.4		5.4
18	2501-FF		31.6		31.6
20	2501-FF				
21	2501-FF		6.1	6.1	6.1
22	2501-FF				
23	2501-FF				
24	2501-FF				
26	2501-FF		5.8		5.8
27	2501-FF				
28	2501-FF		5.6		5.6
30	2501-FF		5.6		5.6
32	2501-FF		10.6		10.6
33	2501-FF		4.3		4.3
34	2501-FF				
35	2501-FF		4.3		4.3
37	2501-FF		5.6	5.6	5.6
38	2501-FF		6.0		6.0
39	2501-FF		4.2		4.2
41	2501-FF		6.7		6.7
42	2501-FF		6.3		6.3
44	2501-FF				
45	2501-FF				
46	2501-FF				
47	2501-FF		3.1		3.1
48	2501-FF		5.2		5.2
49	2501-FF		5.8		5.8
50	2501-FF		5.5		5.5
51	2501-FF		4.4		4.4
52	2501-FF		6.0		6.0
54	2501-FF		5.7		5.7
56	2501-FF		5.7		5.7
57	2501-FF		5.4		5.4
58	2501-FF		3.2		3.2
59	2501-FF				
61	2501-FF		5.6		5.6
62	2501-FF				
63	2501-FF		5.9		5.9
64	2501-FF		6.0		6.0
65	2501-FF		5.6		5.6
66	2501-FF				
68	2501-FF		5.5		5.5



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Fish Fillet (2501-FF)
Lipid content - Results

LC	Sample	Result %	Lipid content	Lipid content	Lipid content
			Physico-chemical methods	Bioanalytical methods	Mean
69	2501-FF		6.3		6.3
70	2501-FF				
71	2501-FF		4.0		4.0
72	2501-FF		5.6		5.6
73	2501-FF		5.6		5.6
74	2501-FF				
75	2501-FF		6.1		6.1
77	2501-FF		6.3		6.3
78	2501-FF			6.3	6.3
80	2501-FF		5.6		5.6
82	2501-FF		4.5		4.5
83	2501-FF		3.8		3.8
84	2501-FF		5.8		5.8
86	2501-FF				
87	2501-FF		5.6		5.6
88	2501-FF				
90	2501-FF		5.5		5.5
92	2501-FF		5.1		5.1
93	2501-FF				
94	2501-FF		5.4		5.4
96	2501-FF				
97	2501-FF		6.0		6.0
99	2501-FF		5.4		5.4
100	2501-FF				
102	2501-FF				

**EURL Proficiency Study on the Determination of PCDD/Fs, PCBs, PBDEs, HBCDDs and PFAS in Fish Fillet 2025 [EURL-PT-POP_2501-FF]**

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

28 January 2026

Annex 3: Participants' z-scores and bioassay-scores of PCDD/Fs and PCBs - Tables**Test sample - Fish Fillet (2501-FF)****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**

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

 x_a : assigned value (physical-chemical methods) x : participant's result (BEQ from bioanalytical screening method) σ_{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

Fish Fillet (2501-FF)
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	2501-FF		0.1	-0.6	0.1	-0.6	1.9		1.7		-0.1	-0.1	-0.2	-0.2		0.0	0.1	0.0	0.1
2	2501-FF															1.2	1.2	1.2	1.3
5	2501-FF		-3.7	-3.8	-3.8	-3.9	14.3		14.1		-6.4	-6.5	-6.5	-6.5		-5.5	-5.5	-5.5	-5.5
6	2501-FF		1.0	1.2	0.9	1.0	0.9	1.0	0.8	1.0	1.0	1.0	0.9	0.9		1.5	1.6	1.5	1.6
7	2501-FF		0.9	1.0	0.8	0.9	0.0		0.0		1.0	1.0	0.9	0.9		-0.4	-0.3	-0.4	-0.3
8	2501-FF															-2.5	-2.8	-2.5	-2.8
9	2501-FF															1.6	1.0	1.6	1.0
10	2501-FF		0.5	0.6	0.4	0.5	-0.5		-0.6		0.6	0.6	0.5	0.5		-0.6	-0.5	-0.6	-0.5
11	2501-FF															-2.7	-2.6	-2.7	-2.6
12	2501-FF		0.2	0.1	0.2	0.1	1.9		1.6		-0.1	-0.1	-0.2	-0.1		0.5	0.5	0.4	0.5
13	2501-FF		-1.3	-1.2	-1.3	-1.2	-1.3		-1.1		-1.3	-1.3	-1.4	-1.4		-1.4	-1.4	-1.4	-1.4
15	2501-FF		0.9	1.0	0.8	0.9	-0.1		-0.2		1.0	1.0	0.9	0.9		0.4	0.4	0.3	0.4
16	2501-FF		0.1	0.2	-0.1	0.1	-2.1		-2.2		0.4	0.4	0.2	0.2		0.9	1.0	0.9	1.0
17	2501-FF		1.7	1.8	1.7	1.8	0.3		0.6		1.9	1.9	1.8	1.8		0.8	0.9	0.8	0.9
18	2501-FF		1.0	0.3	0.9	0.3	1.9		1.8		0.8	0.8	0.7	0.8		-0.1	0.0	-0.1	0.0
20	2501-FF		-0.4	-0.4	-0.4	-0.4	1.1		1.0		-0.6	-0.6	-0.6	-0.6		-3.8	-3.8	-3.8	-3.8
21	2501-FF															-0.4	-0.5	-0.5	-0.5
22	2501-FF		7.1	5.2	6.9	5.1	9.8		9.5		6.7	6.1	6.3	5.9		0.6	0.7	0.6	0.7
23	2501-FF		0.8	0.9	0.8	0.9	-3.8		-3.9		1.5	1.5	1.4	1.4		0.3	0.4	0.3	0.4
24	2501-FF		4.6	3.3	4.5	3.2	9.3		9.1		3.9	3.9	3.7	3.8		-1.0	-0.9	-1.0	-0.9
26	2501-FF		-0.2	-0.1	-0.2	-0.2	-0.7		-0.7		-0.1	-0.1	-0.2	-0.2		0.4	0.4	0.4	0.5
27	2501-FF															-3.6	-3.5	-3.6	-3.5
28	2501-FF															-0.1	0.0	-0.1	0.0
30	2501-FF		1.9	0.4	1.9	0.3	6.9		6.7		1.1	1.1	1.0	1.0		-1.5	-2.2	-1.6	-2.2
32	2501-FF		0.5	0.6	0.5	0.6	4.3		4.1		-0.1	-0.1	-0.1	-0.1		-1.3	-1.2	-1.3	-1.2
33	2501-FF															-1.3	-1.4	-1.3	-1.4
34	2501-FF						0.6		20.4										
35	2501-FF															-1.2	-1.0	-1.1	-1.1
37	2501-FF		-1.0	-0.9	-1.1	-1.0	-0.4		-0.5		-1.1	-1.1	-1.2	-1.2		0.5	0.6	0.5	0.6
38	2501-FF															0.2	0.2	0.1	0.2
39	2501-FF		1.0	1.1	1.0	1.1	0.6		0.5		1.1	1.1	0.9	1.0		1.6	1.7	1.6	1.7
41	2501-FF		-1.9	-1.8	-2.0	-1.9	-0.1		-0.2		-2.2	-2.2	-2.3	-2.2		1.3	1.4	1.3	1.4
42	2501-FF		0.4	0.5	0.2	0.3	1.1		1.0		0.1	0.1	-0.1	0.0		0.4	0.5	0.3	0.4
44	2501-FF															0.0	0.1	0.0	0.1
45	2501-FF															-3.2	-5.2	-3.2	-5.2
46	2501-FF		0.6	0.7	0.5	0.6	-0.7		-0.8		0.8	0.8	0.6	0.7		-0.1	0.0	-0.1	0.0
47	2501-FF		-1.9	-2.3	-2.0	-2.3	-0.5		-0.4		-2.1	-2.1	-2.2	-2.2		-1.6	-1.5	-1.6	-1.5
48	2501-FF															1.7	1.6	0.7	0.6
49	2501-FF															1.5	0.9	1.6	1.0
50	2501-FF		-0.9	-0.8	-1.0	-0.9	0.4		0.3		-1.1	-1.1	-1.2	-1.2		0.3	-0.3	0.3	-0.3
51	2501-FF		0.3	0.4	0.2	0.3	1.3		1.2		0.1	0.1	0.0	0.1		-0.3	-0.2	-0.3	-0.2
52	2501-FF															0.9	0.8	0.9	0.8
54	2501-FF		-1.8	-1.7	-1.8	-1.7	-4.0		-4.1		-1.4	-1.4	-1.5	-1.5					
56	2501-FF															0.9	0.9	0.8	0.9
57	2501-FF		-1.6	-1.6	-1.6	-1.6	-4.6		-4.6		-1.1	-1.1	-1.2	-1.2		-1.0	-1.0	-1.0	-1.0
58	2501-FF		-6.2	-6.9	-6.2	-6.9	-2.5		-2.5		-6.7	-6.7	-6.8	-6.8		-4.6	-4.5	-4.6	-4.5
59	2501-FF		1.1	0.6	1.0	0.4	1.1		0.9		1.1	1.1	0.9	0.9		0.2	0.2	0.1	0.2
61	2501-FF															-1.2	-1.1	-1.2	-1.1
62	2501-FF		-1.0	-1.7	-1.1	-1.7	1.0		0.9		-1.4	-1.4	-1.5	-1.4		-0.7	-0.6	-0.7	-0.6
63	2501-FF		1.1	1.3	1.1	1.2	0.9		0.8		1.1	1.1	1.0	1.1		0.2	0.2	0.1	0.2
64	2501-FF		0.3	0.4	0.2	0.3	1.3		1.2		0.1	0.1	0.0	0.1		0.9	1.0	0.9	1.0
65	2501-FF		0.1	0.2	0.1	0.2	0.8		0.7		0.0	0.0	-0.1	-0.1		-0.6	-0.5	-0.6	-0.5
66	2501-FF																	1.4	1.5
68	2501-FF		-7.7	-8.6	-9.5	-10.0	-2.9		-6.5		-8.4	-8.6	-10.0	-10.0		-1.1	-1.0	-1.1	-1.0
69	2501-FF		0.6	0.7	0.5	0.6	0.3		0.2		0.7	0.7	0.5	0.5		0.4	0.5	0.4	0.5
70	2501-FF		-0.6	-0.5	-0.7	-0.6	-4.0		-4.1		-0.1	-0.1	-0.2	-0.2		-1.3	-1.2	-1.3	-1.2
71	2501-FF		-3.1	-3.0	-3.1	-3.1	-3.1		-3.1		-3.1	-3.1	-3.2	-3.1		-2.0	-2.0	-2.0	-1.9
72	2501-FF		1.2	1.3	1.1	1.3	0.8		0.7		1.3	1.3	1.1	1.2		1.3	1.3	1.2	1.3
73	2501-FF															0.0	0.1	0.0	0.1
74	2501-FF		1.0	1.1	1.0	1.1	0.3		0.1		1.1	1.1	1.0	1.1		-1.9	-2.0	-1.9	-2.0
75	2501-FF		0.6	0.7	0.6	0.7	1.5		1.5		0.5	0.5	0.4	0.4		0.4	0.5	0.4	0.5
77	2501-FF		2.3	2.5	2.3	2.4	1.2		1.1		2.5	2.5	2.4	2.5		0.1	0.2	0.2	-0.1
78	2501-FF																		
80	2501-FF		-2.0	-1.9	-2.0	-1.9	-4.7		-4.7		-1.5	-1.5	-1.6	-1.6		-1.5	-1.4	-1.5	-1.4
82	2501-FF		-1.8	-2.4	-0.5	-2.7	2.7		2.7		-2.5	-2.5	-1.1	-2.8		-1.0	-0.9	-1.0	-0.9
83	2501-FF															1.2	0.4	1.1	0.4
84	2501-FF															1.2	1.3	1.2	1.3



EURL Proficiency Study on the Determination of PCDD/Fs, PCBs, PBDEs, HBCDDs and PFAS in Fish Fillet 2025 [EURL-PT-POP_2501-FF]
EURL for halogenated Persistent Organic Pollutants (POPs) in Feed and Food

Fish Fillet (2501-FF)
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
86	2501-FF		-0.7	-1.1	-0.8	-0.9	4.3		4.1		-1.7	-1.7	-1.6	-1.6		-0.7	-0.7	-0.8	-0.7
87	2501-FF		0.4	0.5	0.2	0.3	0.3		0.1		0.1	0.1	0.1	0.1					
88	2501-FF		2.7	2.7	2.6	2.7	4.7		4.4		2.4	2.4	2.2	2.3		0.9	1.0	0.9	1.0
90	2501-FF		-2.1	-2.0	-2.1	-2.0	-5.5		-5.6		-1.5	-1.5	-1.6	-1.6		-0.5	-0.4	-0.5	-0.4
92	2501-FF		-1.5	-1.4	-1.4	-1.4	-2.3		-2.3		-1.3	-1.3	-1.4	-1.4					
93	2501-FF															0.6	-0.3	0.6	-0.3
94	2501-FF		-0.7	-0.6	-0.7	-0.6	-0.8		-0.9		-0.7	-0.7	-0.8	-0.7		0.0	0.1	0.0	0.1
96	2501-FF															1.0	1.1	1.0	1.1
97	2501-FF		0.9	1.0	0.9	1.0	1.1		1.0		0.9	0.9	0.8	0.8		0.8	0.9	0.8	0.9
99	2501-FF															-0.1	0.0	-0.1	0.0
100	2501-FF															2.5	0.5	2.5	0.5
102	2501-FF		3.9	4.0	3.9	4.0	-1.8		-1.9		4.8	4.8	4.6	4.7		0.8	0.9	0.9	-4.0
34*	2501-FF						0.6		0.6										
82*	2501-FF		-0.5	-2.4	-1.9	-2.4	2.7		2.7		-1.0	-2.7	-2.6	-2.5		-1.0	-0.9	-1.0	-0.9

Fish Fillet (2501-FF)
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
			upper bound	lower bound	upper bound	lower bound											
1	2501-FF		1.9		1.7										-0.4	0.2	-0.3
2	2501-FF																
5	2501-FF		14.3		14.1				24.8		36.0		39.9	40.4	-1.8	5.9	5.5
6	2501-FF		0.9		0.8		1.6	0.8			1.1		-0.2	-0.5	-0.2	0.0	0.2
7	2501-FF		0.0		0.0		0.2	-0.4			0.4		0.9	5.6	0.3	0.6	-0.1
8	2501-FF																
9	2501-FF																
10	2501-FF		-0.5		-0.6		-1.2	0.2			-0.6		3.4	8.9	-0.3	0.2	0.0
11	2501-FF																
12	2501-FF		1.9		1.6		0.7	0.7							0.3	0.6	0.2
13	2501-FF		-1.3		-1.1		-0.8	-1.4			-0.1		-0.1	-0.4	-0.1	0.1	-0.3
15	2501-FF		-0.1		-0.2		1.1	-0.6			0.0				0.0	-1.2	-0.4
16	2501-FF		-2.1		-2.2		-1.7	-1.5			-0.1		1.2	0.3	-0.4	-0.7	-1.3
17	2501-FF		0.3		0.6		0.4	-0.2			0.2		1.1	2.5	0.4	1.0	0.3
18	2501-FF		1.9		1.8										0.1	1.9	0.2
20	2501-FF		1.1		1.0		0.0	1.2			-0.3				0.2	0.6	0.4
21	2501-FF																
22	2501-FF		9.8		9.5										2.5		2.1
23	2501-FF		-3.8		-3.9		-1.8	-2.0			-0.9		-1.9	-1.7	-2.3	0.1	-1.6
24	2501-FF		9.3		9.1										2.1	8.4	1.4
26	2501-FF		-0.7		-0.7		-0.4	-0.2			-1.0		-0.5	-0.9	-0.3	1.2	-0.7
27	2501-FF																
28	2501-FF																
30	2501-FF		6.9		6.7										-1.2	0.1	-1.0
32	2501-FF		4.3		4.1		2.2	0.8			1.1		6.2	90.3	2.8	1.2	2.2
33	2501-FF																
34	2501-FF		0.6		20.4		64.0	0.2			-0.9		-0.2	0.8	0.0	0.8	-0.4
35	2501-FF																
37	2501-FF		-0.4		-0.5		0.0	0.0			-0.8		-1.6		-0.3	3.1	-0.3
38	2501-FF																
39	2501-FF		0.6		0.5		-0.5	0.2			-0.1		0.7	1.1	0.7	-0.2	0.7
41	2501-FF		-0.1		-0.2		0.1	-1.0			-0.1		-3.4	0.7	0.1	0.9	0.2
42	2501-FF		1.1		1.0		0.5	0.6			0.7		-0.9	-0.9	0.8	1.1	0.6
44	2501-FF																
45	2501-FF																
46	2501-FF		-0.7		-0.8		-0.7	0.4			-0.8		-0.6	-2.1	-0.5	-0.4	-0.3
47	2501-FF		-0.5		-0.4		-1.0								-1.3	0.2	-0.4
48	2501-FF																
49	2501-FF																
50	2501-FF		0.4		0.3		-0.1	0.3			0.7				-0.3	3.9	0.3
51	2501-FF		1.3		1.2		0.6	0.5			0.7		-1.0	1.3	0.9	0.4	0.8
52	2501-FF																
54	2501-FF		-4.0		-4.1		-1.3	-1.6			-2.3		-1.4	-0.5	-2.7	0.8	-2.2
56	2501-FF																
57	2501-FF		-4.6		-4.6		-1.0				0.1		-1.4	-0.7	-2.7	-2.1	-1.8
58	2501-FF		-2.5		-2.5										-3.2		-3.3
59	2501-FF		1.1		0.9								1.0	2.1	-0.8	-0.5	0.2
61	2501-FF																
62	2501-FF		1.0		0.9								1.0	1.5	-0.2	-2.1	-0.7
63	2501-FF		0.9		0.8		0.4	0.7			-0.1		0.2	-0.1	0.4	0.3	0.7
64	2501-FF		1.3		1.2		0.0	1.3			2.2		0.9	0.9	0.3	0.5	0.8
65	2501-FF		0.8		0.7		-0.3	0.2			0.1		-0.3	-1.2	0.9	-0.1	0.5
66	2501-FF																
68	2501-FF		-2.9		-6.5									-5.0	-4.8		
69	2501-FF		0.3		0.2		-0.8	-0.1			-0.6		0.3		0.4	-1.0	0.6
70	2501-FF		-4.0		-4.1		-2.2	-2.9			-0.4		1.0	4.2	-2.0	11.2	-2.1
71	2501-FF		-3.1		-3.1		-1.9	-1.4			-1.2		-1.9	-1.9	-1.2	-0.9	-1.8
72	2501-FF		0.8		0.7		0.5	0.1			0.1		-0.3	-1.4	0.7	-0.7	0.6
73	2501-FF																
74	2501-FF		0.3		0.1		-0.8	0.5			0.8		1.6	1.0	0.5	0.2	0.0
75	2501-FF		1.5		1.5		1.2	-1.1			3.6		2.7	-2.0	0.9	0.1	1.5
77	2501-FF		1.2		1.1		0.6	-1.6			3.1		9.4		1.3	-1.5	1.0
78	2501-FF																
80	2501-FF		-4.7		-4.7		-2.6	-1.9			-2.3		-1.5	-1.3	-2.7	-1.9	-2.1
82	2501-FF		2.7		2.7									0.8	1.4	2.7	0.3
83	2501-FF																
84	2501-FF																
86	2501-FF		4.3		4.1		3.6	2.4			3.1				0.8	0.0	0.9
87	2501-FF		0.3		0.1		0.6	0.4			0.0		-0.7	0.1	0.2	-0.3	-0.3
88	2501-FF		4.7		4.4			12.1					9.4	19.6	0.2	3.7	2.1

Fish Fillet (2501-FF)
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
			upper bound	lower bound	upper bound	lower bound											
90	2501-FF		-5.5		-5.6			-2.8	-2.3		-2.0		-1.1	-1.7	-3.2	-1.6	-2.5
92	2501-FF		-2.3		-2.3			1.3			-1.6		-0.4	2.5	-0.8	1.0	-0.7
93	2501-FF																
94	2501-FF		-0.8		-0.9			0.4	-0.1		-1.4		0.9	0.0	-0.7	-0.2	-0.4
96	2501-FF																
97	2501-FF		1.1		1.0			-0.5	0.9		-0.8		-0.7	6.1	0.8	4.1	0.7
99	2501-FF																
100	2501-FF																
102	2501-FF		-1.8		-1.9			-1.3	-0.6		-2.2		-2.4		-0.7	-0.9	-1.4
34*	2501-FF		0.6		0.6			1.9	0.2		-0.9		-0.2	0.8	0.0	0.8	-0.4
82*	2501-FF		2.7		2.7									0.8	1.4	2.7	0.3

Fish Fillet (2501-FF)
Dioxin-like PCB - Z-scores

LC	Sample	Z-score [σ _p = 10 %]	WHO-PCB-TEQ reported		WHO-PCB-TEQ calculated		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
			upper bound	lower bound	upper bound	lower bound													
1	2501-FF		-0.1	-0.1	-0.2	-0.2		-0.1	-0.7	-0.4		0.4	-0.5	0.6	-0.7	0.2	0.3	-0.1	0.5
2	2501-FF																		
5	2501-FF		-6.4	-6.5	-6.5	-6.5		-4.1		-4.2		-4.3	-4.3		-4.4	-4.2		-3.0	
6	2501-FF		1.0	1.0	0.9	0.9		1.0	1.9	0.8		0.7	0.7	1.0	0.9	1.5		0.4	1.2
7	2501-FF		1.0	1.0	0.9	0.9		0.2	0.3	0.0		0.0	1.3	0.1	0.5	0.6	0.5	0.5	1.1
8	2501-FF																		
9	2501-FF																		
10	2501-FF		0.6	0.6	0.5	0.5		0.0	0.0	-0.1		-0.6	1.3	0.2	-0.1	0.6	0.1	0.4	-0.2
11	2501-FF																		
12	2501-FF		-0.1	-0.1	-0.2	-0.1		0.3	-0.6	0.1		0.1	0.0	0.0	0.2	0.2	-0.2	-0.1	-0.1
13	2501-FF		-1.3	-1.3	-1.4	-1.4		-0.6	-1.4	-0.9		-0.4	-0.7	-0.1	-0.8	-0.9	-0.4	-0.7	-0.5
15	2501-FF		1.0	1.0	0.9	0.9		0.1	-0.4	0.1		0.1	0.3	0.9	0.2	0.3	0.1	0.6	0.2
16	2501-FF		0.4	0.4	0.2	0.2		-0.1	1.6	0.1		0.5	0.8	0.7	-0.2	-0.6	-0.3	0.1	0.2
17	2501-FF		1.9	1.9	1.8	1.8		1.4	1.9	1.6		0.5	0.3	0.5	0.4	2.5	4.5	0.8	1.1
18	2501-FF		0.8	0.8	0.7	0.8		0.2	-0.4	-0.3		0.0	0.2	0.1	0.2	0.4		0.5	0.9
20	2501-FF		-0.6	-0.6	-0.6	-0.6		-0.6	-0.7	-1.1		-0.4	-0.3	-0.5	-0.4	-0.3	-1.8	-0.2	-0.2
21	2501-FF																		
22	2501-FF		6.7	6.1	6.3	5.9		6.8	1.0	0.5		0.4	0.2	0.1	0.3	0.4	51.3	3.5	
23	2501-FF		1.5	1.5	1.4	1.4		1.1	1.8	1.1		1.1	2.9	2.2	2.9	0.0	-0.5	0.7	0.2
24	2501-FF		3.9	3.9	3.7	3.8		1.8	8.8	2.3		1.2	2.9	4.9	1.2	0.3	1.2	1.8	3.4
26	2501-FF		-0.1	-0.1	-0.2	-0.2		0.0	0.7	0.9		0.1	0.0	-0.5	0.0	0.4	0.2	-0.2	0.1
27	2501-FF																		
28	2501-FF																		
30	2501-FF		1.1	1.1	1.0	1.0		-0.7	-0.8	0.4		-0.4	-1.9	-1.0	-1.1	-1.4		0.7	-1.8
32	2501-FF		-0.1	-0.1	-0.1	-0.1		-0.6	0.9	0.0		0.4	0.7	0.4	0.4	0.2	0.9	0.0	-0.1
33	2501-FF																		
34	2501-FF																		
35	2501-FF																		
37	2501-FF		-1.1	-1.1	-1.2	-1.2		-0.2	0.5	-0.9		-0.3	0.2	-0.8	-0.4	-0.4	-0.1	-0.6	-0.5
38	2501-FF																		
39	2501-FF		1.1	1.1	0.9	1.0		1.5	0.9	1.2		1.3	0.7	1.1	0.7	0.7	-0.3	0.5	-1.3
41	2501-FF		-2.2	-2.2	-2.3	-2.2		1.3	1.6	0.9		1.7	1.5	1.3	1.1	-2.1	-1.5	-1.4	-2.4
42	2501-FF		0.1	0.1	-0.1	0.0		0.4	-0.6	0.4		0.5	0.9	0.4	0.1	-0.1	0.2	-0.1	0.5
44	2501-FF							-1.0	-0.7	-0.4		-0.9	-0.1	-0.6	-0.5				
45	2501-FF																		
46	2501-FF		0.8	0.8	0.6	0.7		0.1	-0.8	-0.5		-0.1	-0.8	0.3	0.3	0.6	0.5	0.4	1.0
47	2501-FF		-2.1	-2.1	-2.2	-2.2		-0.4	0.3	-1.0		-0.7	-1.0	-1.0	2.0	-1.0	-1.3	-1.1	-1.4
48	2501-FF																		
49	2501-FF									0.8									
50	2501-FF		-1.1	-1.1	-1.2	-1.2		0.7	3.7	0.1		-0.3	-0.1	-0.3	-0.6	1.1	1.7	-0.7	-1.0
51	2501-FF		0.1	0.1	0.0	0.1		-0.7	-0.3	-0.9		-1.1	-0.6	-1.0	-0.5	0.0	0.1	0.2	0.8
52	2501-FF																		
54	2501-FF		-1.4	-1.4	-1.5	-1.5		-0.6	-1.2	-0.6		-0.2	-0.5	-0.7	-0.3	-1.2	-0.6	-0.8	0.2
56	2501-FF																		
57	2501-FF		-1.1	-1.1	-1.2	-1.2		-0.9	0.4	-0.5		0.0	-0.3	-0.2	-0.7	-0.9	-0.5	-0.6	-0.2
58	2501-FF		-6.7	-6.7	-6.8	-6.8		-3.4	-3.5	-3.5		-3.6	-3.5	-3.5	-3.7	-3.1	-2.6	-3.4	-3.4
59	2501-FF		1.1	1.1	0.9	0.9		0.3	-0.4	-0.3		-0.5	-0.6	-0.8	1.0	0.4	-0.1	0.6	-0.7
61	2501-FF									-5.0									
62	2501-FF		-1.4	-1.4	-1.5	-1.4		-0.6	-2.4	-0.9		-0.8	-0.6	-0.7	-1.7	-1.7	-1.8	-0.7	-1.0
63	2501-FF		1.1	1.1	1.0	1.1		-0.2	0.6	0.9		-0.1	0.3	-0.5	0.1	0.6	-0.8	0.6	-0.2
64	2501-FF		0.1	0.1	0.0	0.1		-0.1	4.6	-0.2		0.2	0.5	0.9	0.8	0.7	0.6	0.0	0.5
65	2501-FF		0.0	0.0	-0.1	-0.1		0.4	0.8	0.0		0.2	0.0	0.1	0.3	-0.3	-0.1	0.0	0.4
66	2501-FF																		
68	2501-FF		-8.4	-8.6	-10.0	-10.0		-5.0	-5.0	-5.0		-5.0	-5.0	-5.0	-5.0	-5.0			-4.9
69	2501-FF		0.7	0.7	0.5	0.5		0.4	0.6	0.7		0.6	0.9	0.3	0.0	0.2	1.6	0.2	0.2
70	2501-FF		-0.1	-0.1	-0.2	-0.2		-1.1	4.5	-1.1		-1.1	-1.5	-0.1	-0.8	-0.8	0.3	0.1	-0.1
71	2501-FF		-3.1	-3.1	-3.2	-3.1		-1.6	-1.8	-1.9		-1.5	-1.4	-1.7	-1.5	-0.8	-0.8	-1.6	-0.6
72	2501-FF		1.3	1.3	1.1	1.2		-0.5		0.3		0.2	0.4	0.0	0.6	0.2	0.8	0.7	0.8
73	2501-FF																		
74	2501-FF		1.1	1.1	1.0	1.1		0.0	-0.6	-0.4		0.1	0.5	0.5	0.0	1.1	49.2	0.0	17.4
75	2501-FF		0.5	0.5	0.4	0.4		0.8	8.4	0.5		0.4	0.3	0.3	0.3	0.5	1.1	0.1	1.6
77	2501-FF		2.5	2.5	2.4	2.5		1.4	2.3	1.8		0.5	2.1	1.6	0.5	0.8	0.7	1.2	2.1
78	2501-FF																		
80	2501-FF		-1.5	-1.5	-1.6	-1.6		-1.0	-0.4	-0.6		-0.4	-0.7	-0.2	-0.2	-1.6	-1.1	-0.8	-0.1
82	2501-FF		-2.5	-2.5	-1.1	-2.8		-0.8	-0.5	-1.0		-1.3	-0.7	-1.8	-0.7	-1.7		-1.3	
83	2501-FF																		
84	2501-FF																		

LC	Sample	Z-score [C _p = 10 %]	WHO-PCB-TEQ reported		WHO-PCB-TEQ calculated		Z-score [C _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
			upper bound	lower bound	upper bound	lower bound													
86	2501-FF		-1.7	-1.7	-1.6	-1.6		-0.1	-1.7	-1.3		-0.2	-0.4	-0.6	-0.3	0.3	0.2	-0.8	-0.1
87	2501-FF		0.1	0.1	0.1	0.1		0.5	1.1	-0.1		0.6	0.1	-0.5	-0.4	0.2	-0.1	0.1	-0.1
88	2501-FF		2.4	2.4	2.2	2.3		1.3	1.1	0.8		1.2	1.6	1.1	0.9	1.4	2.1	1.1	3.4
90	2501-FF		-1.5	-1.5	-1.6	-1.6		-1.1	-1.4	-0.8		-0.5	-0.8	0.0	-0.3	-1.3	-0.2	-0.8	-0.5
92	2501-FF		-1.3	-1.3	-1.4	-1.4		0.0	-0.6	0.3		-0.3	-0.2	-0.2	0.0	-0.5		-0.6	
93	2501-FF																		
94	2501-FF		-0.7	-0.7	-0.8	-0.7		0.0	-0.8	0.0		-0.1	-0.6	-0.5	0.1	0.1	-0.6	-0.4	-0.1
96	2501-FF																		
97	2501-FF		0.9	0.9	0.8	0.8		-0.3	1.5	0.1		-0.3	-0.5	-0.4	-0.3	0.9	1.6	0.5	0.8
99	2501-FF																		
100	2501-FF																		
102	2501-FF		4.8	4.8	4.6	4.7		-0.3	-0.8	0.6		0.2	0.0	0.3	0.2	0.0	3.3	2.8	-1.5
82*	2501-FF		-1.0	-2.7	-2.6	-2.5		-0.8	-0.5	-1.0		-1.3	-0.7	-1.8	-0.7	-1.7	-1.7	-1.3	-0.8

Fish Fillet (2501-FF)
Non dioxin-like PCB - Z-scores

LC	Sample	Z-score	Sum Indicator PCBs reported		Sum Indicator PCBs calculated		Z-score	PCB 28	PCB 52	PCB 101	PCB 138	PCB 153	PCB 180
		[σ _p = 15 %]	upper bound	lower bound	upper bound	lower bound							
1	2501-FF			0.0	0.1	0.0	0.1	-1.4	-1.4	0.1	-0.3	0.5	-0.3
2	2501-FF			1.2	1.2	1.2	1.3	-0.5	0.4	0.8	1.4	0.6	1.3
5	2501-FF			-5.5	-5.5	-5.5	-5.5	-3.3	-3.6	-4.0	-3.9	-4.2	-4.3
6	2501-FF			1.5	1.6	1.5	1.6	1.5	0.9	0.9	0.9	1.5	1.3
7	2501-FF			-0.4	-0.3	-0.4	-0.3	-0.6	-0.2	-0.3	-0.5	-0.1	-0.3
8	2501-FF			-2.5	-2.8	-2.5	-2.8			-2.6	-1.2	-2.1	-2.2
9	2501-FF			1.6	1.0	1.6	1.0			0.8	2.3	0.6	0.5
10	2501-FF			-0.6	-0.5	-0.6	-0.5	0.3	0.2	-0.1	-0.7	-0.3	-0.5
11	2501-FF			-2.7	-2.6	-2.7	-2.6	2.5	-1.9	-1.9	-2.3	-2.1	-1.7
12	2501-FF			1	1	0	1	0.3	0.5	0.3	0	1	0.7
13	2501-FF			-1.4	-1.4	-1.4	-1.4	-0.8	-0.7	-1.0	-1.2	-1.1	-0.7
15	2501-FF			0.4	0.4	0.3	0.4	0.9	0.8	0.2	0.3	0.3	0.2
16	2501-FF			1	1.0	1	1.0	2.8	0.1	0.1	-0.1	1.5	0.7
17	2501-FF			0.8	0.9	0.8	0.9	3.1	3.0	1.2	0.3	0.5	0.0
18	2501-FF			-0.1	0.0	-0.1	0.0	0.4	0.1	0.2	-0.1	-0.1	0.0
20	2501-FF			-3.8	-3.8	-3.8	-3.8	-2.1	-3.3	-3.4	-2.4	-2.7	-3.5
21	2501-FF			-0.4	-0.5	-0.5	-0.5		-1.3	-2.1	0.9	-0.4	-0.5
22	2501-FF			0.6	0.7	0.6	0.7	2.6	1.2	1.0	4.5	-1.2	-2.6
23	2501-FF			0.3	0.4	0.3	0.4	0.0	0.5	-0.1	0.1	0.0	1.3
24	2501-FF			-1.0	-0.9	-1.0	-0.9	-2.9	-2.0	1.1	0.4	-2.9	2.0
26	2501-FF			0.4	0.4	0.4	0.5	0.1	0.6	0.3	0.1	0.3	0.5
27	2501-FF			-3.6	-3.5	-3.6	-3.5	-2.6	-2.5	-2.9	-2.2	-2.8	-3.0
28	2501-FF			-0.1	0.0	-0.1	0.0	0.1	0.4	-0.3	-0.2	0.1	0.0
30	2501-FF			-1.5	-2.2	-1.6	-2.2			-0.1	-0.8	-2.9	-0.2
32	2501-FF			-1.3	-1.2	-1.3	-1.2	-0.4	-0.1	0.0	-1.0	-1.7	-0.2
33	2501-FF			-1.3	-1.4	-1.3	-1.4		-0.2	-1.2	-1.0	-0.9	-1.3
34	2501-FF												
35	2501-FF			-1	-1.0	-1.1	-1.1		-0.8	-0.9	-0.8	-0.7	-1.1
37	2501-FF			0.5	0.6	0.5	0.6	-0.1	0.2	-0.5	0.0	1.4	-0.4
38	2501-FF			0.2	0.2	0.1	0.2	0.1	0.3	0.4	1.0	-0.2	-0.8
39	2501-FF			1.6	1.7	1.6	1.7	0.0	0.3	1.1	0.9	1.6	1.2
41	2501-FF			1	1	1	1	6.9	1.6	2.1	2.4	-1.0	2.0
42	2501-FF			0.4	0.5	0.3	0.4	0.0	0.1	0.4	0.5	0.0	0.6
44	2501-FF			0.0	0.1	0.0	0.1	-1.5	-0.8	-0.5	0.0	0.3	0.1
45	2501-FF			-3.2	-5.2	-3.2	-5.2				-3.1	-3.5	
46	2501-FF			-0.1	0.0	-0.1	0.0	0.0	0.5	-0.2	-0.1	-0.2	0.4
47	2501-FF			-1.6	-1.5	-1.6	-1.5	2.2	-0.8	-0.9	-1.3	-1.3	-1.2
48	2501-FF			1.7	1.6	0.7	0.6		-0.4	0.3	0.4	0.8	0.5
49	2501-FF			1.5	0.9	1.6	1.0			0.8	0.5	1.5	0.8
50	2501-FF			0.3	-0.3	0.3	-0.3			0.9	-0.5	0.0	-0.1
51	2501-FF			-0.3	-0.2	-0.3	-0.2	-1.0	-0.6	-0.7	0.2	0.0	-0.6
52	2501-FF			0.9	0.8	0.9	0.8		1.3	0.8	0.4	0.8	0.5
54	2501-FF												
56	2501-FF			0.9	0.9	0.8	0.9	0.4	0.0	0.2	1.0	0.9	0.2
57	2501-FF			-1.0	-1.0	-1.0	-1.0	-1.3	-0.8	-1.1	-0.8	-0.6	-0.5
58	2501-FF			-4.6	-4.5	-4.6	-4.5	-2.6	-2.8	-3.4	-3.3	-3.5	-3.6
59	2501-FF			0.2	0.2	0.1	0.2	1.1	0.7	0.1	-0.3	0.0	1.1
61	2501-FF			-1.2	-1.1	-1.2	-1.1	-1.7	-1.2	-1.0	-0.7	-0.8	-1.1
62	2501-FF			-0.7	-0.6	-0.7	-0.6	-1.6	-0.7	-0.8	-0.7	0.2	-1.3
63	2501-FF			0.2	0.2	0.1	0.2	-0.2	1.0	1.8	0.5	-1.5	1.9
64	2501-FF			0.9	1.0	0.9	1.0	0.8	0.7	0.4	2.1	0.2	0.0
65	2501-FF			-0.6	-0.5	-0.6	-0.5	0.2	0.2	-0.2	-0.7	-0.5	-0.2
66	2501-FF					1.4	1.5	4.9	1.6	0.2	1.4	1.3	0.6
68	2501-FF			-1.1	-1.0	-1.1	-1.0	2.3	0.1	0.0	0.4	-2.3	0.0
69	2501-FF			0.4	0.5	0.4	0.5	-0.6	0.2	0.1	0.9	0.2	0.0
70	2501-FF			-1.3	-1.2	-1.3	-1.2	0.0	0.0	-0.4	-1.0	-1.4	-0.7
71	2501-FF			-2.0	-2.0	-2.0	-1.9	-1.9	-1.6	-1.5	-1.9	-1.2	-1.6
72	2501-FF			1.3	1.3	1.2	1.3	0.3	0.3	1.0	0.7	1.5	0.3
73	2501-FF			0.0	0.1	0.0	0.1	-2.2	-1.5	-0.3	0.2	0.2	0.1
74	2501-FF			-1.9	-2.0	-1.9	-2.0		-0.5	-1.3	-1.4	-1.4	-2.0
75	2501-FF			0.4	0.5	0.4	0.5	0.6	0.4	0.2	0.2	0.5	0.0
77	2501-FF			0.1	0.2	0.2	-0.1			-0.2	-0.2	0.5	0.3
78	2501-FF												
80	2501-FF			-1.5	-1.4	-1.5	-1.4	-2.6	-1.9	-1.2	-1.2	-0.9	-1.0
82	2501-FF			-1.0	-0.9	-1.0	-0.9	3.9	-0.4	-0.5	-0.4	-1.0	-1.4
83	2501-FF			1.2	0.4	1.1	0.4			-2.6	3.1	0.2	0.1
84	2501-FF			1.2	1.3	1.2	1.3	-0.1	0.5	0.3	1.0	0.9	1.6

Fish Fillet (2501-FF)
Non dioxin-like PCB - Z-scores

LC	Sample	Z-score [σ _p = 15 %]	Sum Indicator PCBs reported		Sum Indicator PCBs calculated		Z-score [σ _p = 20 %]	PCB 28	PCB 52	PCB 101	PCB 138	PCB 153	PCB 180
			upper bound	lower bound	upper bound	lower bound							
86	2501-FF		-0.7	-0.7	-0.8	-0.7		0.0	-0.5	-0.4	-0.8	-0.5	-0.6
87	2501-FF												
88	2501-FF		0.9	1.0	0.9	1.0		0.5	0.6	0.9	0.7	0.6	0.8
90	2501-FF		-0.5	-0.4	-0.5	-0.4		-1.7	-0.5	0.0	-0.5	-0.3	-0.3
92	2501-FF												
93	2501-FF		0.6	-0.3	0.6	-0.3				-0.5	1.6	-0.5	-1.0
94	2501-FF		0.0	0.1	0.0	0.1		-0.9	0.0	0.1	-0.1	0.0	0.5
96	2501-FF		1.0	1.1	1.0	1.1		1.3	1.2	0.7	1.2	0.7	0.4
97	2501-FF		0.8	0.9	0.8	0.9		1.0	0.8	0.6	0.1	0.9	0.9
99	2501-FF		-0.1	0.0	-0.1	0.0		-1.1	-0.6	-0.5	0.2	0.1	-0.3
100	2501-FF		2.5	0.5	2.5	0.5				0.8	1.1	0.5	0.3
102	2501-FF		0.8	0.9	0.9	-4.0		0.4	0.7	0.5			0.7



EURL Proficiency Study on the Determination of PCDD/Fs, PCBs, PBDEs, HBCDDs and PFAS in Fish Fillet 2025 [EURL-PT-POP_2501-FF]
EURL for halogenated Persistent Organic Pollutants (POPs) in Feed and Food

Fish Fillet (2501-FF)
Bioanalytical screening methods - Bioassay-scores

LC	Sample	Bioassay-score [σ _{bioassay} = 20 %]	PCDD/F + DL-PCB	PCDD/F	DL-PCB
10	2501-FF		-2.6		
16	2501-FF		0.8	3.8	0.0
21	2501-FF		-1.3		
37	2501-FF		-2.7		
78	2501-FF		0.3		

Fish Fillet (2501-FF)
Lipid content - Z-scores

LC	Sample	Z-score [σ _p = 10 %]	Lipid content	Lipid content	Lipid content
			Physico-chemical methods	Bioanalytical methods	Mean
1	2501-FF		8.1		8.1
2	2501-FF		8.3		8.3
5	2501-FF		6.3		6.3
6	2501-FF		1.6		1.6
7	2501-FF		-0.4		-0.4
8	2501-FF				
9	2501-FF				
10	2501-FF		0.3	0.3	0.3
11	2501-FF		0.0		0.0
12	2501-FF				
13	2501-FF		-1.1		-1.1
15	2501-FF		-5.8		-5.8
16	2501-FF		0.0	0.0	0.0
17	2501-FF		-0.2		-0.2
18	2501-FF		47.2		47.2
20	2501-FF				
21	2501-FF		1.1	1.1	1.1
22	2501-FF				
23	2501-FF				
24	2501-FF				
26	2501-FF		0.5		0.5
27	2501-FF				
28	2501-FF		0.1		0.1
30	2501-FF		0.1		0.1
32	2501-FF		9.2		9.2
33	2501-FF		-2.2		-2.2
34	2501-FF				
35	2501-FF		-2.2		-2.2
37	2501-FF		0.1	0.1	0.1
38	2501-FF		0.9		0.9
39	2501-FF		-2.4		-2.4
41	2501-FF		2.1		2.1
42	2501-FF		1.3		1.3
44	2501-FF				
45	2501-FF				
46	2501-FF				
47	2501-FF		-4.4		-4.4
48	2501-FF		-0.5		-0.5
49	2501-FF		0.5		0.5
50	2501-FF		0.0		0.0
51	2501-FF		-2.0		-2.0
52	2501-FF		0.8		0.8
54	2501-FF		0.3		0.3
56	2501-FF		0.3		0.3
57	2501-FF		-0.1		-0.1
58	2501-FF		-4.2		-4.2
59	2501-FF				
61	2501-FF		0.1		0.1
62	2501-FF				
63	2501-FF		0.7		0.7
64	2501-FF		0.9		0.9
65	2501-FF		0.1		0.1
66	2501-FF				
68	2501-FF		0.0		0.0
69	2501-FF		1.4		1.4
70	2501-FF				
71	2501-FF		-2.8		-2.8
72	2501-FF		0.2		0.2
73	2501-FF		0.1		0.1
74	2501-FF				
75	2501-FF		1.1		1.1
77	2501-FF		1.3		1.3
78	2501-FF			1.4	1.4
80	2501-FF		0.1		0.1
82	2501-FF		-1.8		-1.8
83	2501-FF		-3.1		-3.1
84	2501-FF		0.5		0.5
86	2501-FF				
87	2501-FF		0.1		0.1
88	2501-FF				



EURL Proficiency Study on the Determination of PCDD/Fs, PCBs, PBDEs, HBCDDs and PFAS in Fish Fillet 2025 [EURL-PT-POP_2501-FF]
EURL for halogenated Persistent Organic Pollutants (POPs) in Feed and Food

Fish Fillet (2501-FF)
Lipid content - Z-scores

LC	Sample	Z-score [σ _p = 10 %]	Lipid content	Lipid content	Lipid content
			Physico-chemical methods	Bioanalytical methods	Mean
90	2501-FF		0.0		0.0
92	2501-FF		-0.7		-0.7
93	2501-FF				
94	2501-FF		-0.2		-0.2
96	2501-FF				
97	2501-FF		0.9		0.9
99	2501-FF		-0.2		-0.2
100	2501-FF				
102	2501-FF				

**EURL Proficiency Study on the Determination of PCDD/Fs, PCBs, PBDEs, HBCDDs and PFAS in Fish Fillet 2025 [EURL-PT-POP_2501-FF]**

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

28 January 2026

Annex 4: Participants' z-scores of PCDD/Fs and PCBs - Charts**Test sample - Fish Fillet (2501-FF)****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

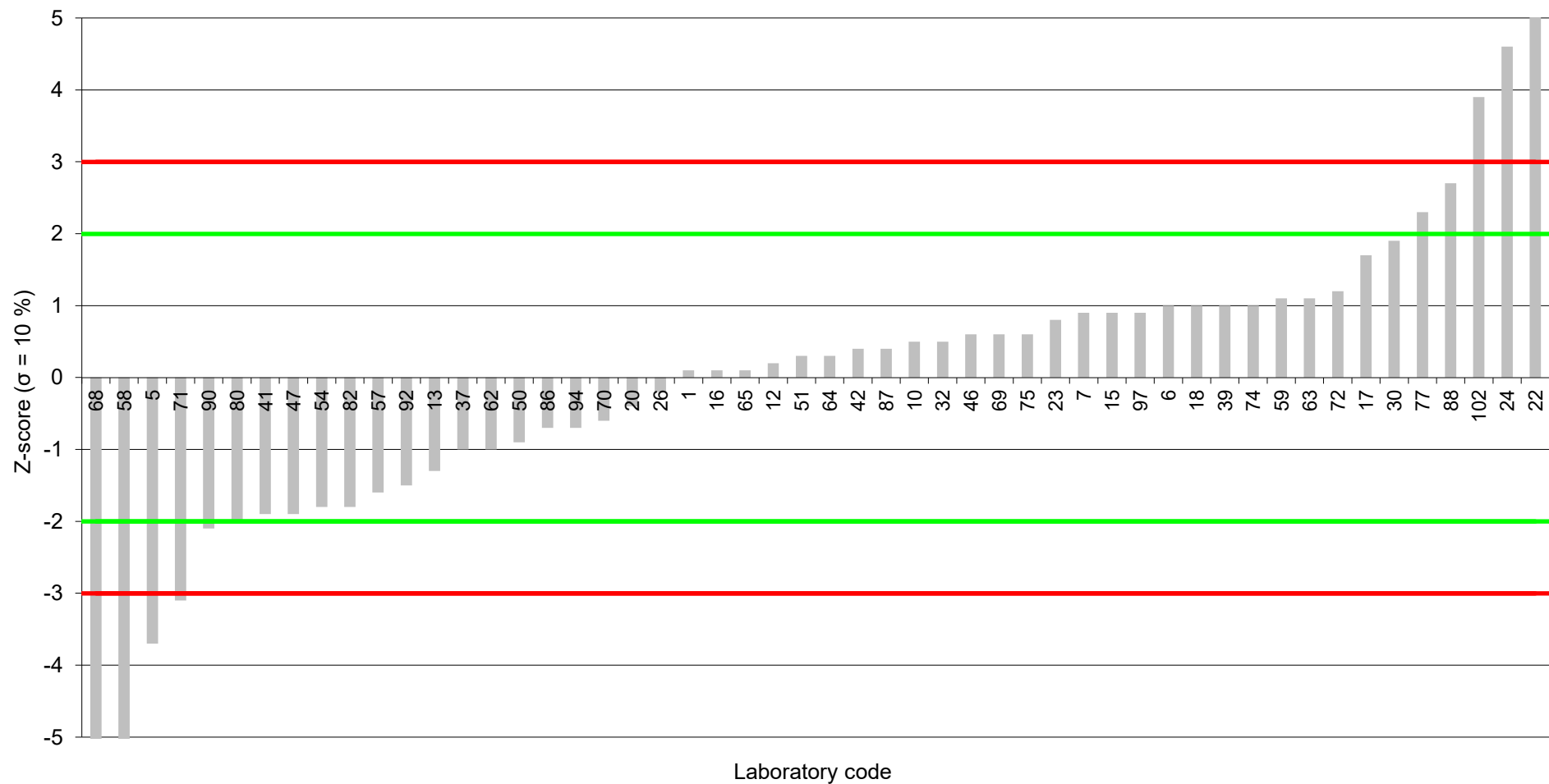
10%: WHO-PCDD/F-TEQ, WHO-PCB-TEQ and WHO-PCDD/F-PCB-TEQ

15%: Sum of six indicator PCBs (PCB 28, 52, 101, 138, 153, 180)

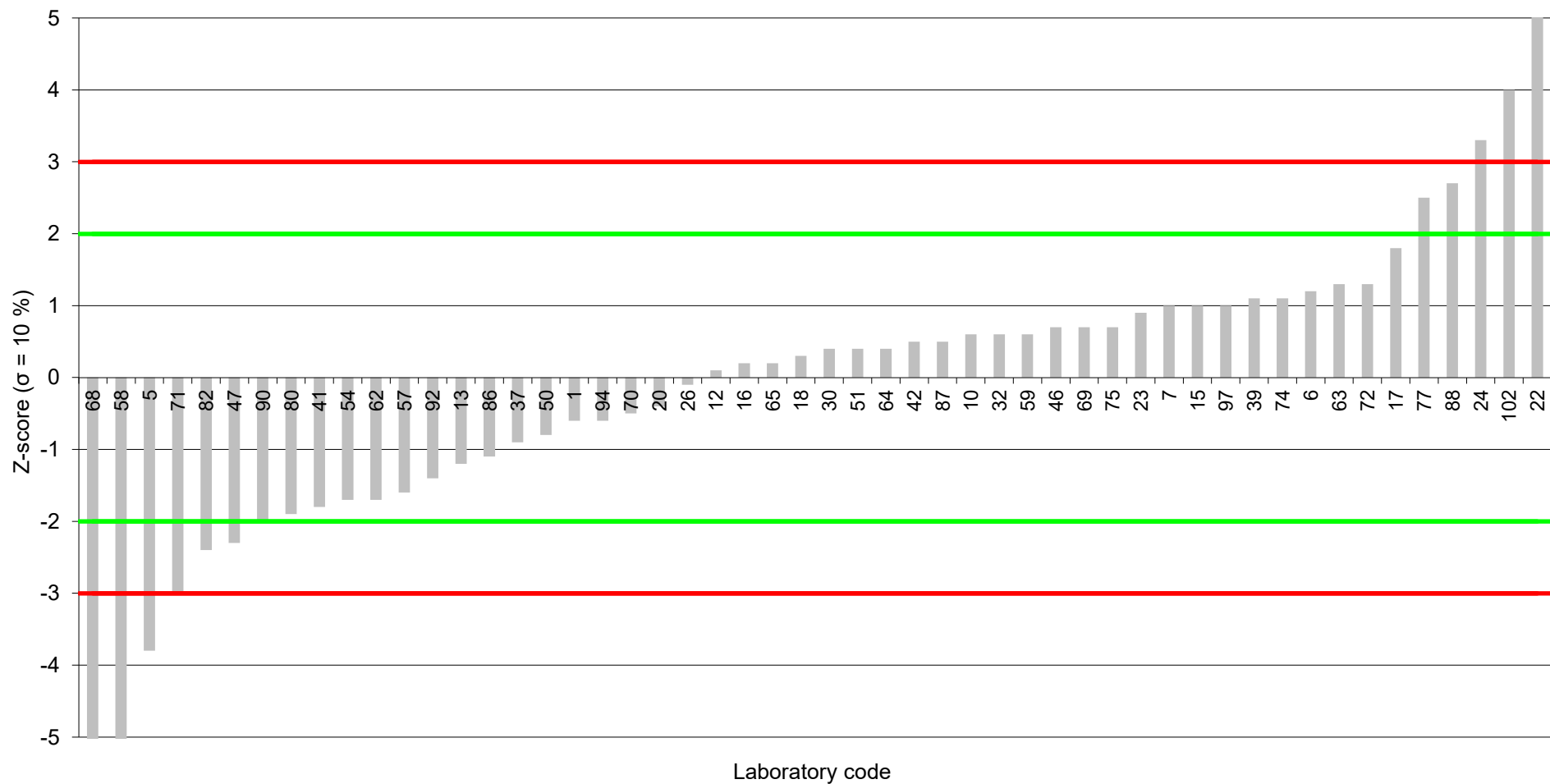
20%: Evaluated individual PCDD/F and PCB congeners

 ± 2 z-scores: ——— ± 3 z-scores: ———

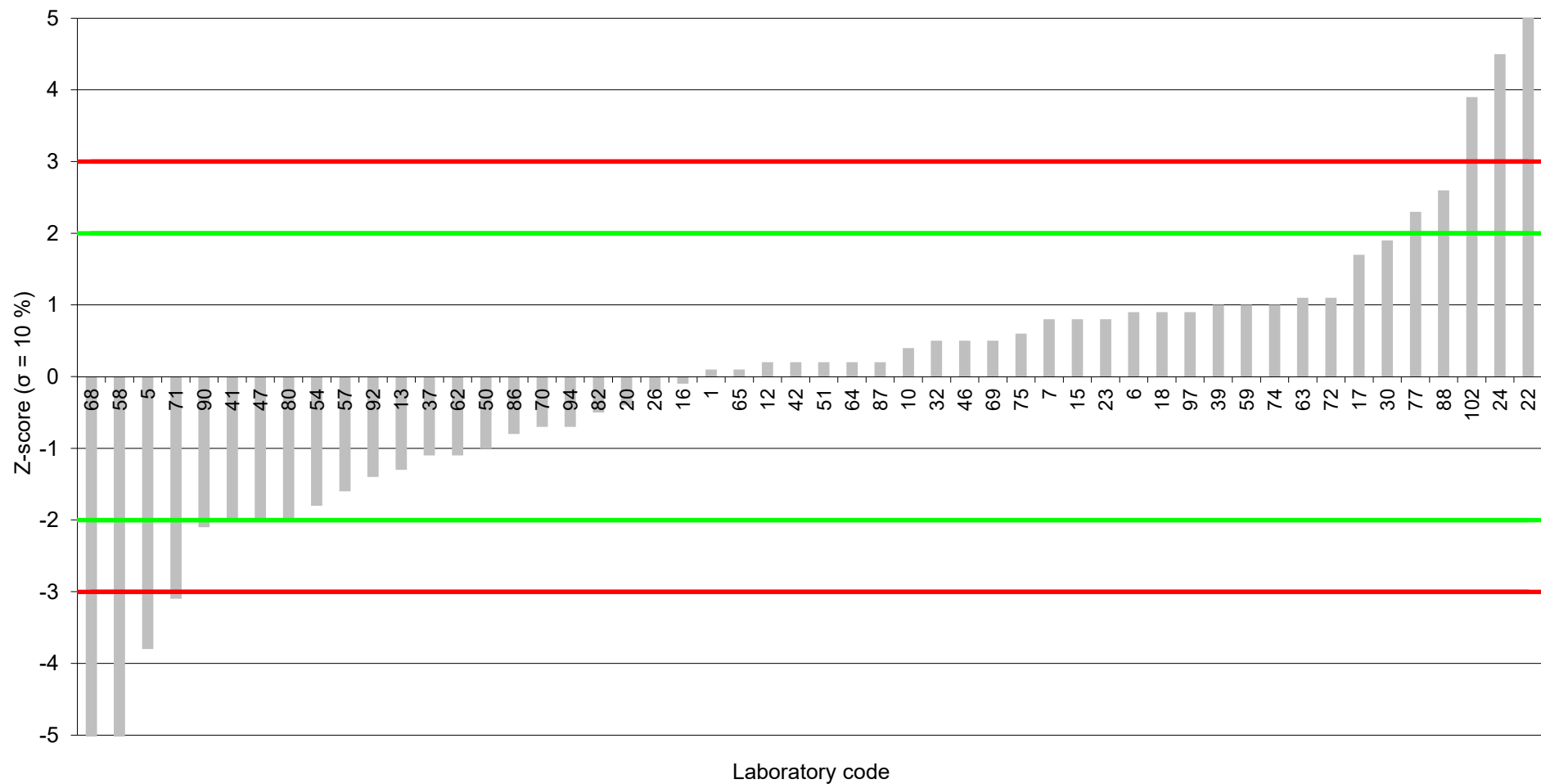
Fish Fillet (2501-FF)
WHO-PCDD/F-PCB-TEQ upper bound (reported)
Assigned value: 1.93 pg/g wet weight



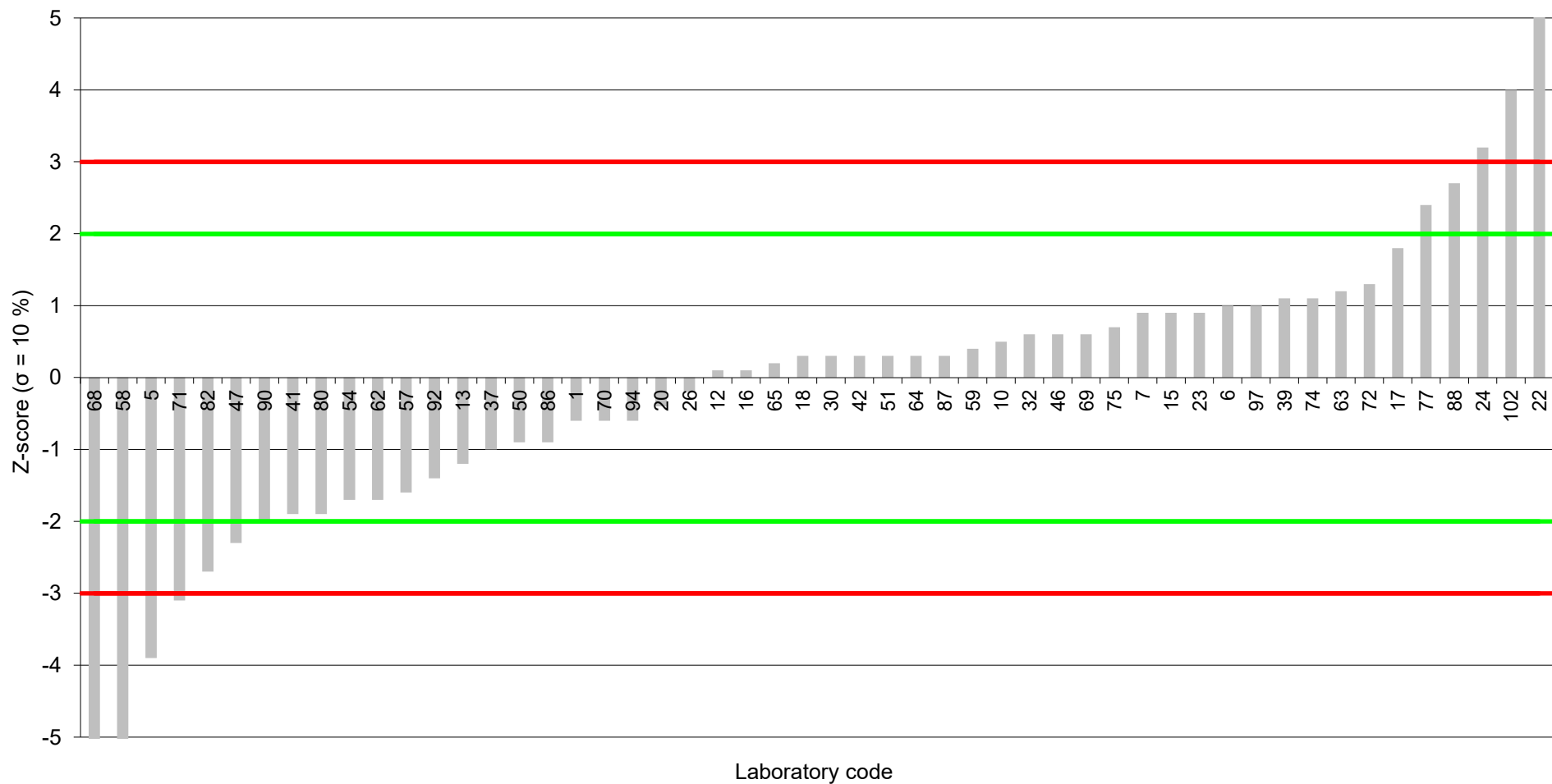
Fish Fillet (2501-FF)
WHO-PCDD/F-PCB-TEQ lower bound (reported)
 Assigned value: 1.91 pg/g wet weight



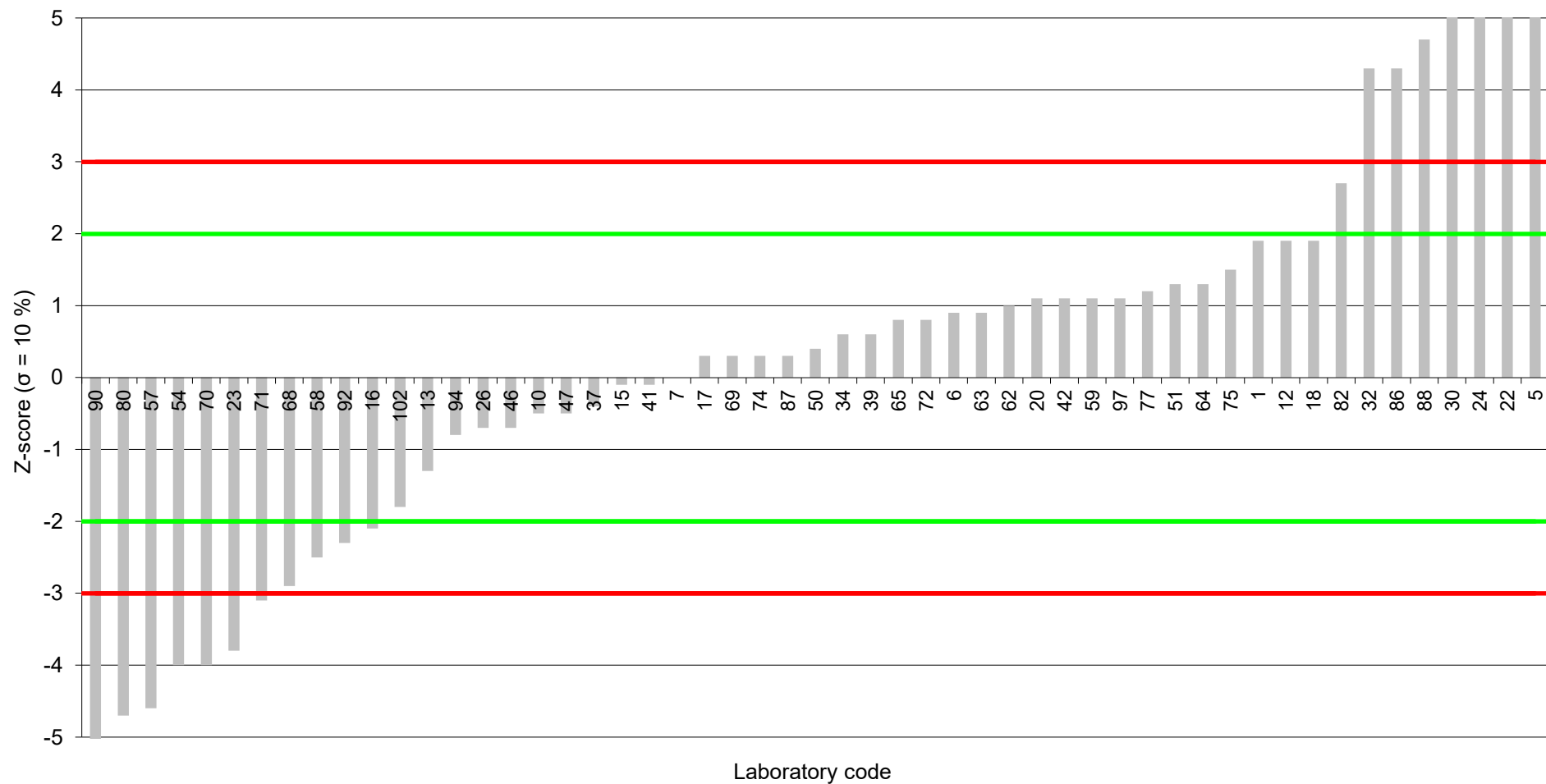
Fish Fillet (2501-FF)
WHO-PCDD/F-PCB-TEQ upper bound (calculated)
Assigned value: 1.94 pg/g wet weight



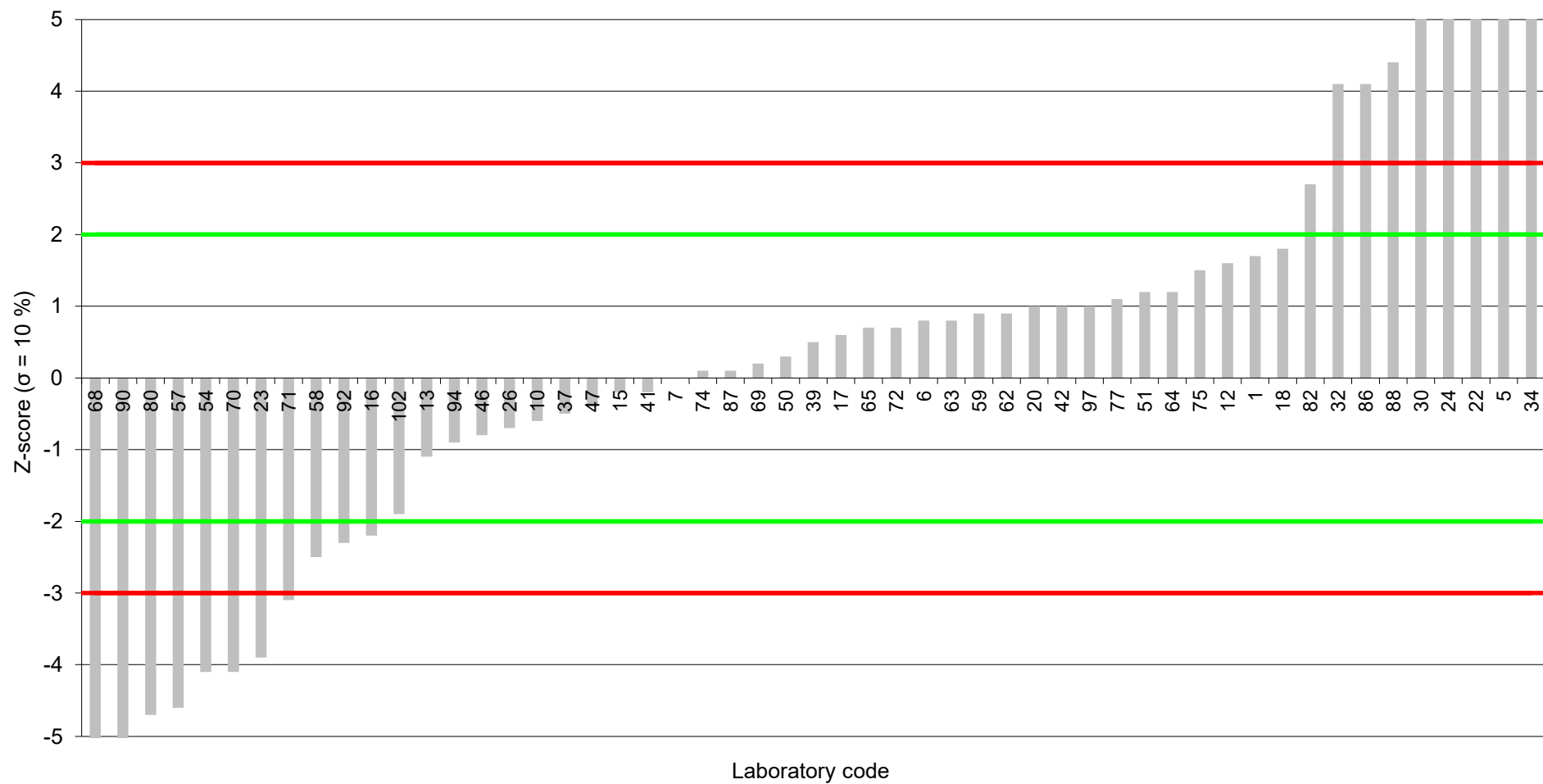
Fish Fillet (2501-FF)
WHO-PCDD/F-PCB-TEQ lower bound (calculated)
 Assigned value: 1.92 pg/g wet weight



Fish Fillet (2501-FF)
WHO-PCDD/F-TEQ upper bound (reported)
Assigned value: 0.252 pg/g wet weight



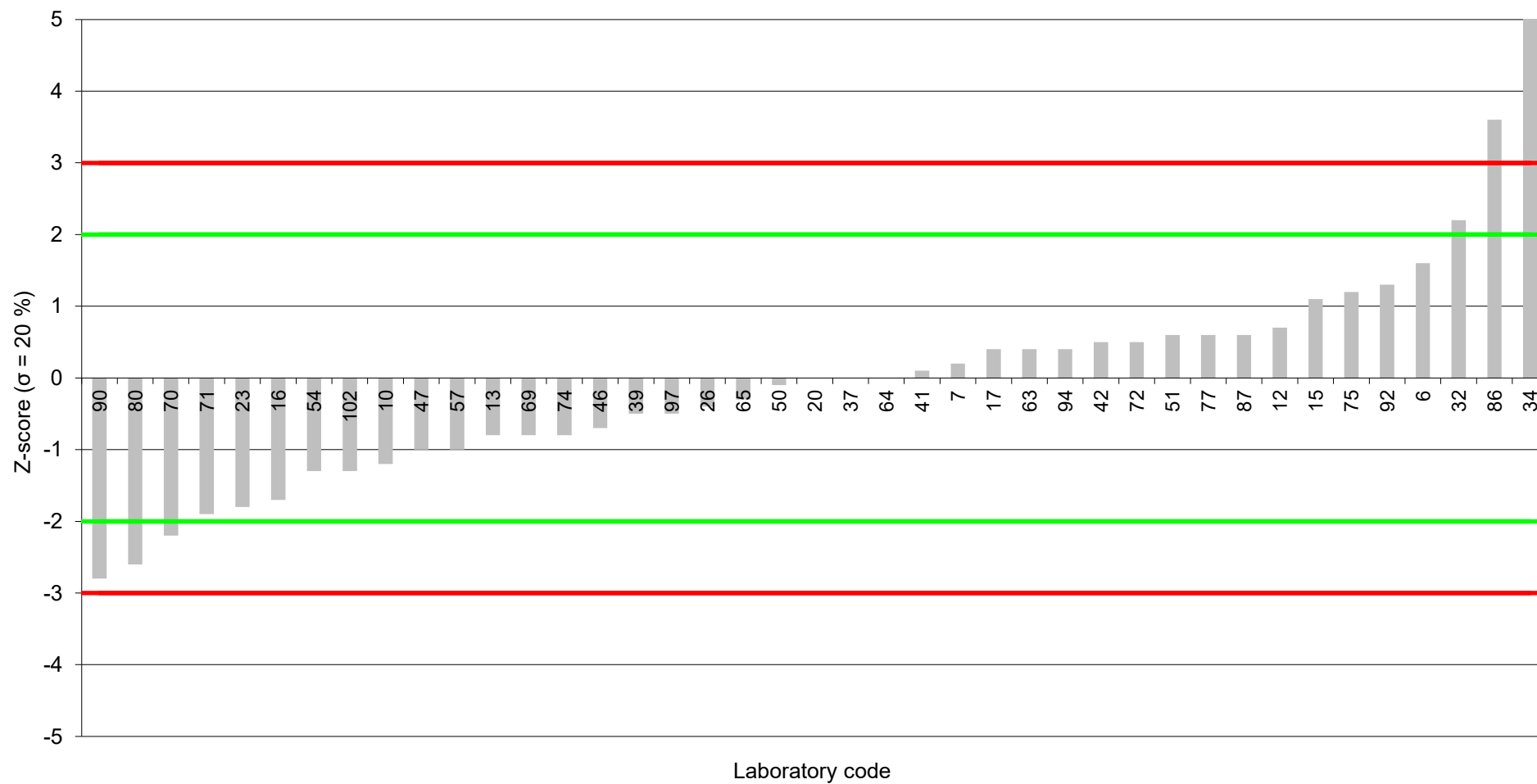
Fish Fillet (2501-FF)
WHO-PCDD/F-TEQ upper bound (calculated)
Assigned value: 0.254 pg/g wet weight



Fish Fillet (2501-FF)

2,3,7,8-TCDD

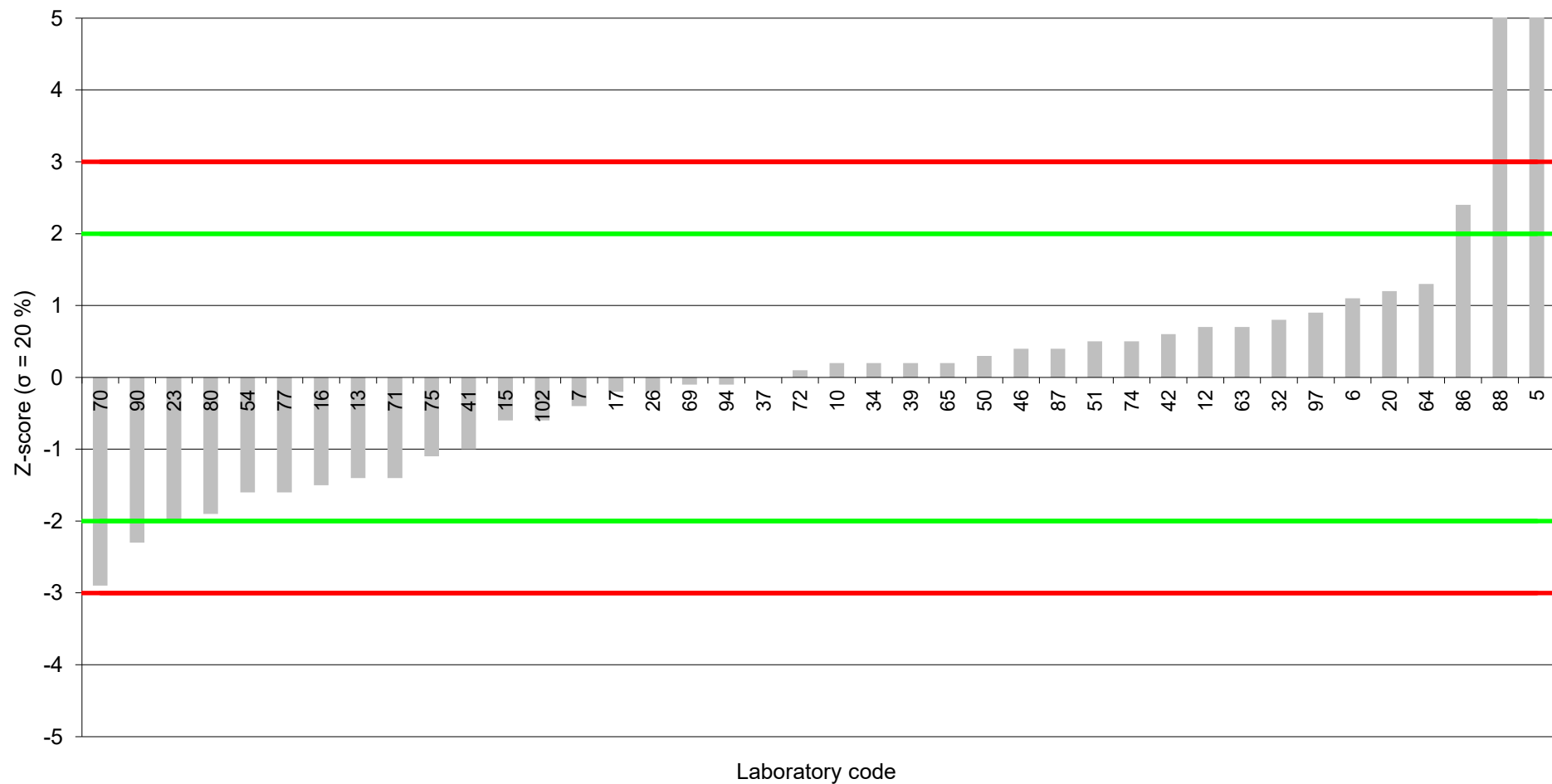
Assigned value: 0.0403 pg/g wet weight



Fish Fillet (2501-FF)

1,2,3,7,8-PeCDD

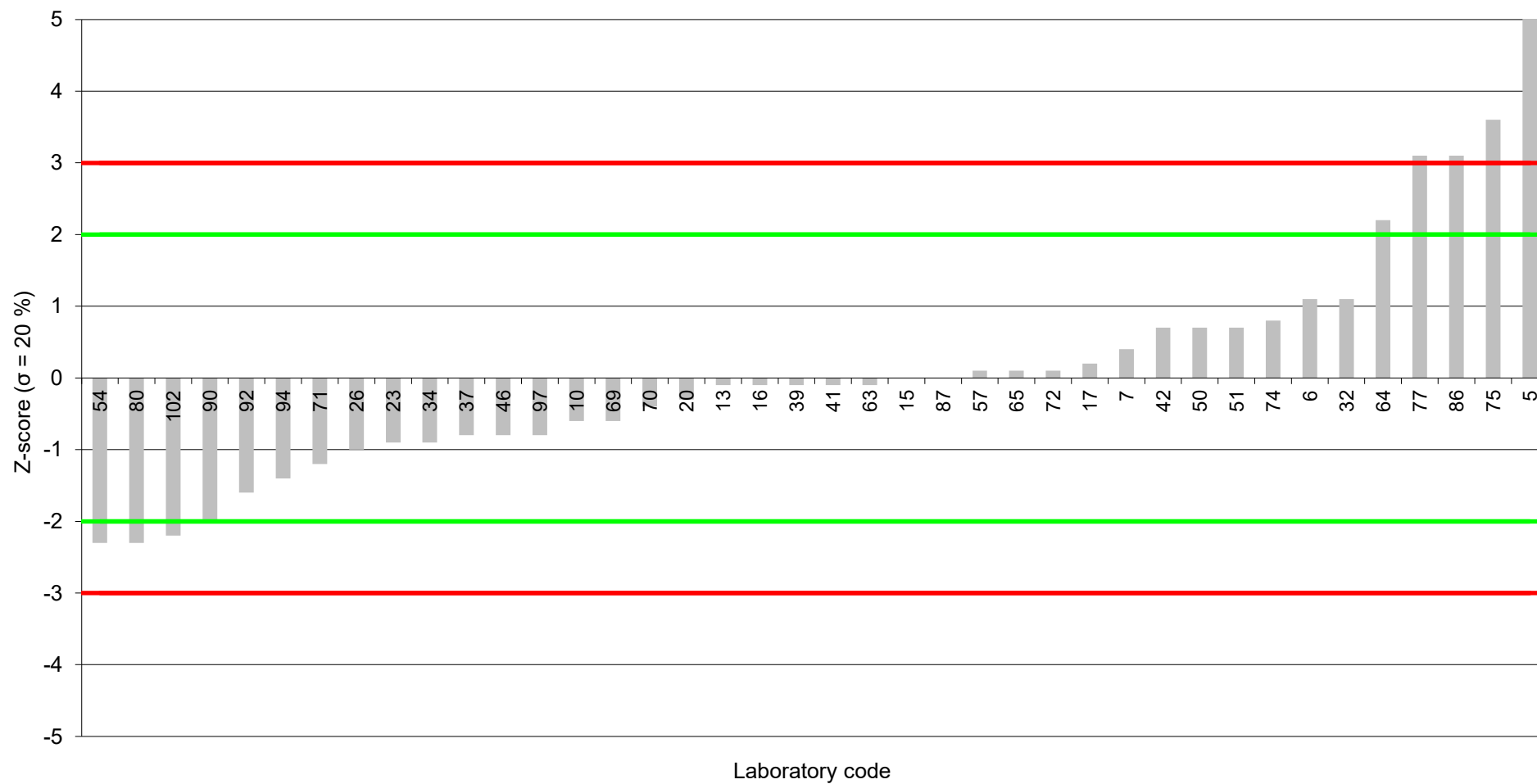
Assigned value: 0.0439 pg/g wet weight



Fish Fillet (2501-FF)

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

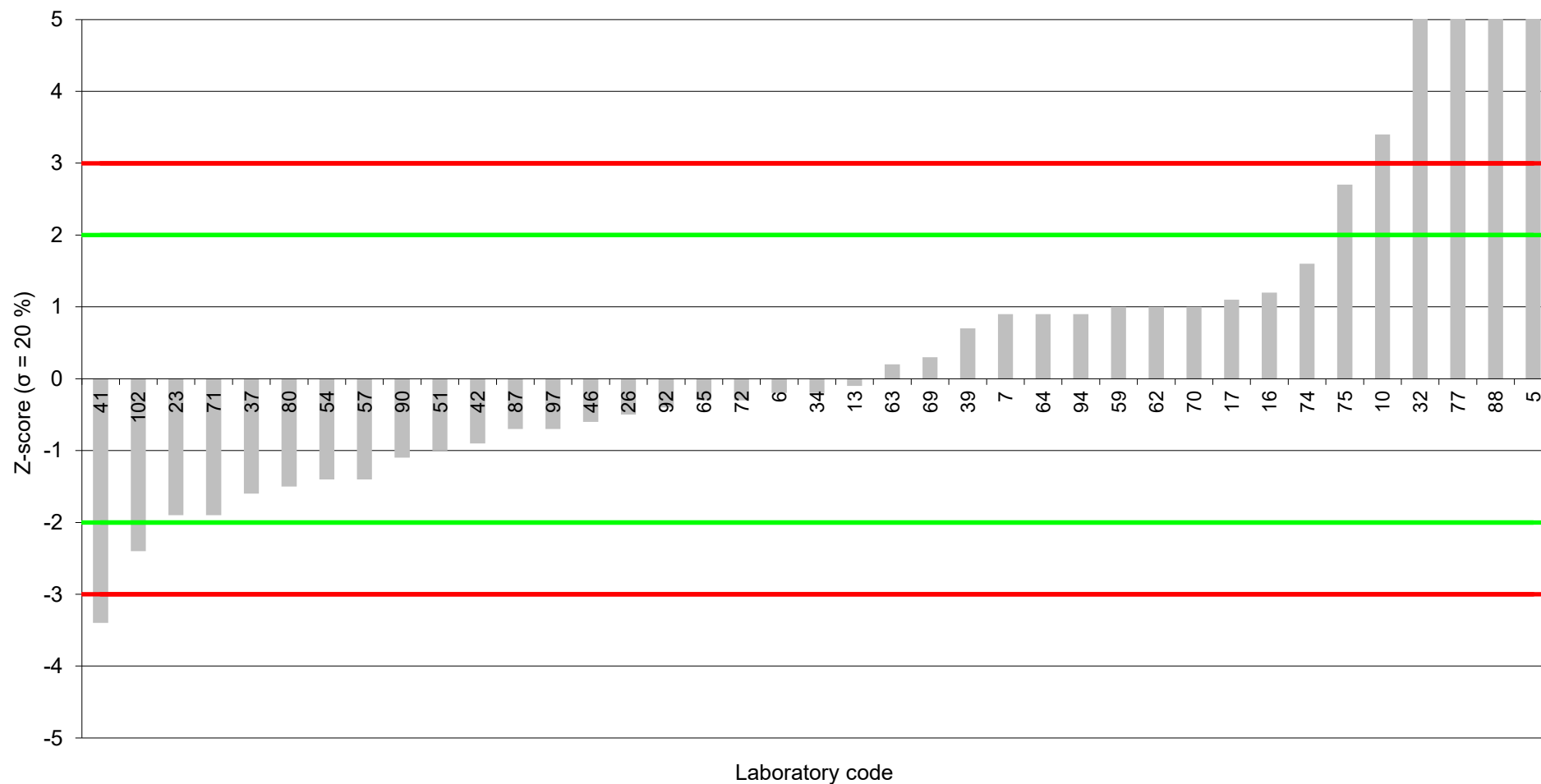
Assigned value: 0.0371 pg/g wet weight



Fish Fillet (2501-FF)

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

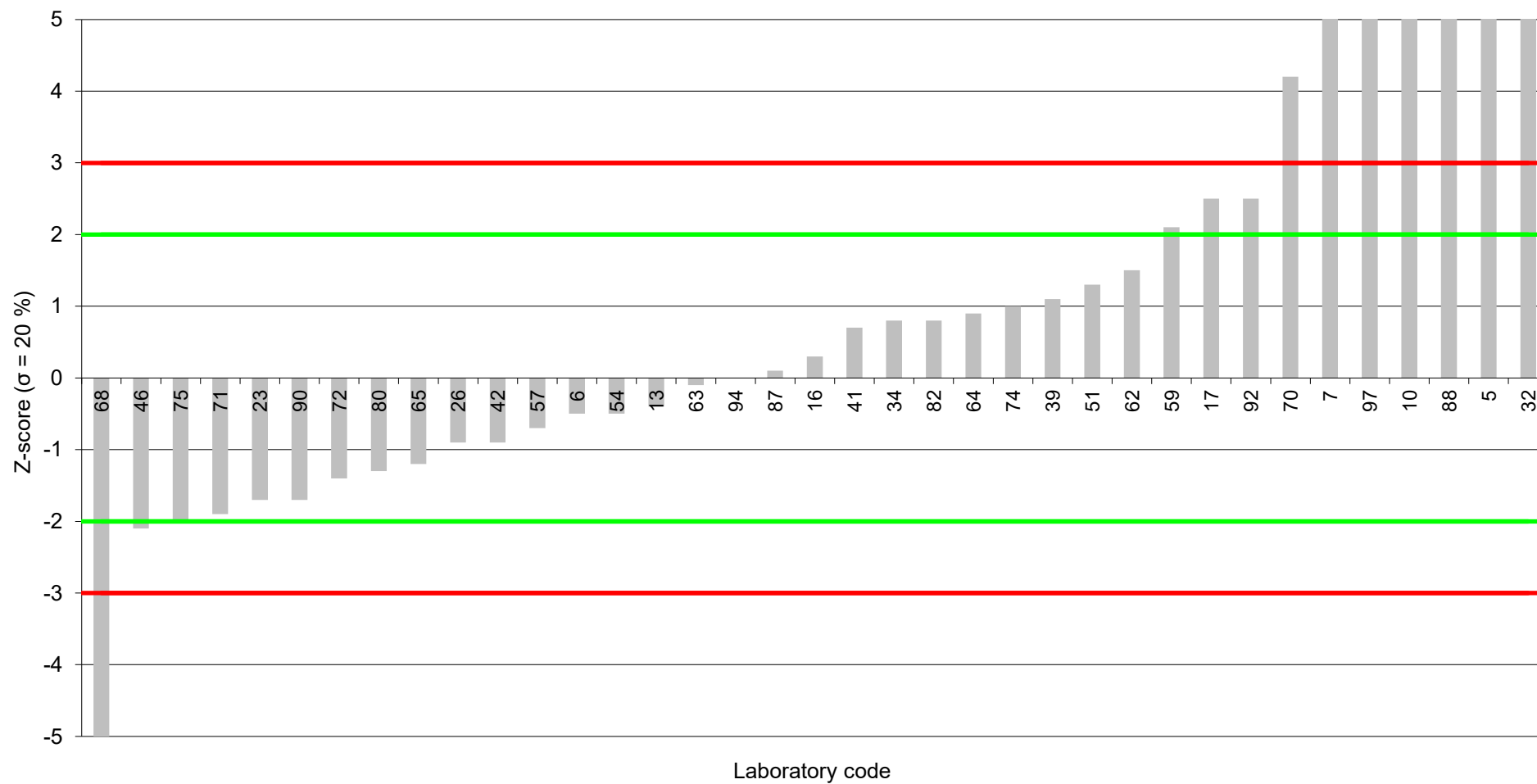
Assigned value: 0.0418 pg/g wet weight



Fish Fillet (2501-FF)

OCDD

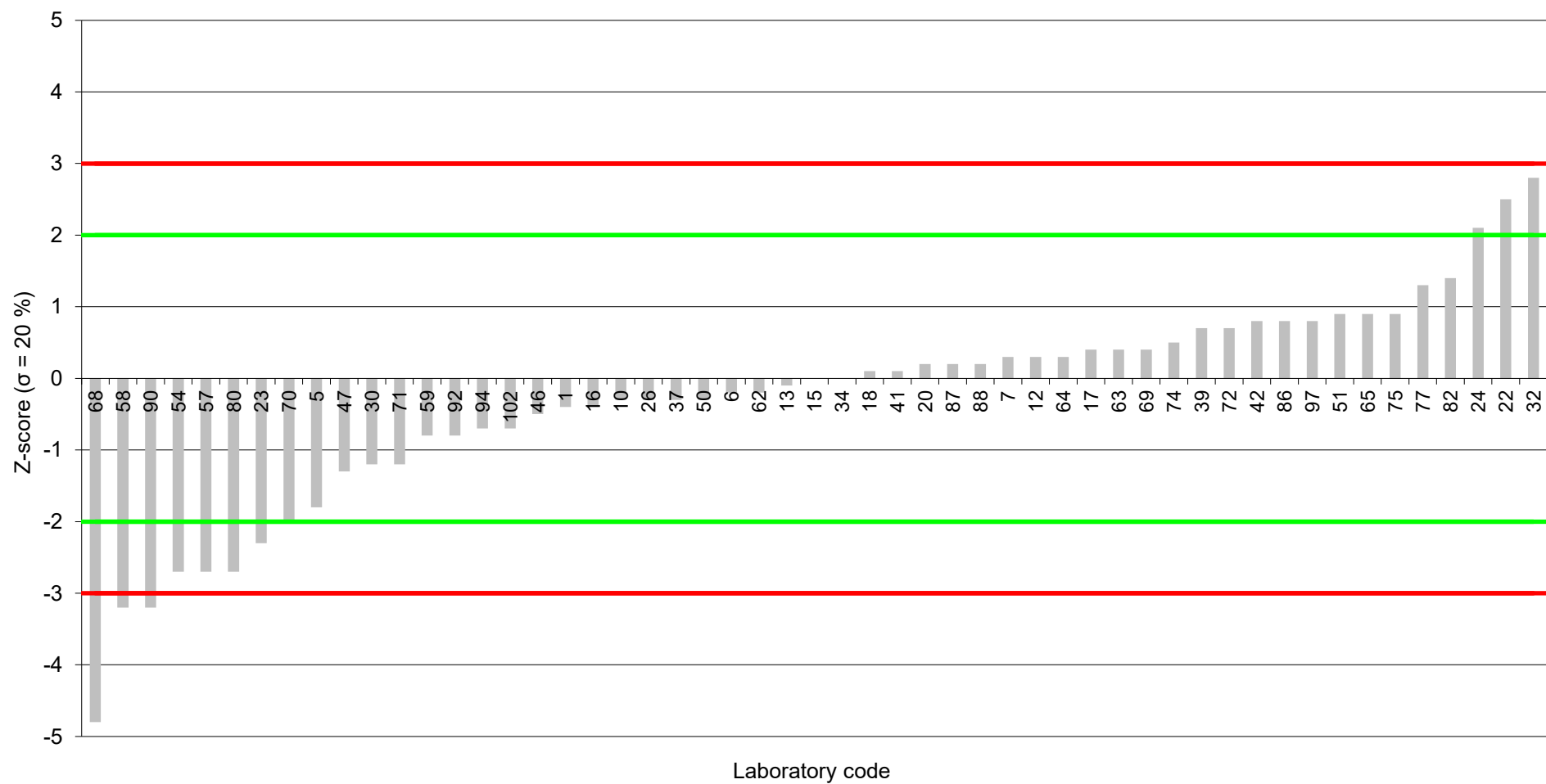
Assigned value: 0.0771 pg/g wet weight



Fish Fillet (2501-FF)

2,3,7,8-TCDF

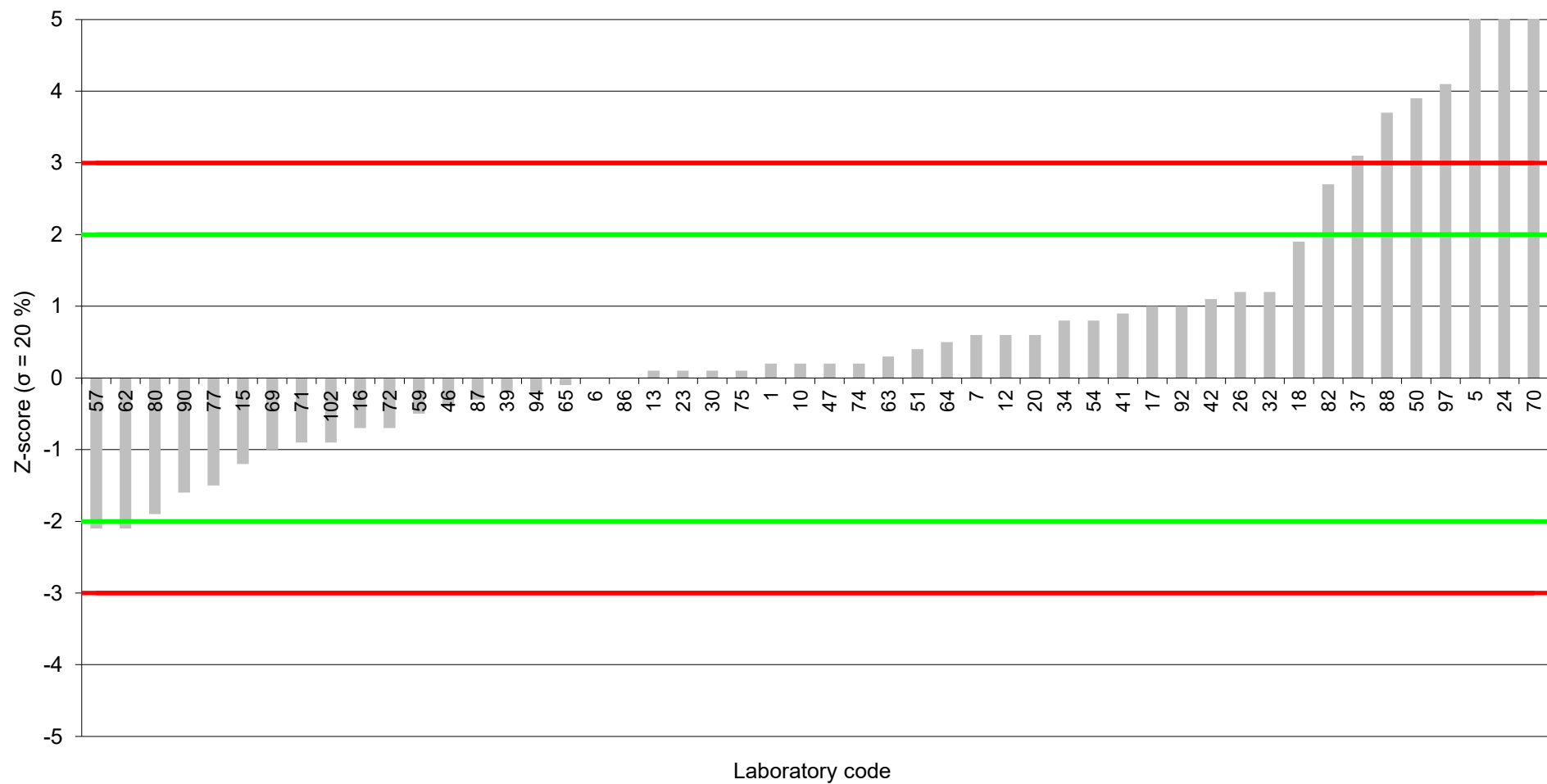
Assigned value: 0.869 pg/g wet weight



Fish Fillet (2501-FF)

1,2,3,7,8-PeCDF

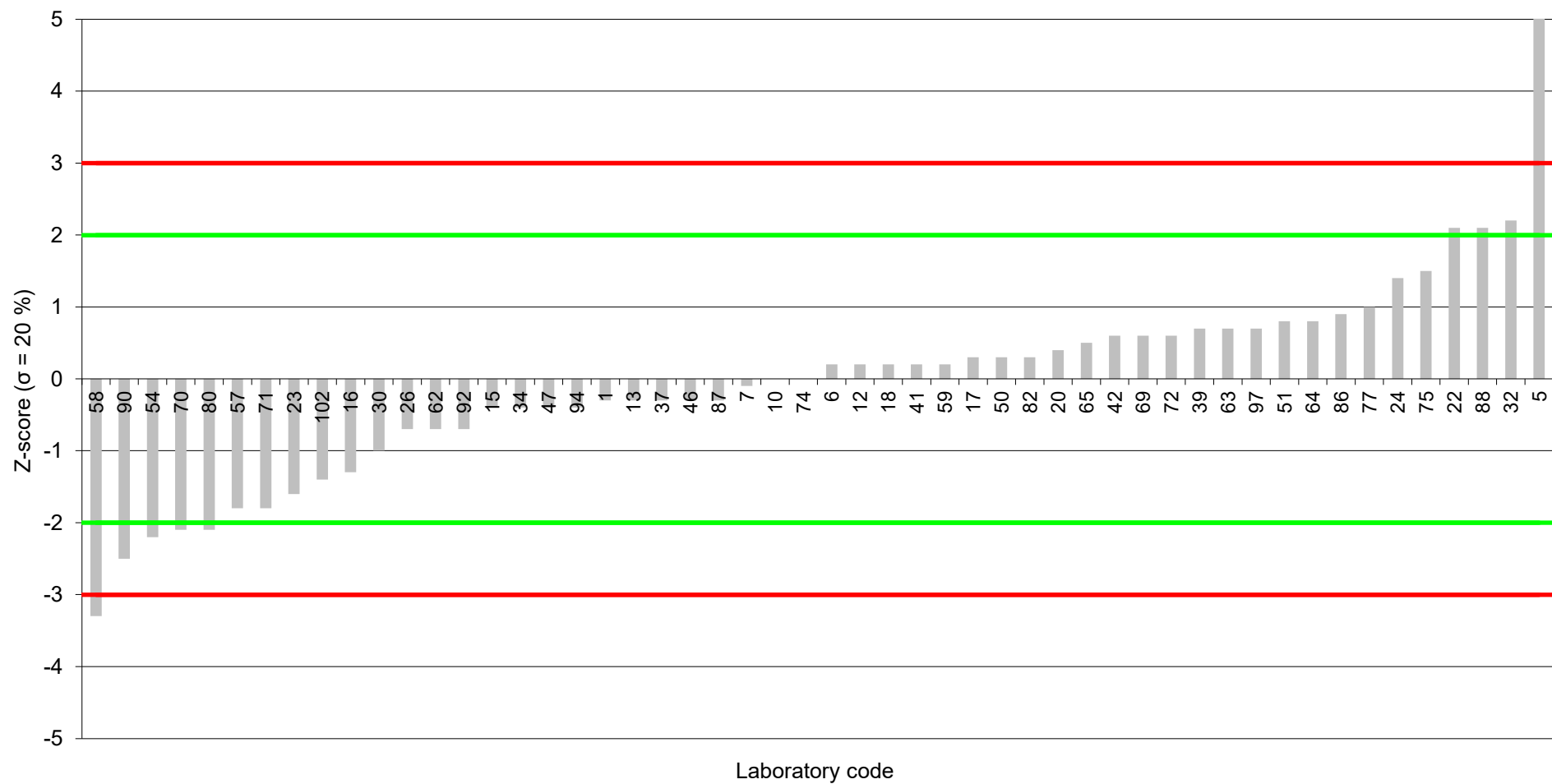
Assigned value: 0.086 pg/g wet weight



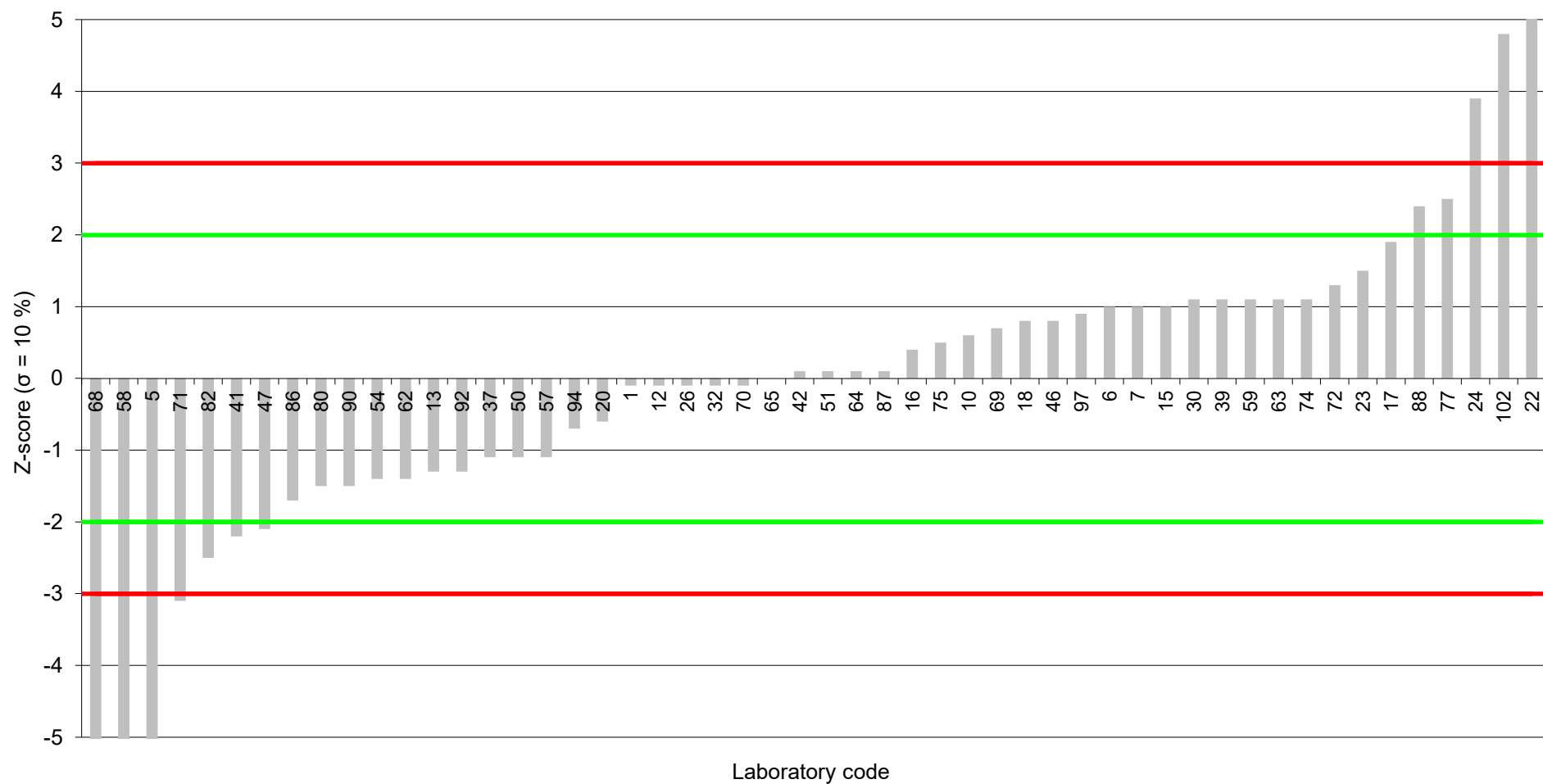
Fish Fillet (2501-FF)

2,3,4,7,8-PeCDF

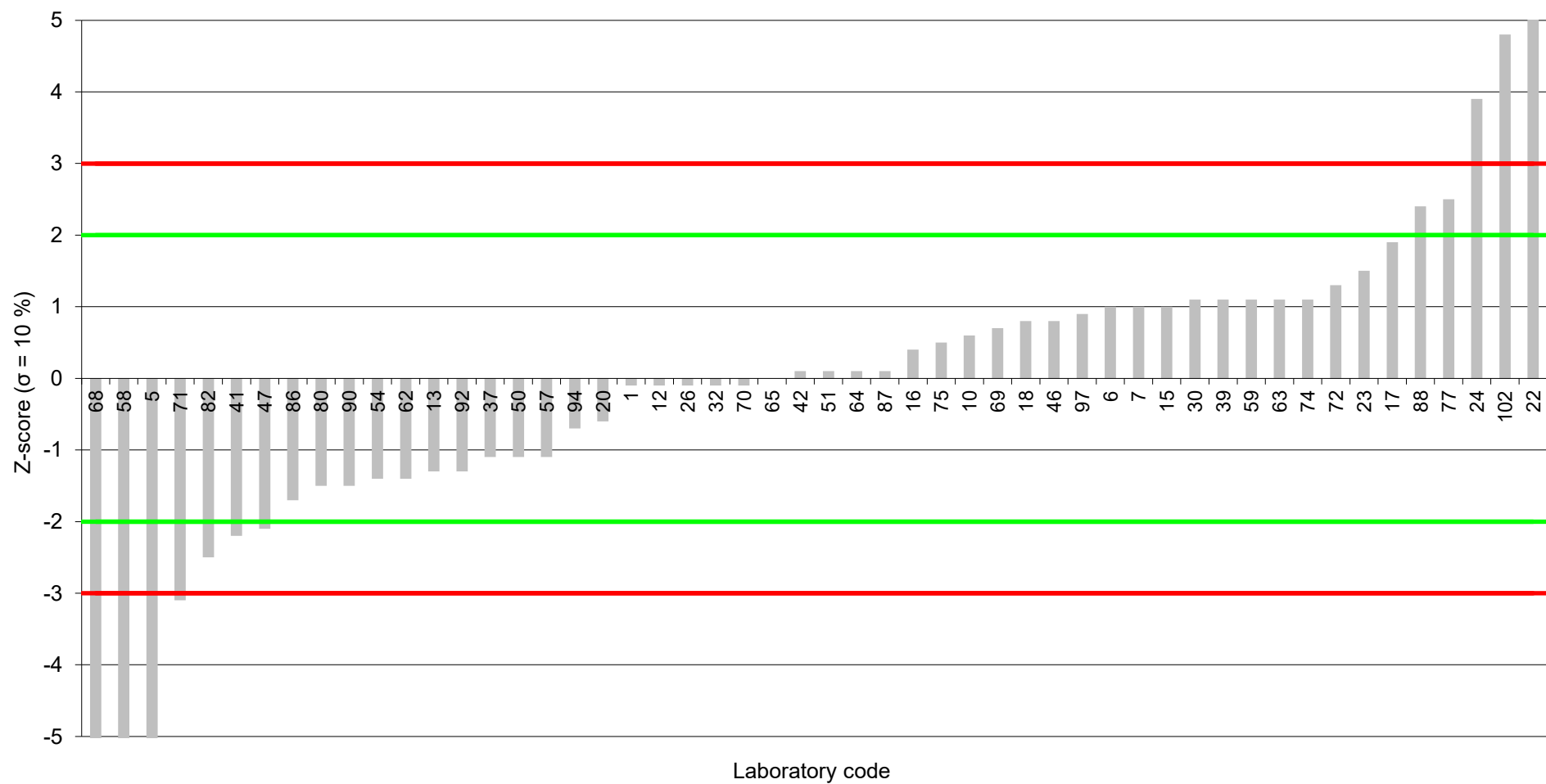
Assigned value: 0.211 pg/g wet weight



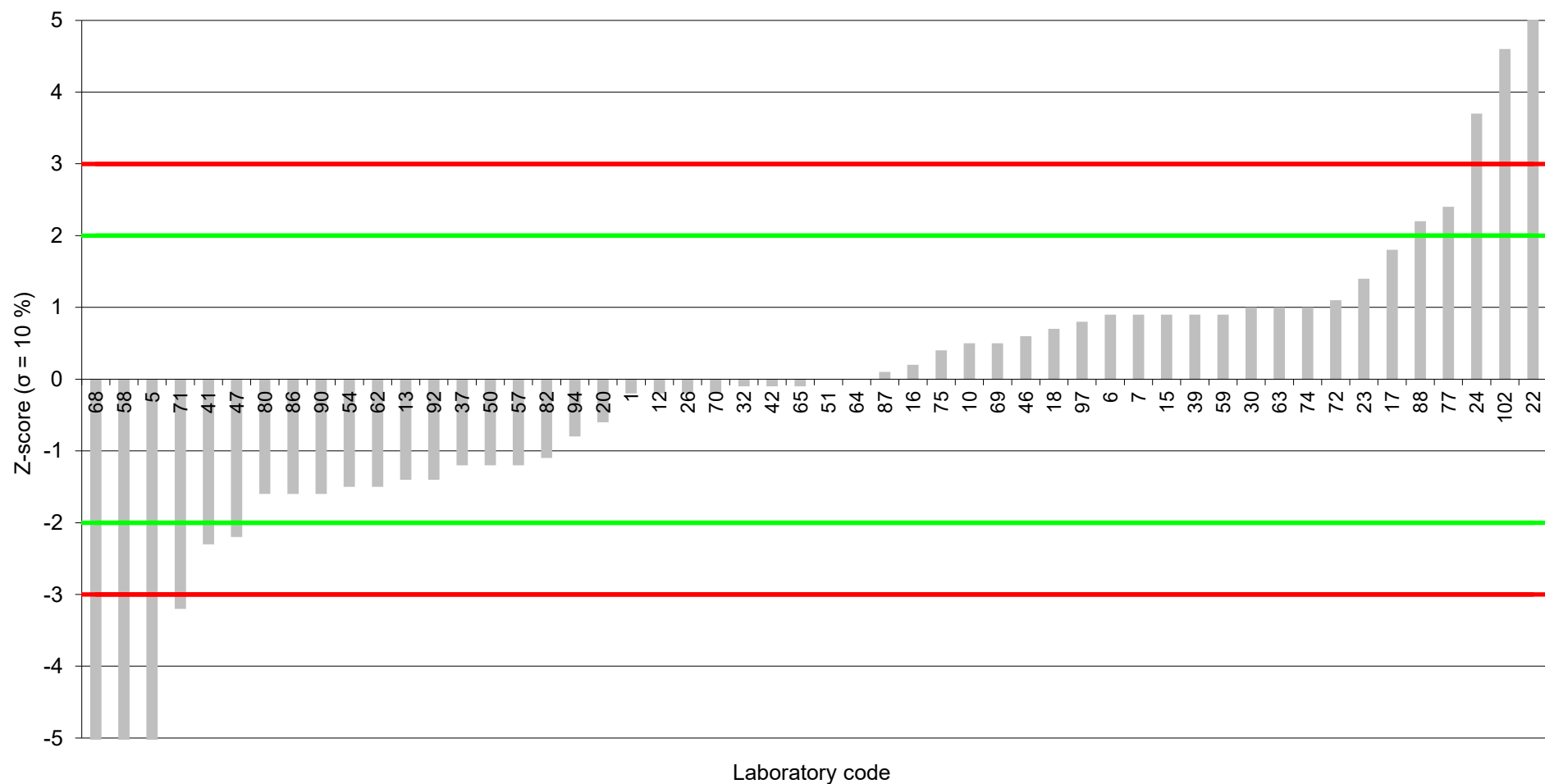
Fish Fillet (2501-FF)
WHO-PCB-TEQ upper bound (reported)
 Assigned value: 1.68 pg/g wet weight



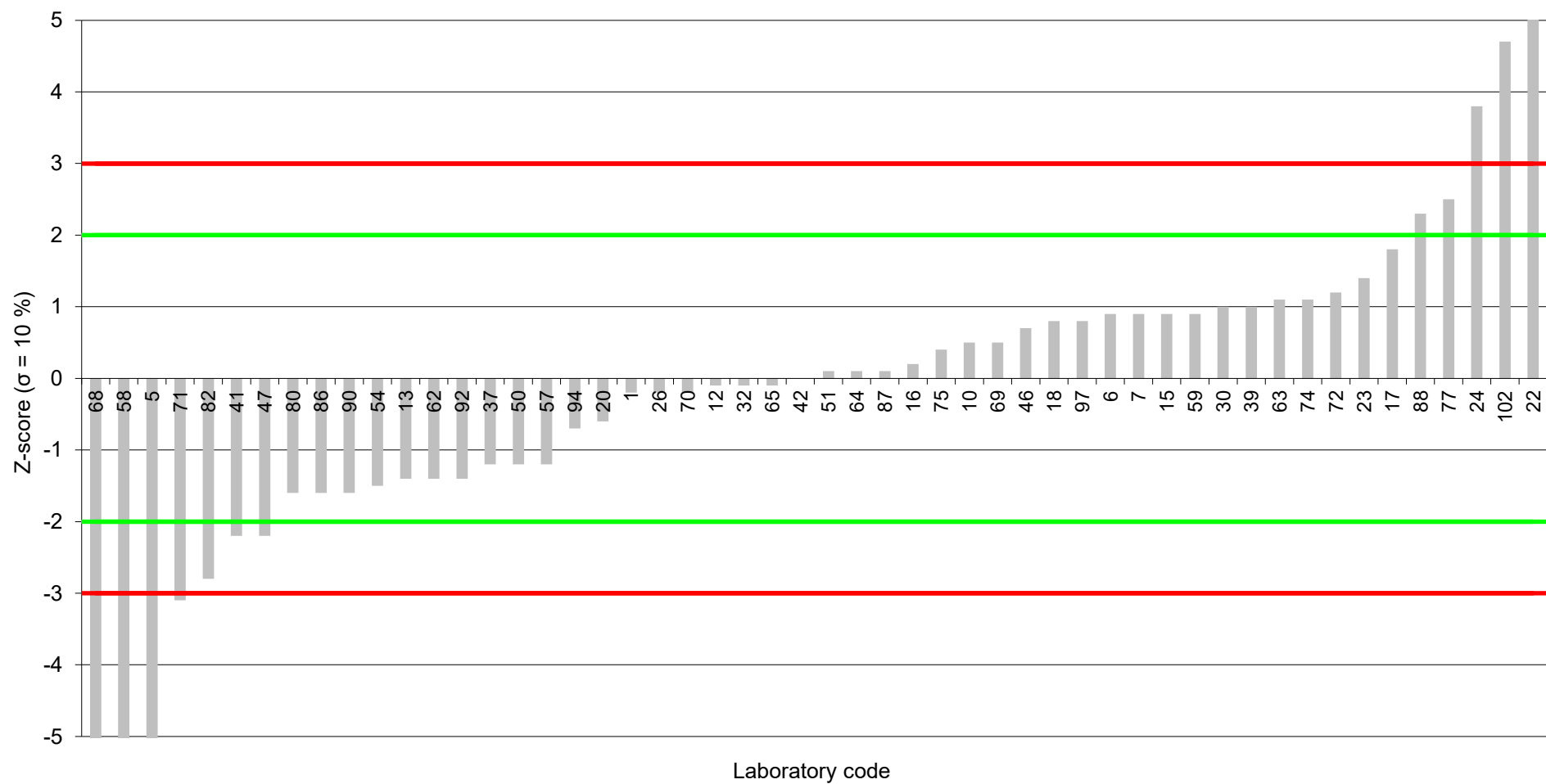
Fish Fillet (2501-FF)
WHO-PCB-TEQ lower bound (reported)
 Assigned value: 1.68 pg/g wet weight



Fish Fillet (2501-FF)
WHO-PCB-TEQ upper bound (calculated)
Assigned value: 1.7 pg/g wet weight



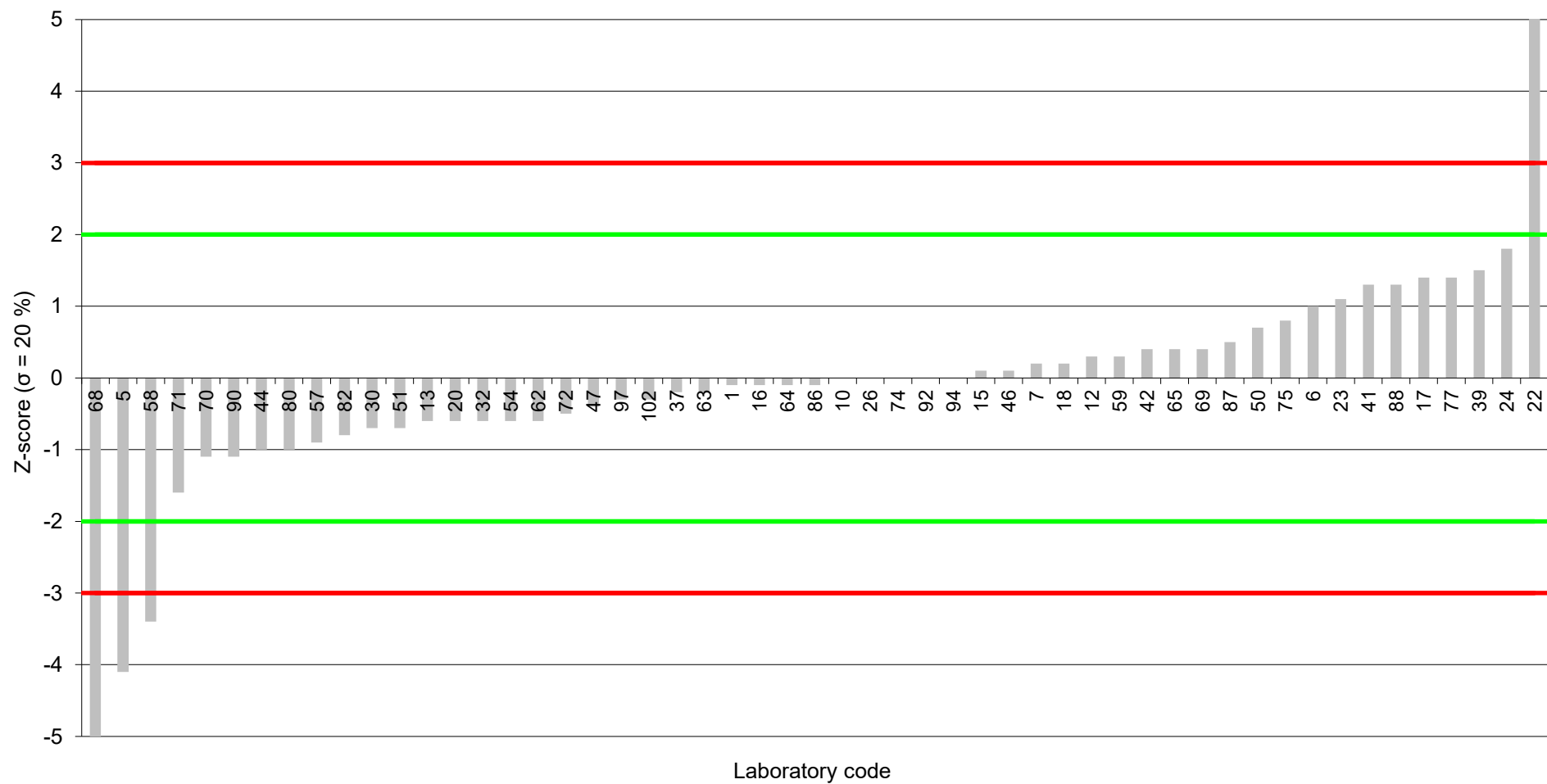
Fish Fillet (2501-FF)
WHO-PCB-TEQ lower bound (calculated)
 Assigned value: 1.69 pg/g wet weight



Fish Fillet (2501-FF)

PCB 105

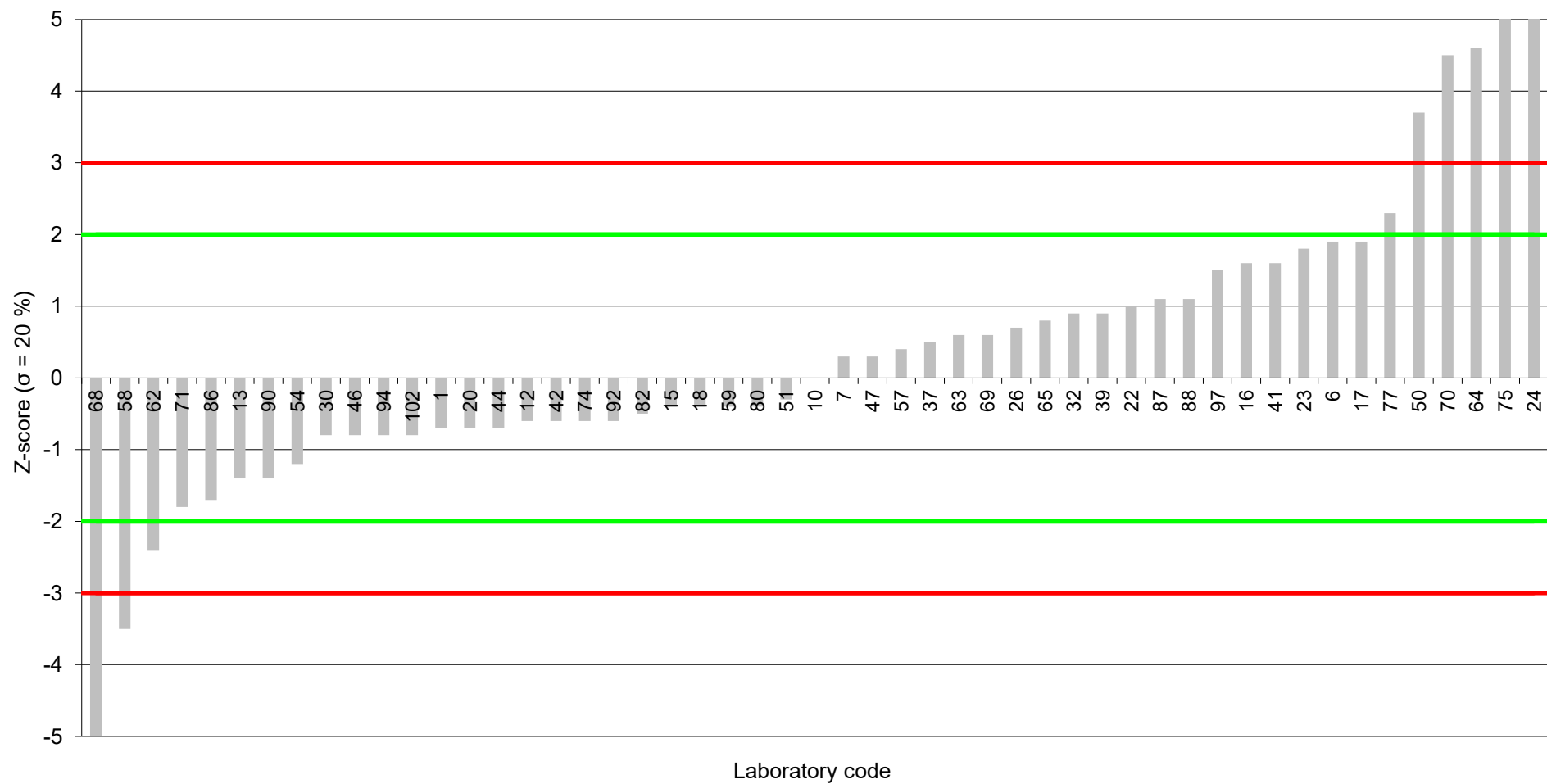
Assigned value: 896 pg/g wet weight



Fish Fillet (2501-FF)

PCB 114

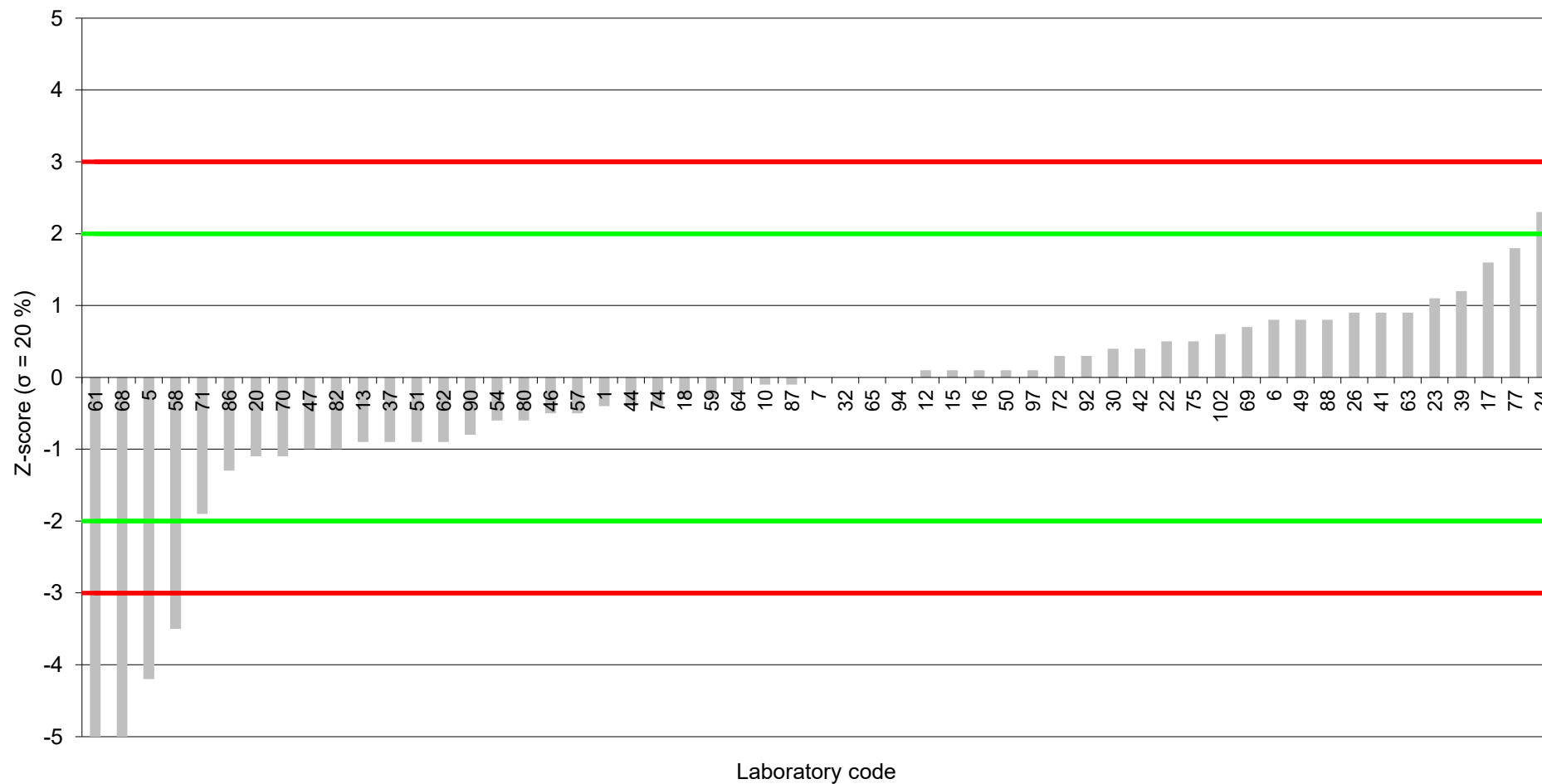
Assigned value: 59.5 pg/g wet weight



Fish Fillet (2501-FF)

PCB 118

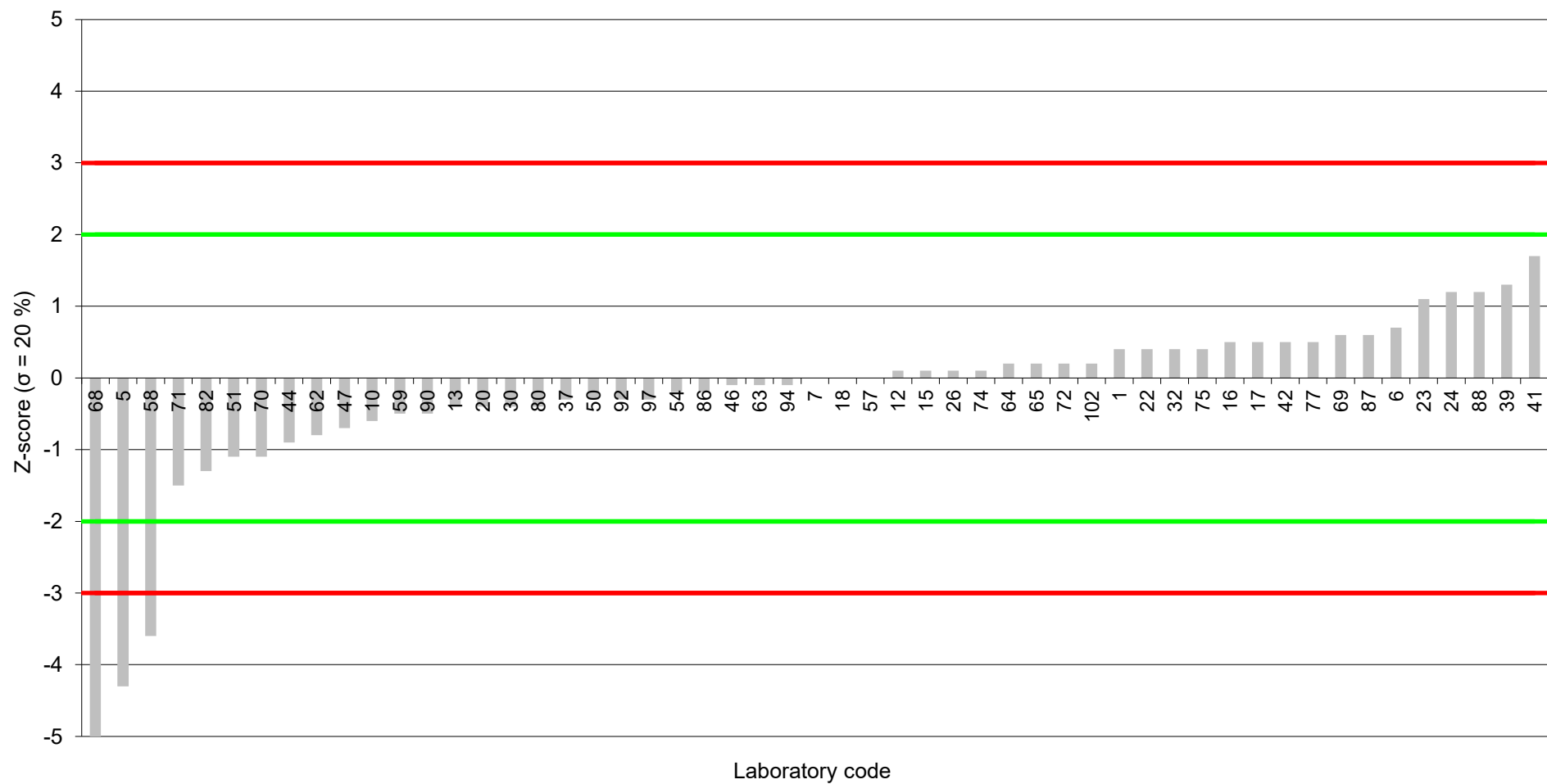
Assigned value: 4340 pg/g wet weight



Fish Fillet (2501-FF)

PCB 156

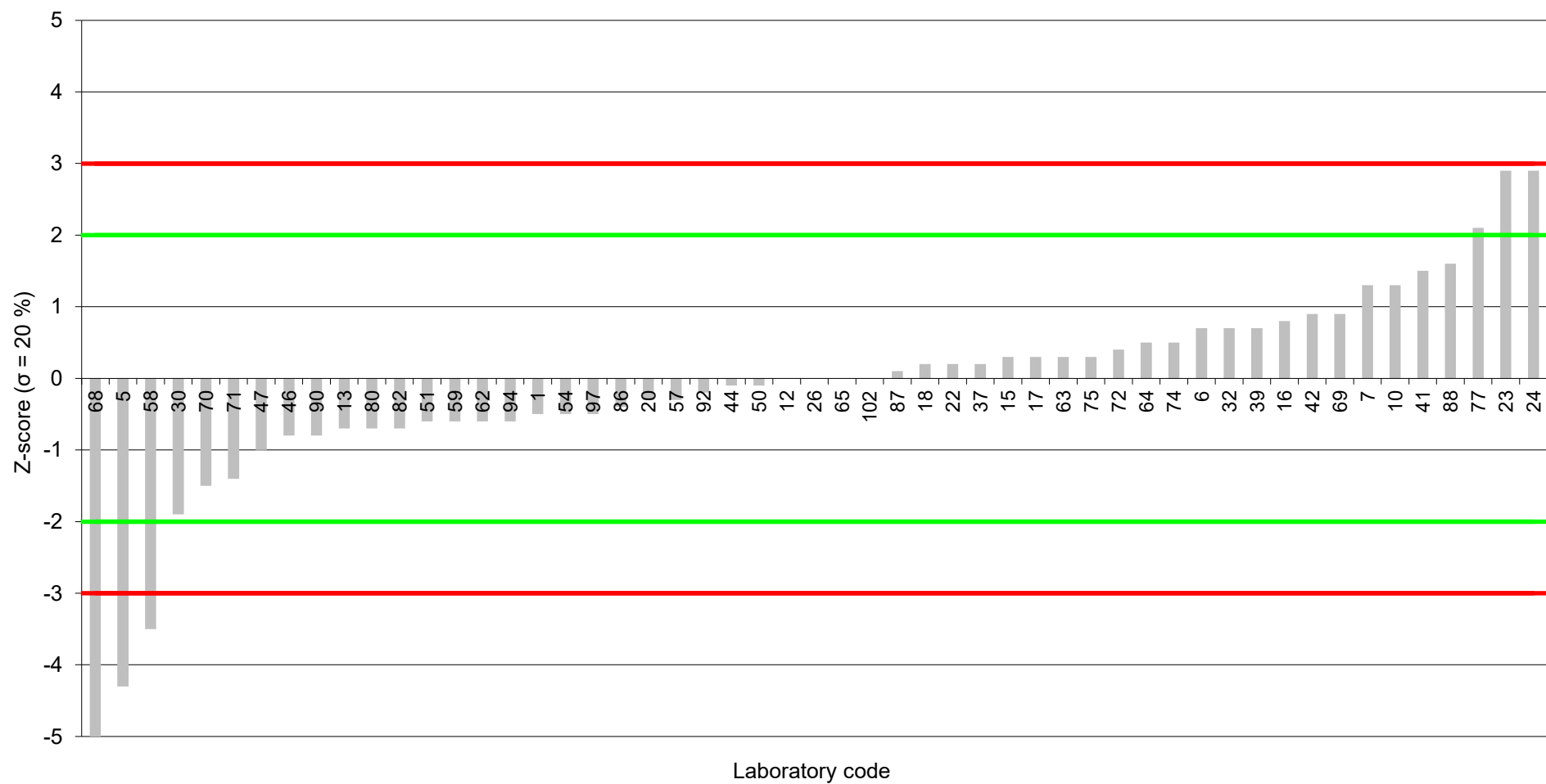
Assigned value: 894 pg/g wet weight



Fish Fillet (2501-FF)

PCB 157

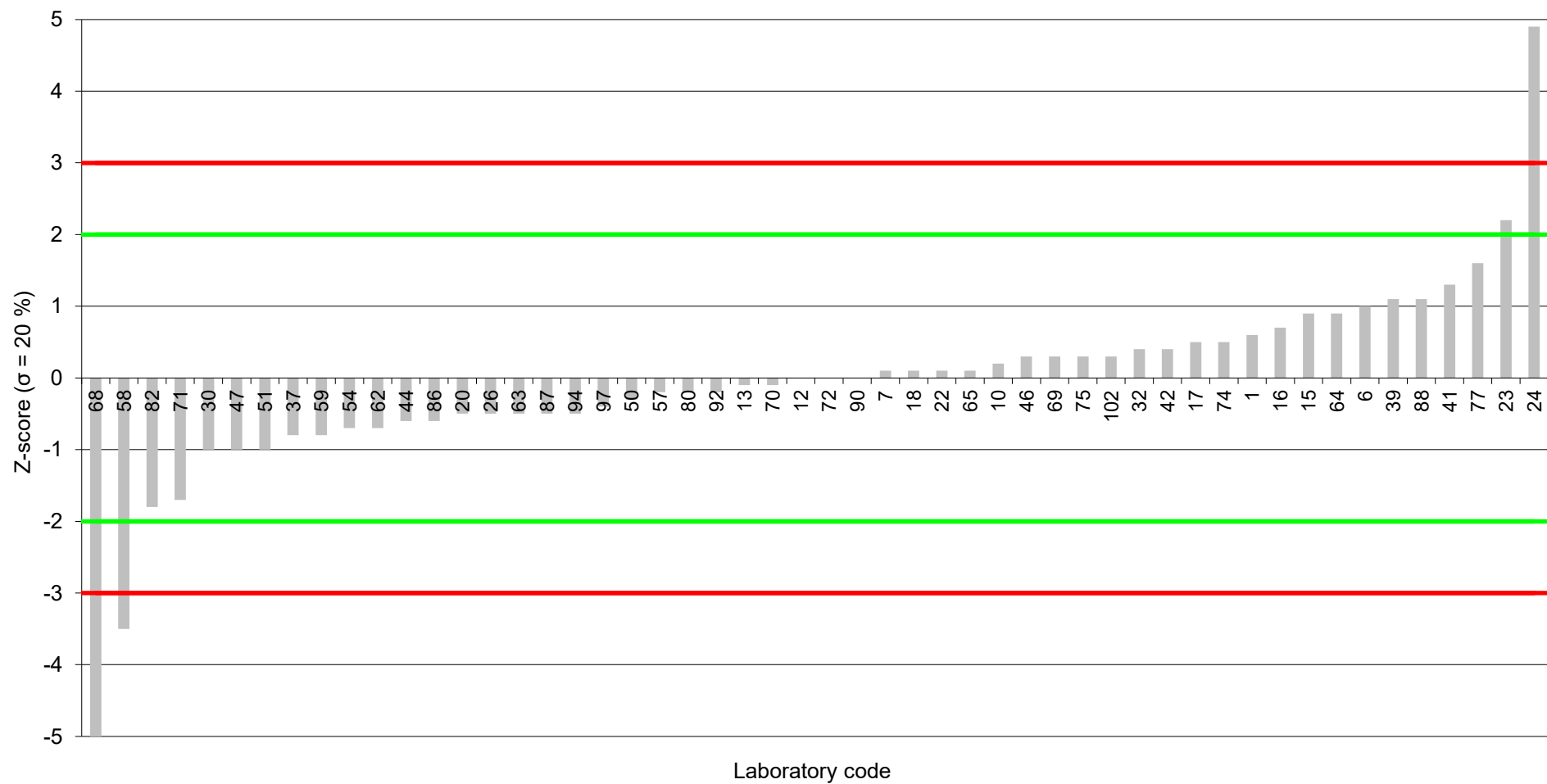
Assigned value: 119 pg/g wet weight



Fish Fillet (2501-FF)

PCB 167

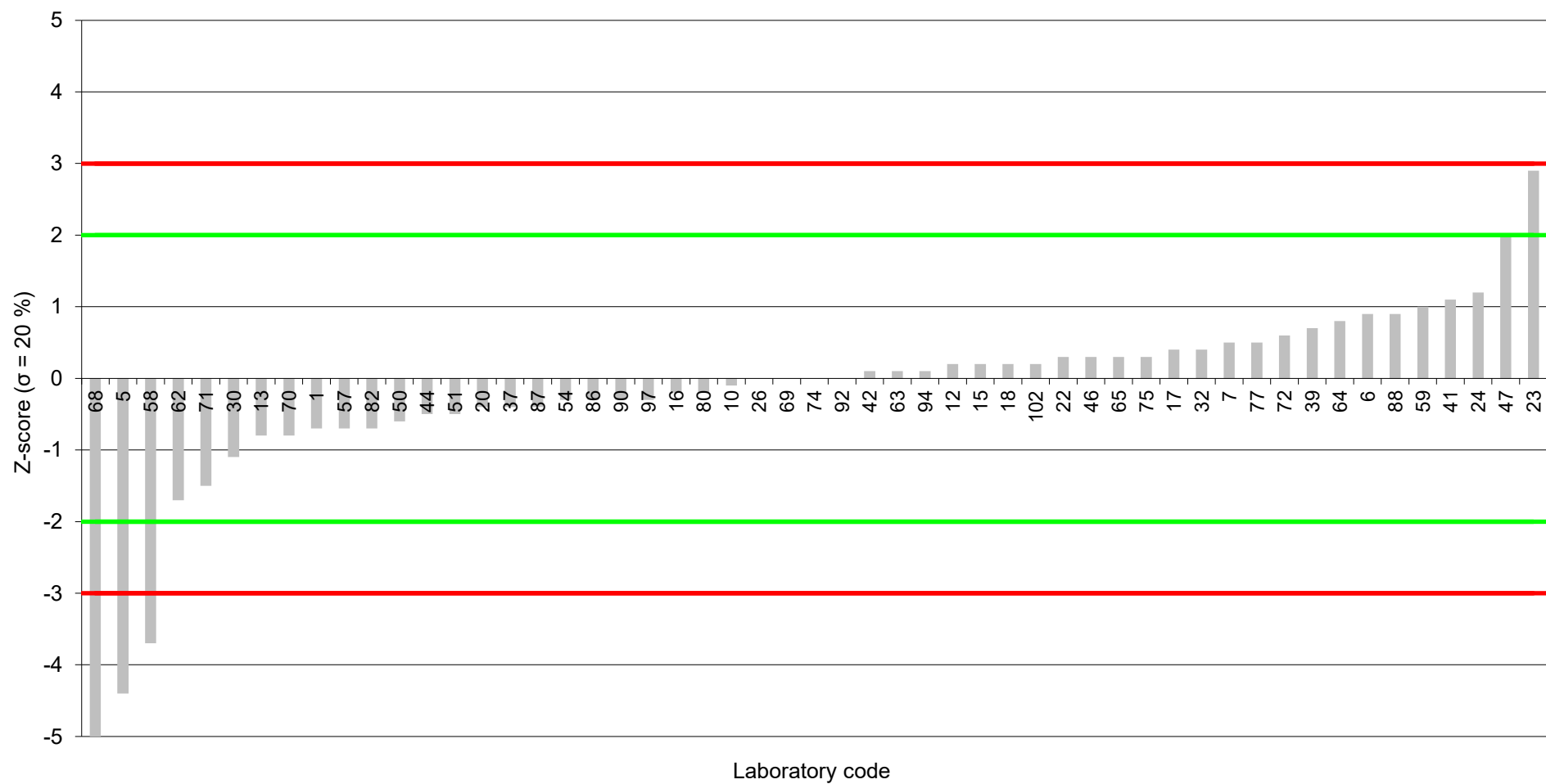
Assigned value: 550 pg/g wet weight



Fish Fillet (2501-FF)

PCB 189

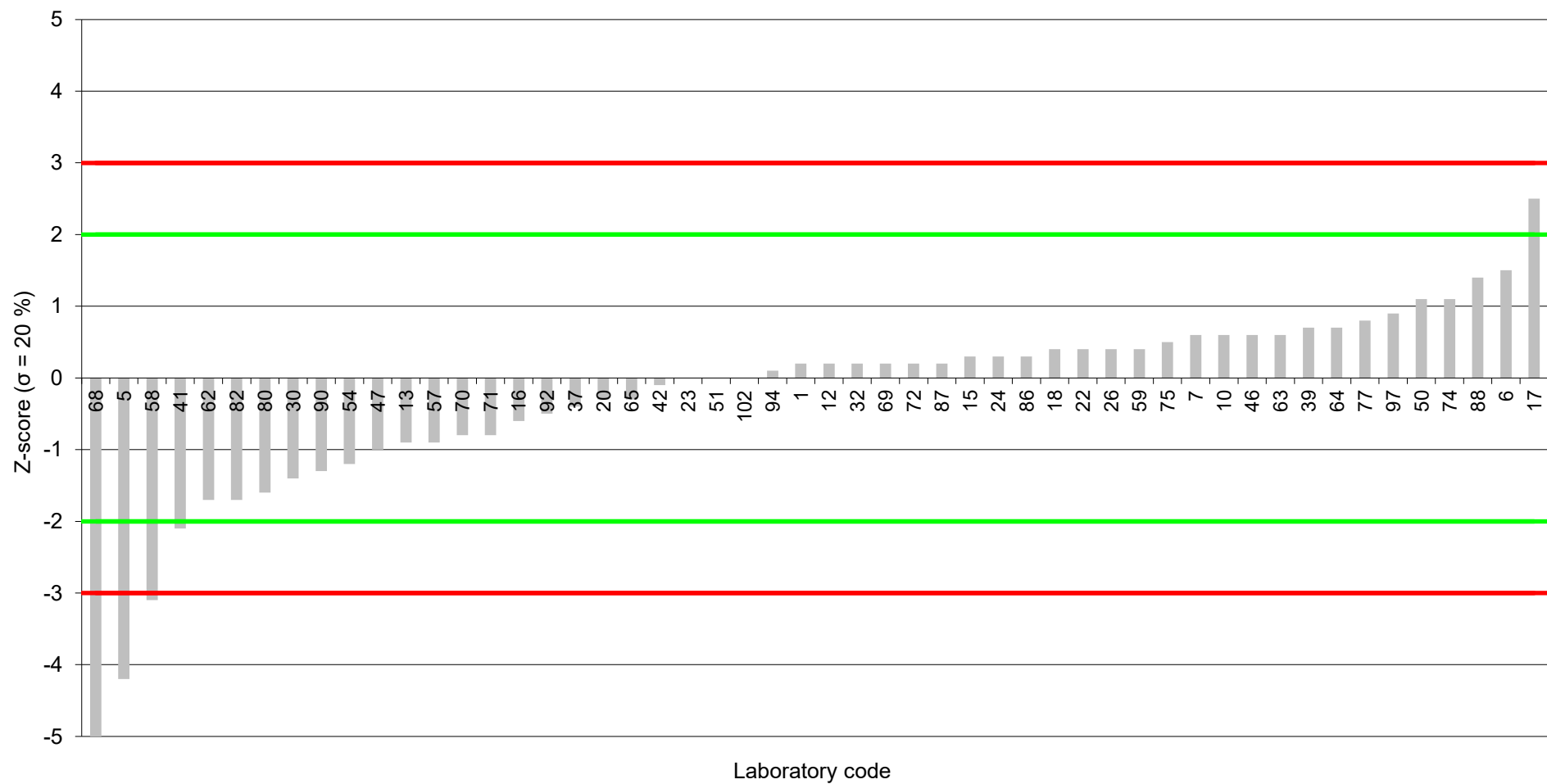
Assigned value: 107 pg/g wet weight



Fish Fillet (2501-FF)

PCB 77

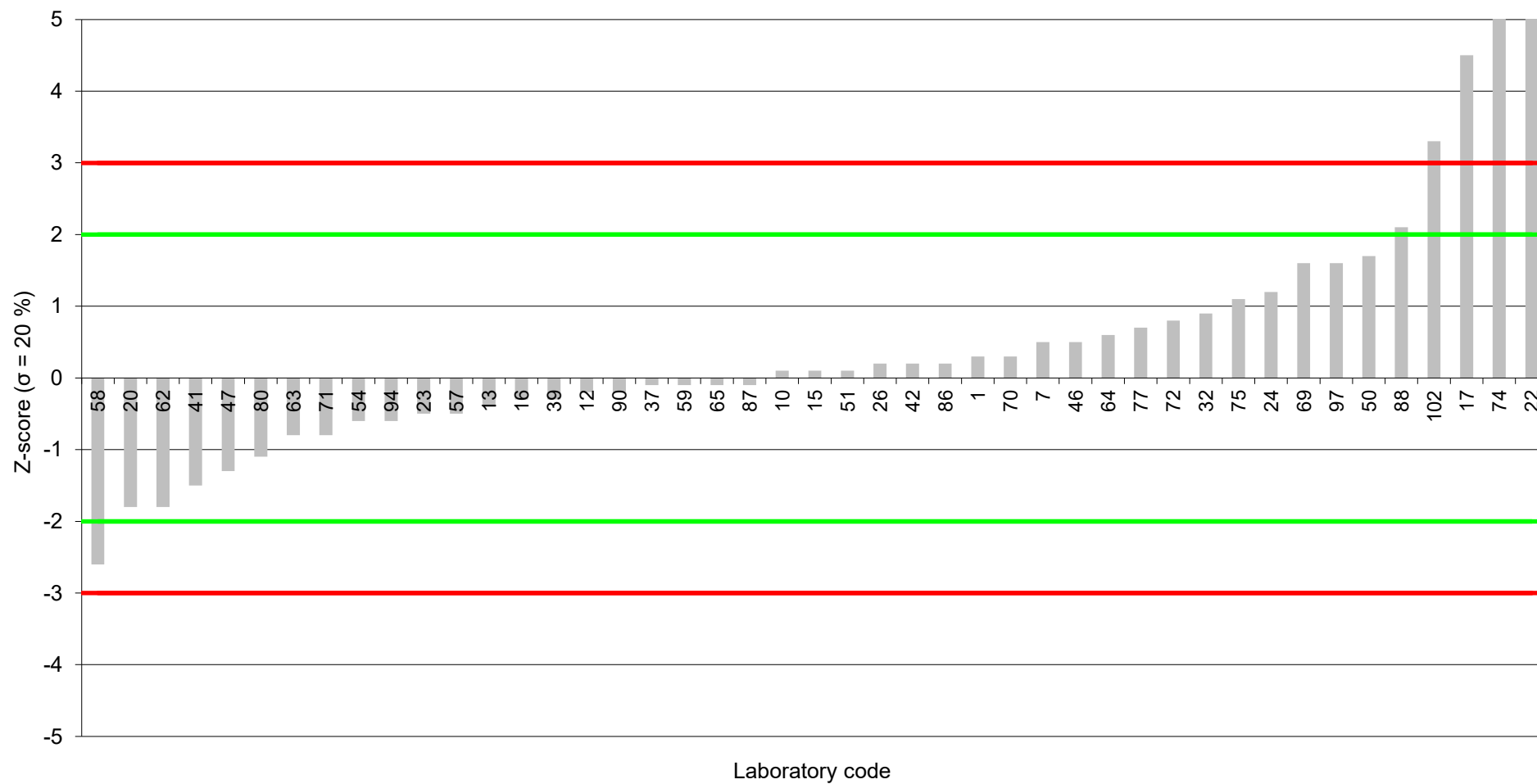
Assigned value: 50 pg/g wet weight



Fish Fillet (2501-FF)

PCB 81

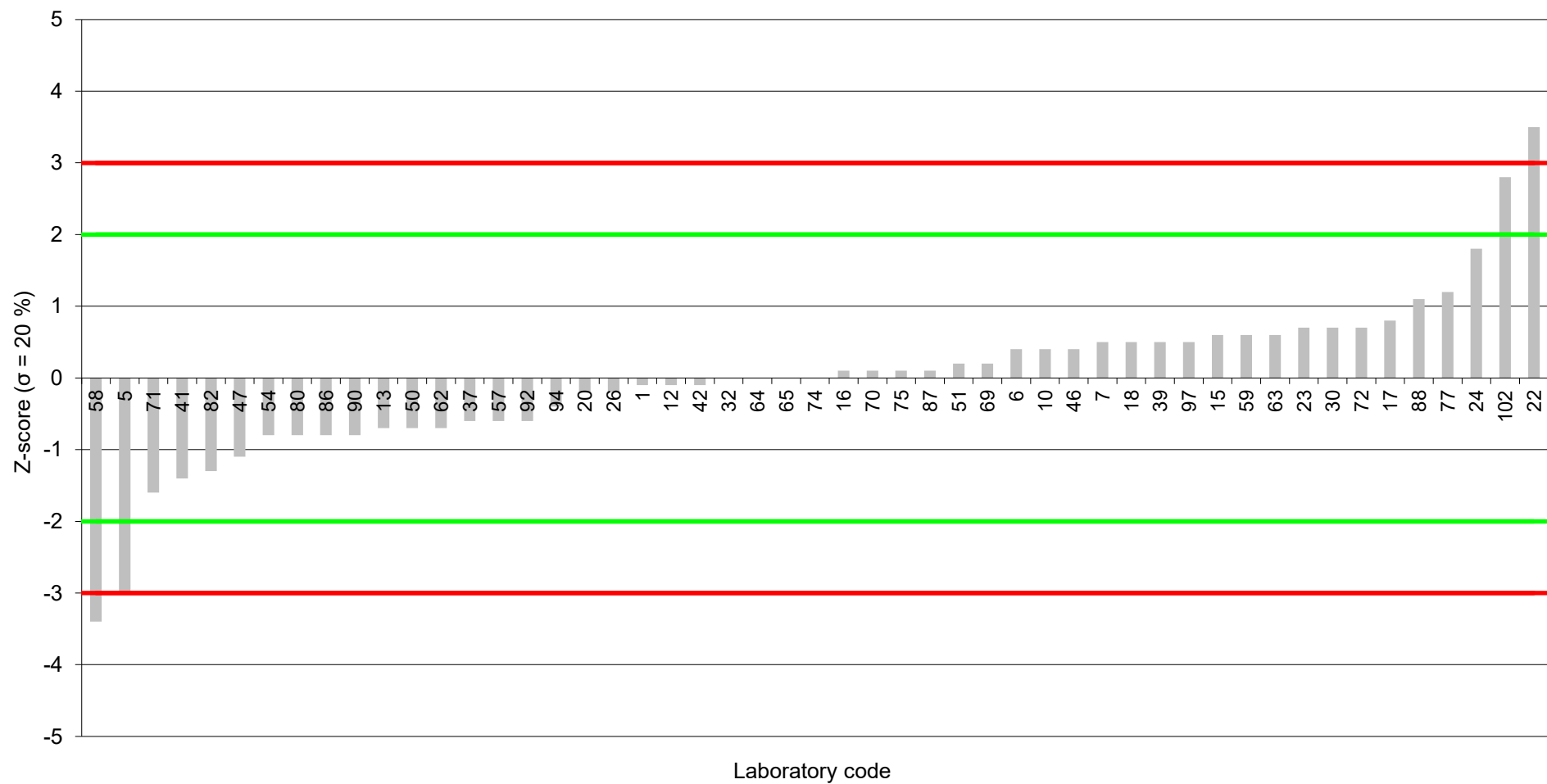
Assigned value: 1.92 pg/g wet weight



Fish Fillet (2501-FF)

PCB 126

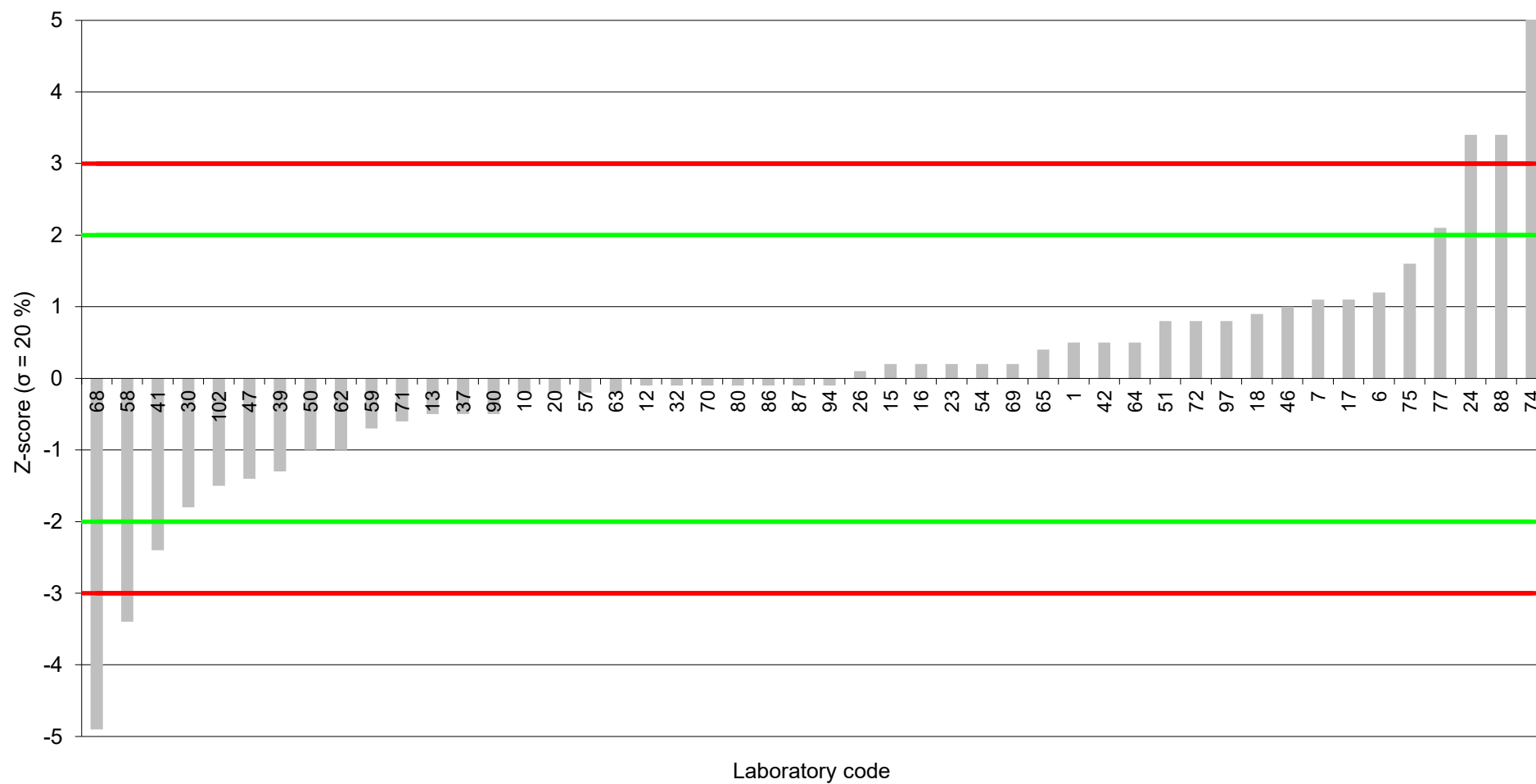
Assigned value: 14.2 pg/g wet weight



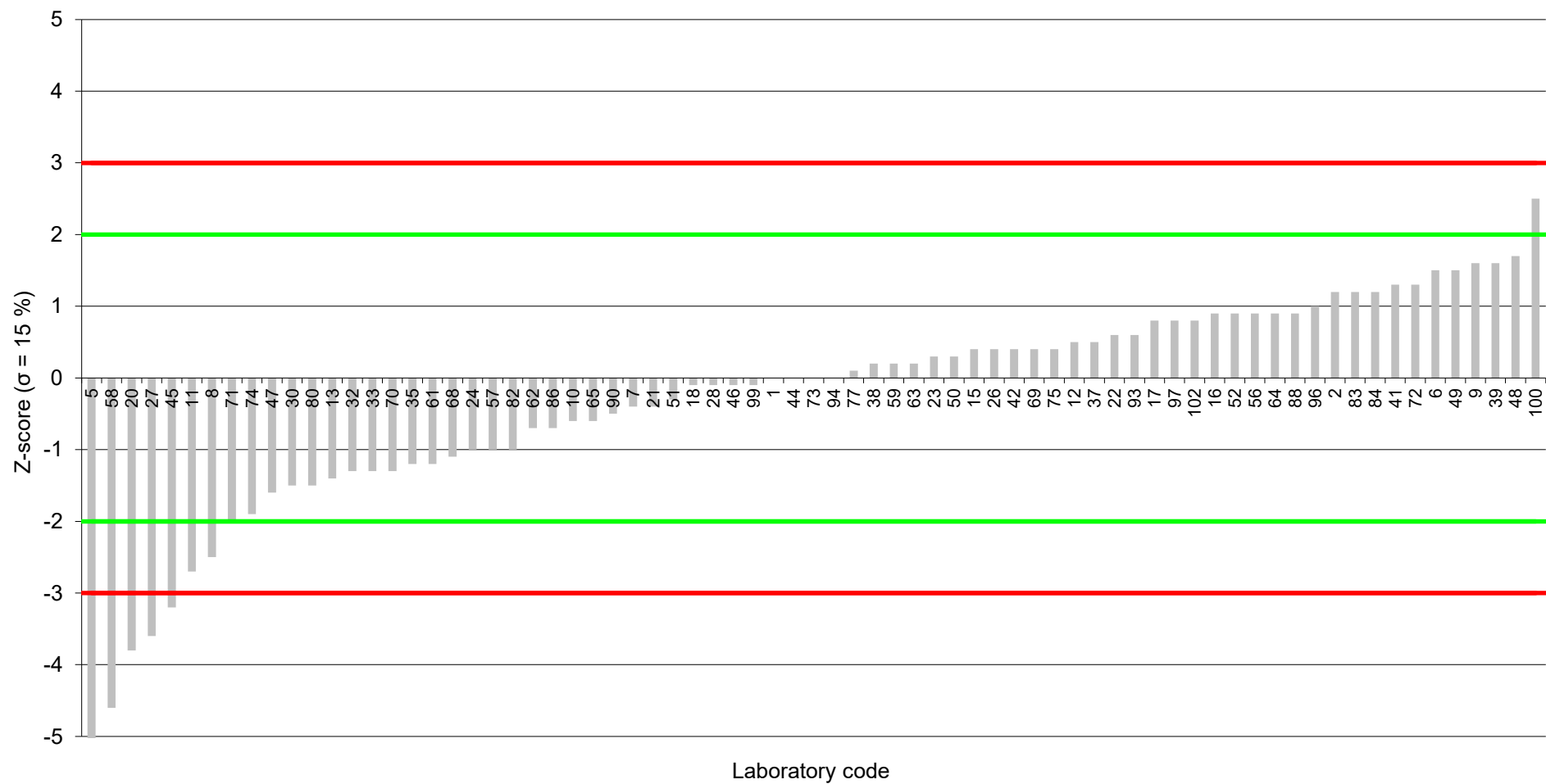
Fish Fillet (2501-FF)

PCB 169

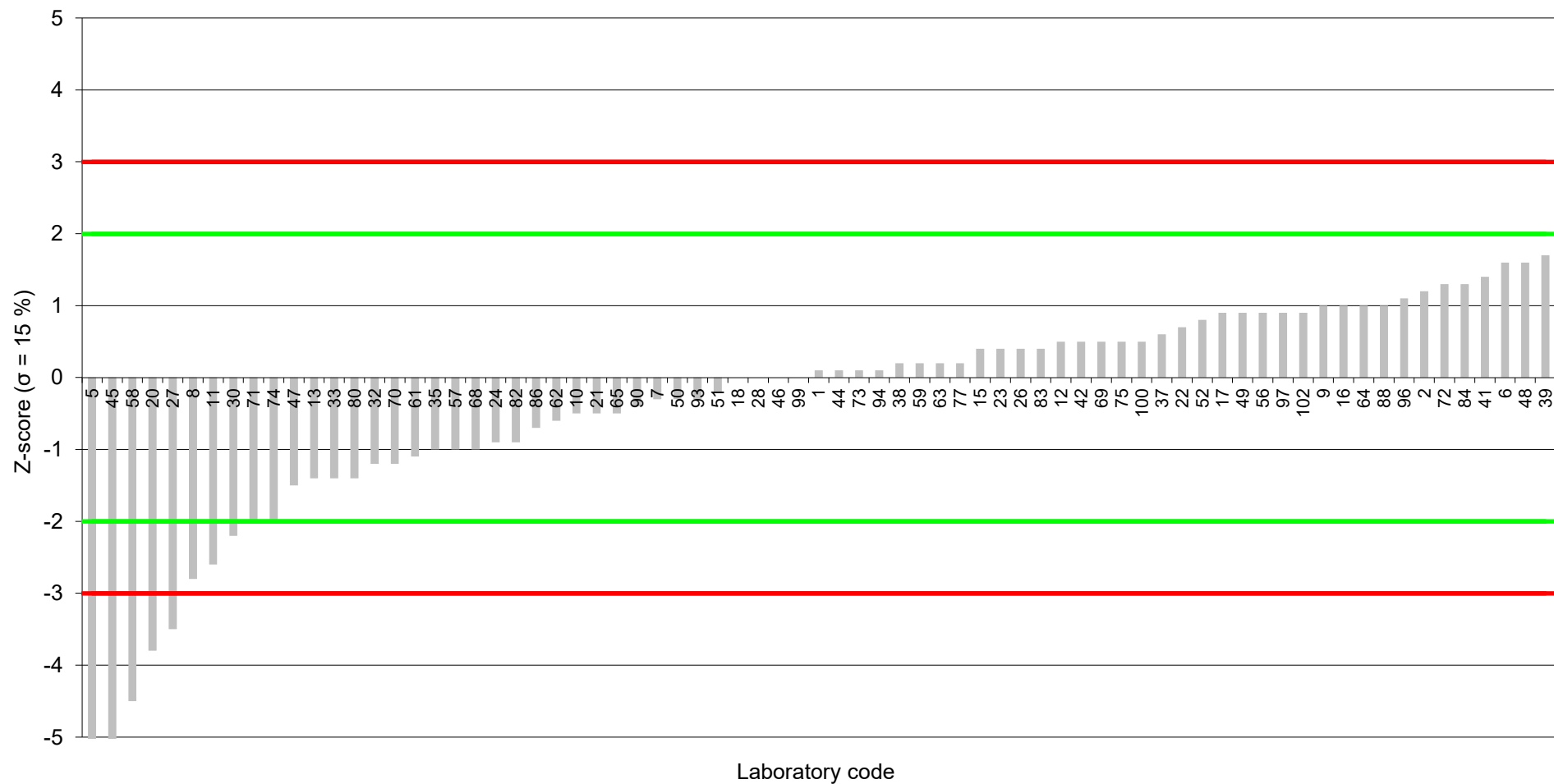
Assigned value: 1.64 pg/g wet weight



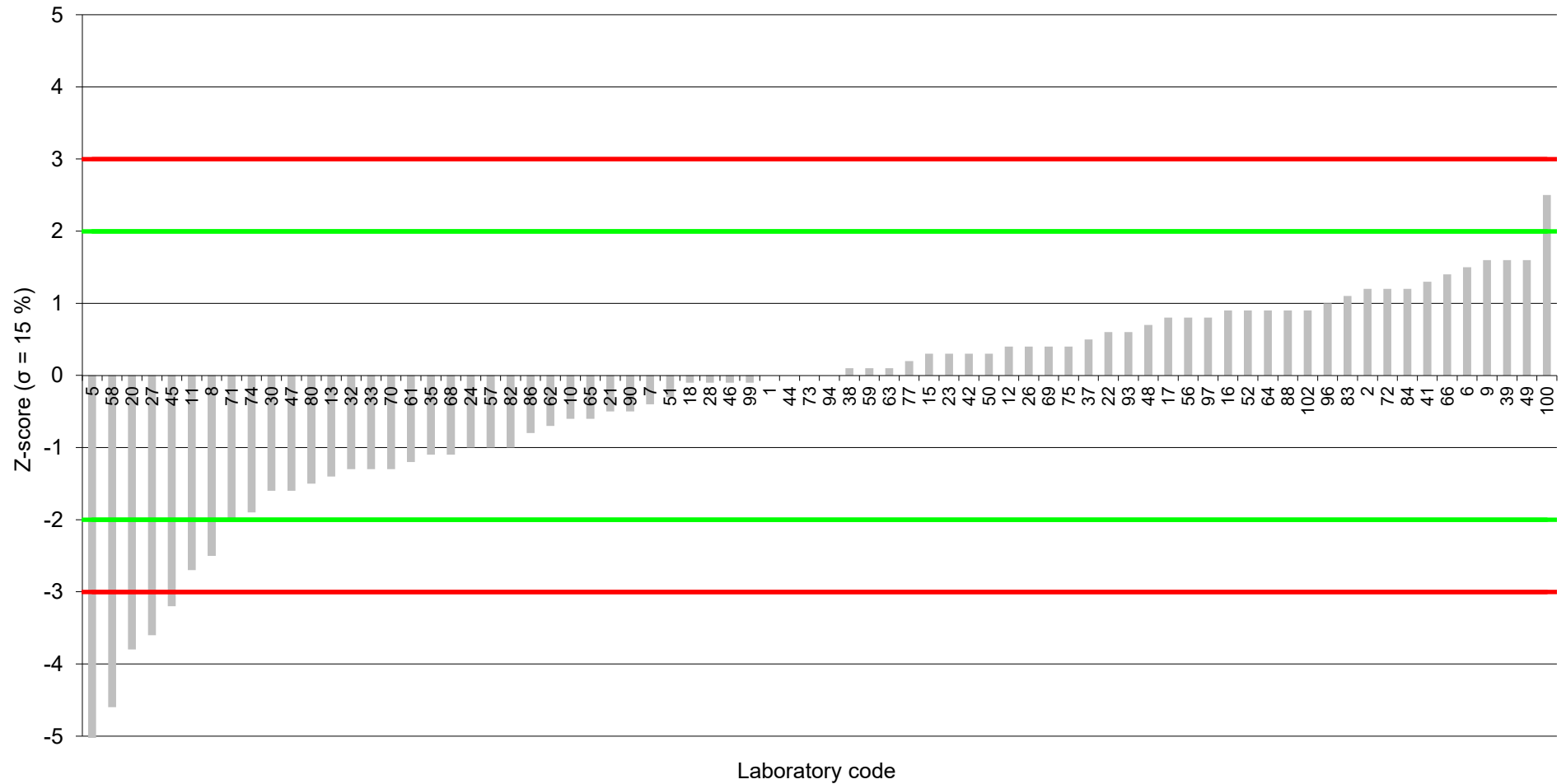
Fish Fillet (2501-FF)
Sum of 6 NDL-PCBs upper bound (reported)
Assigned value: 39.4 ng/g wet weight



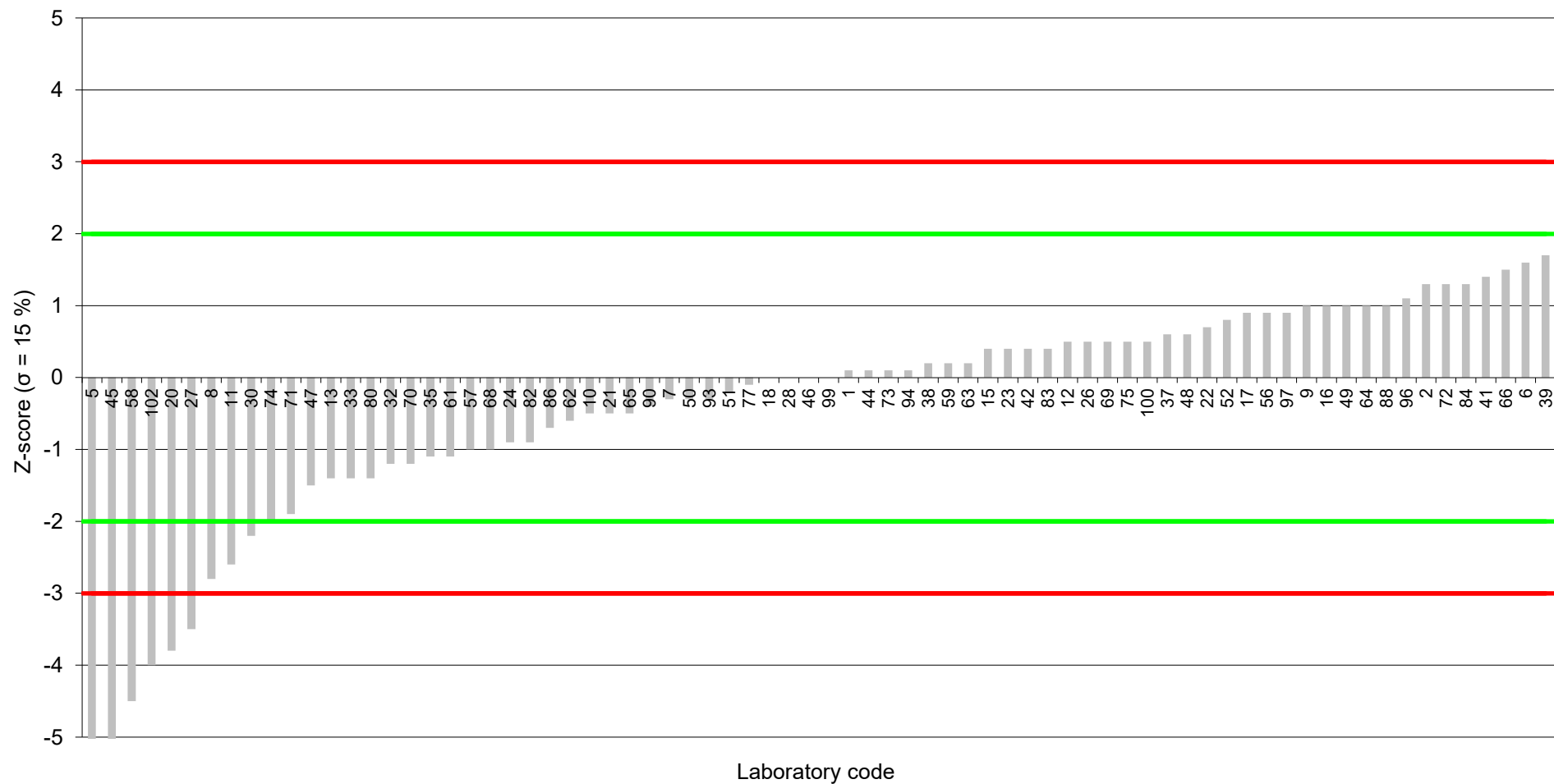
Fish Fillet (2501-FF)
Sum of 6 NDL-PCBs lower bound (reported)
Assigned value: 39 ng/g wet weight



Fish Fillet (2501-FF)
Sum of 6 NDL-PCBs upper bound (calculated)
Assigned value: 39.5 ng/g wet weight



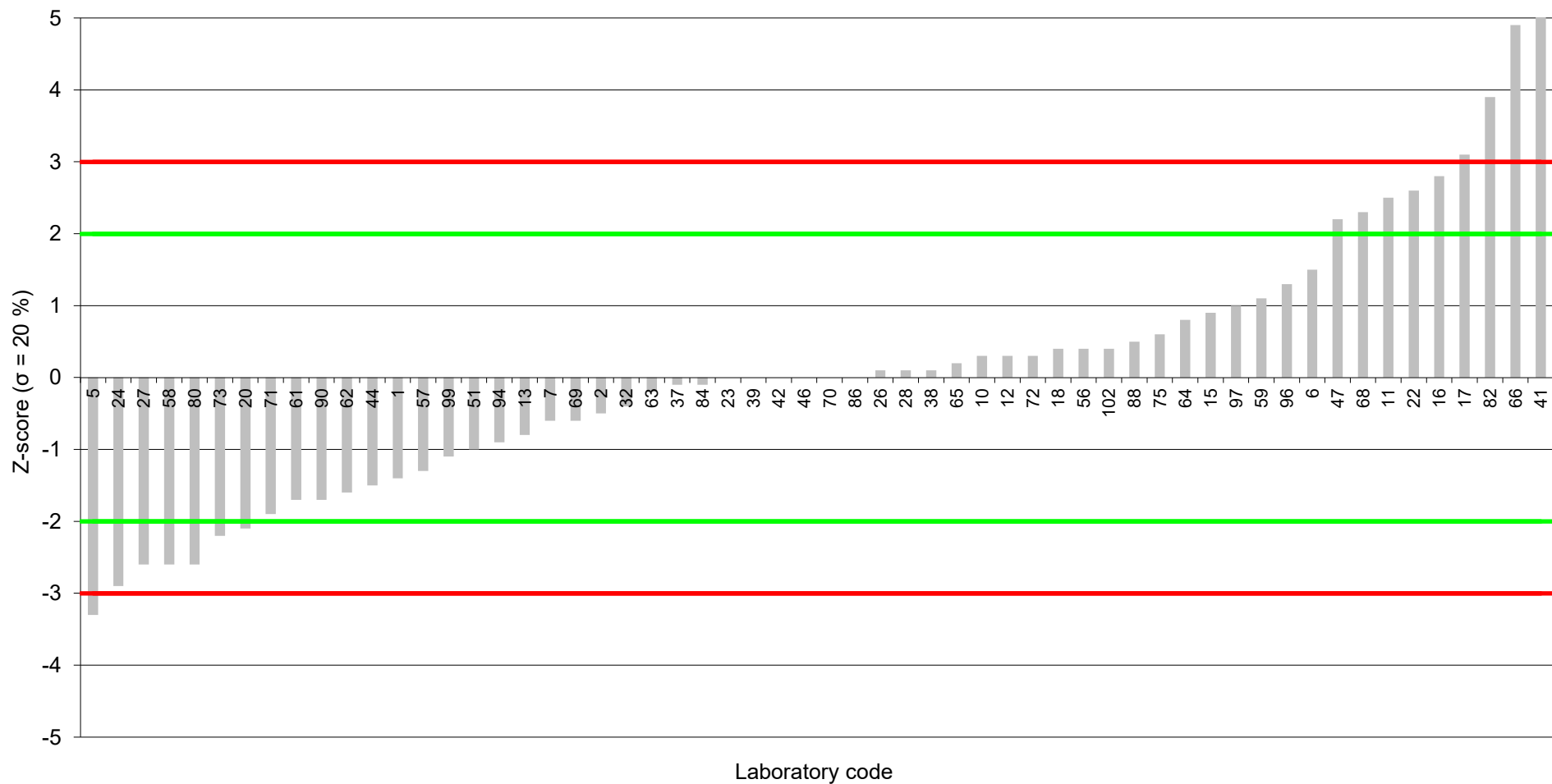
Fish Fillet (2501-FF)
Sum of 6 NDL-PCBs lower bound (calculated)
Assigned value: 39 ng/g wet weight



Fish Fillet (2501-FF)

PCB 28

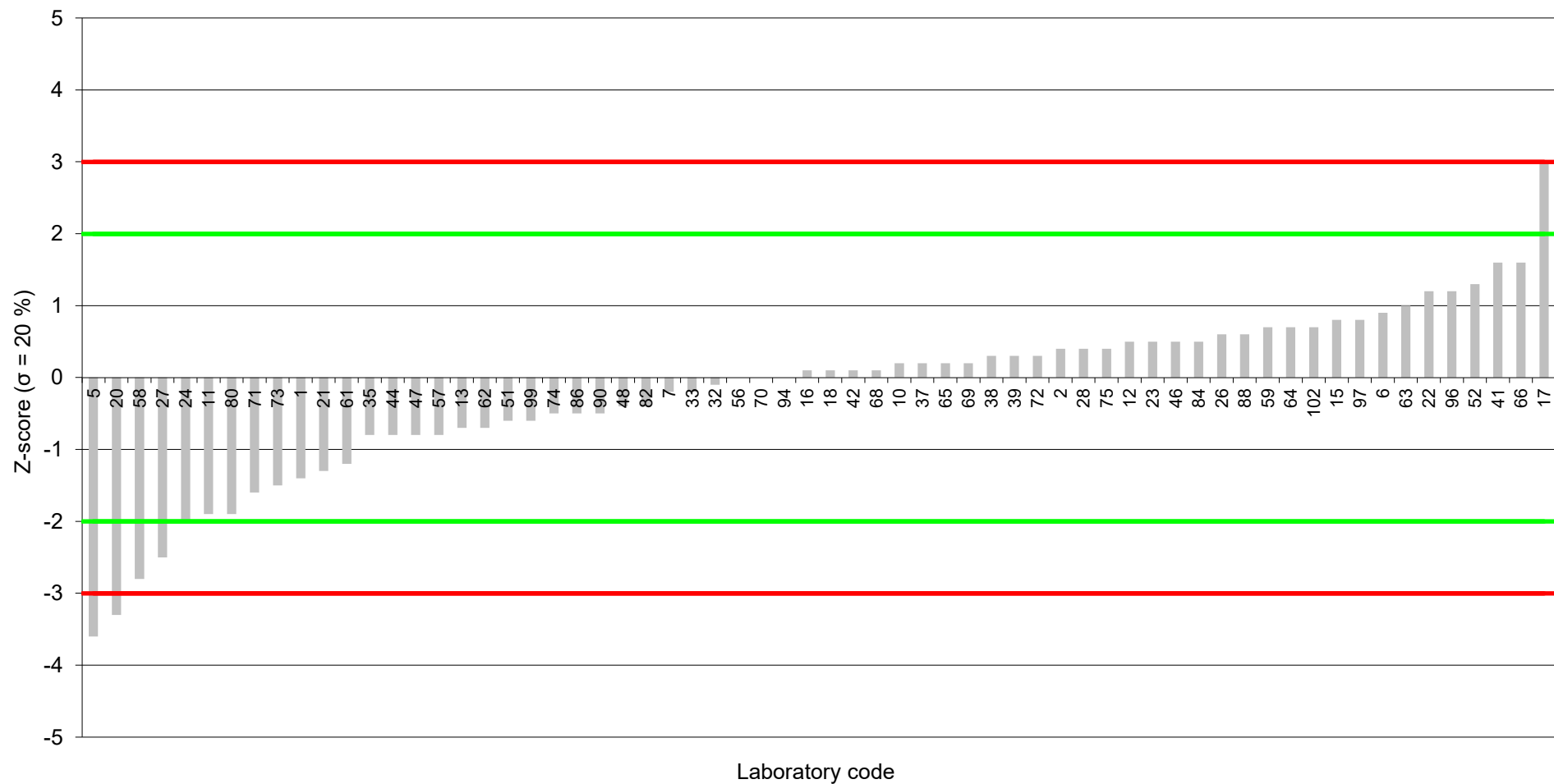
Assigned value: 0.536 ng/g wet weight



Fish Fillet (2501-FF)

PCB 52

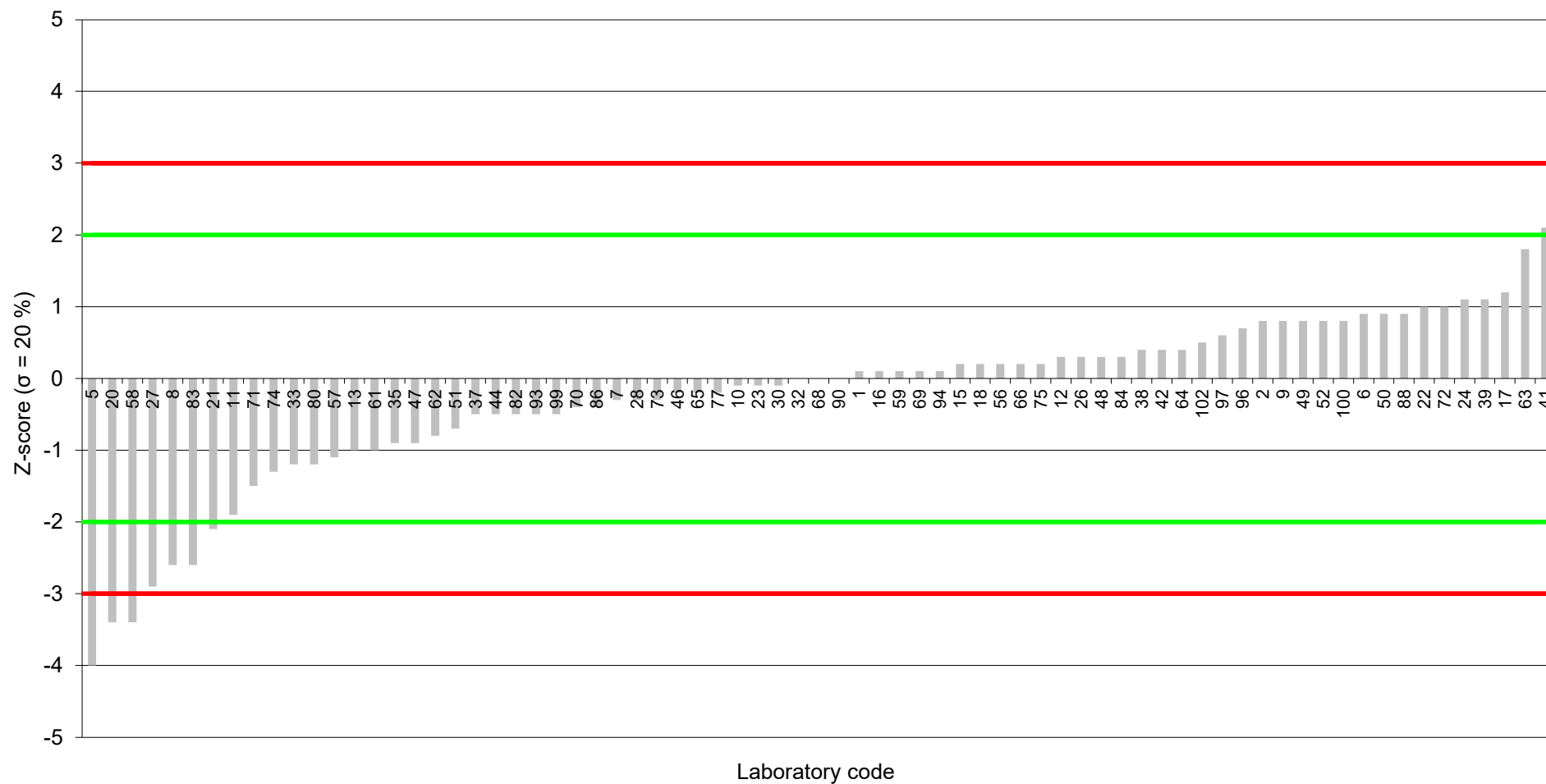
Assigned value: 1.46 ng/g wet weight



Fish Fillet (2501-FF)

PCB 101

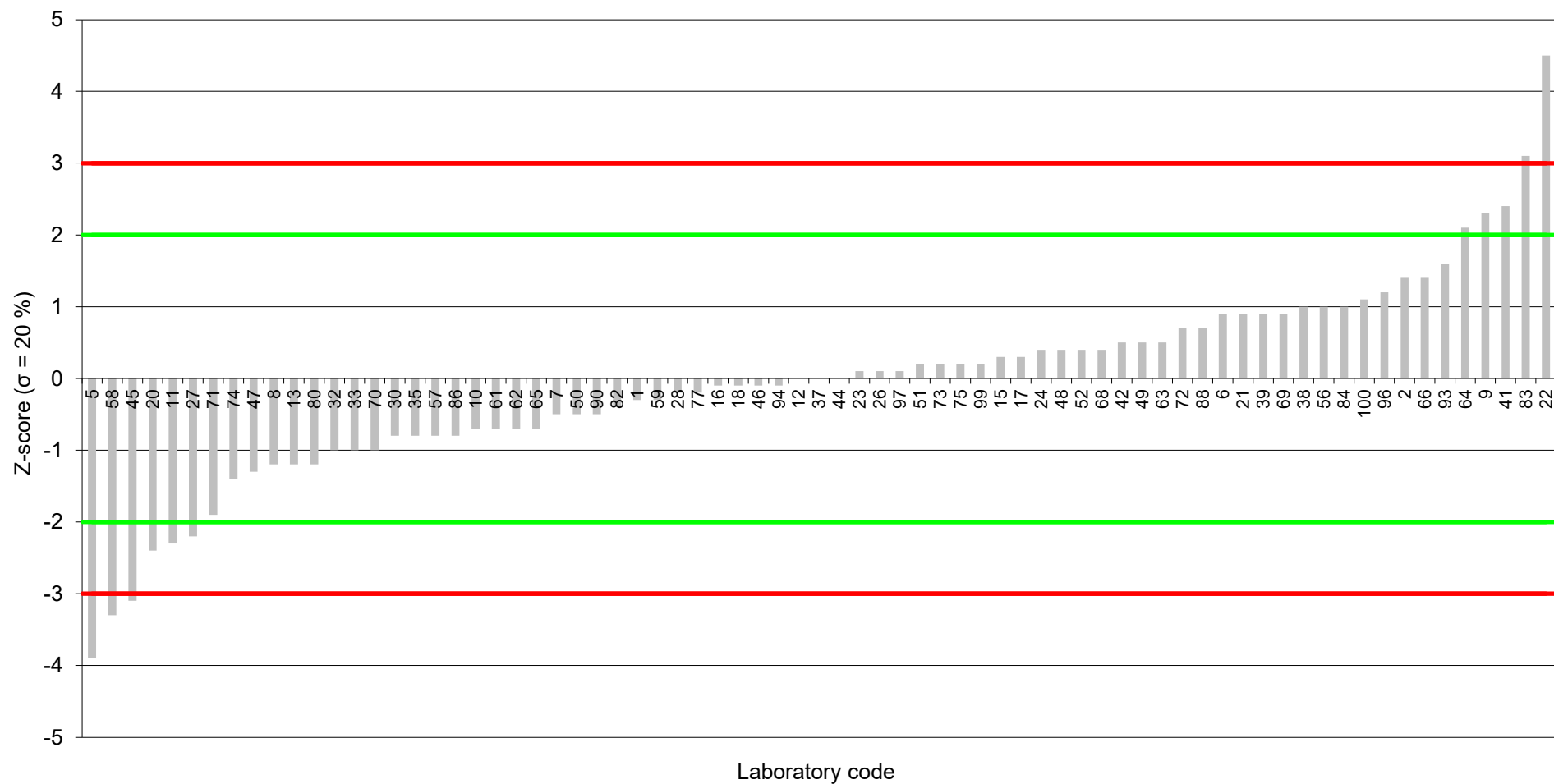
Assigned value: 5.73 ng/g wet weight



Fish Fillet (2501-FF)

PCB 138

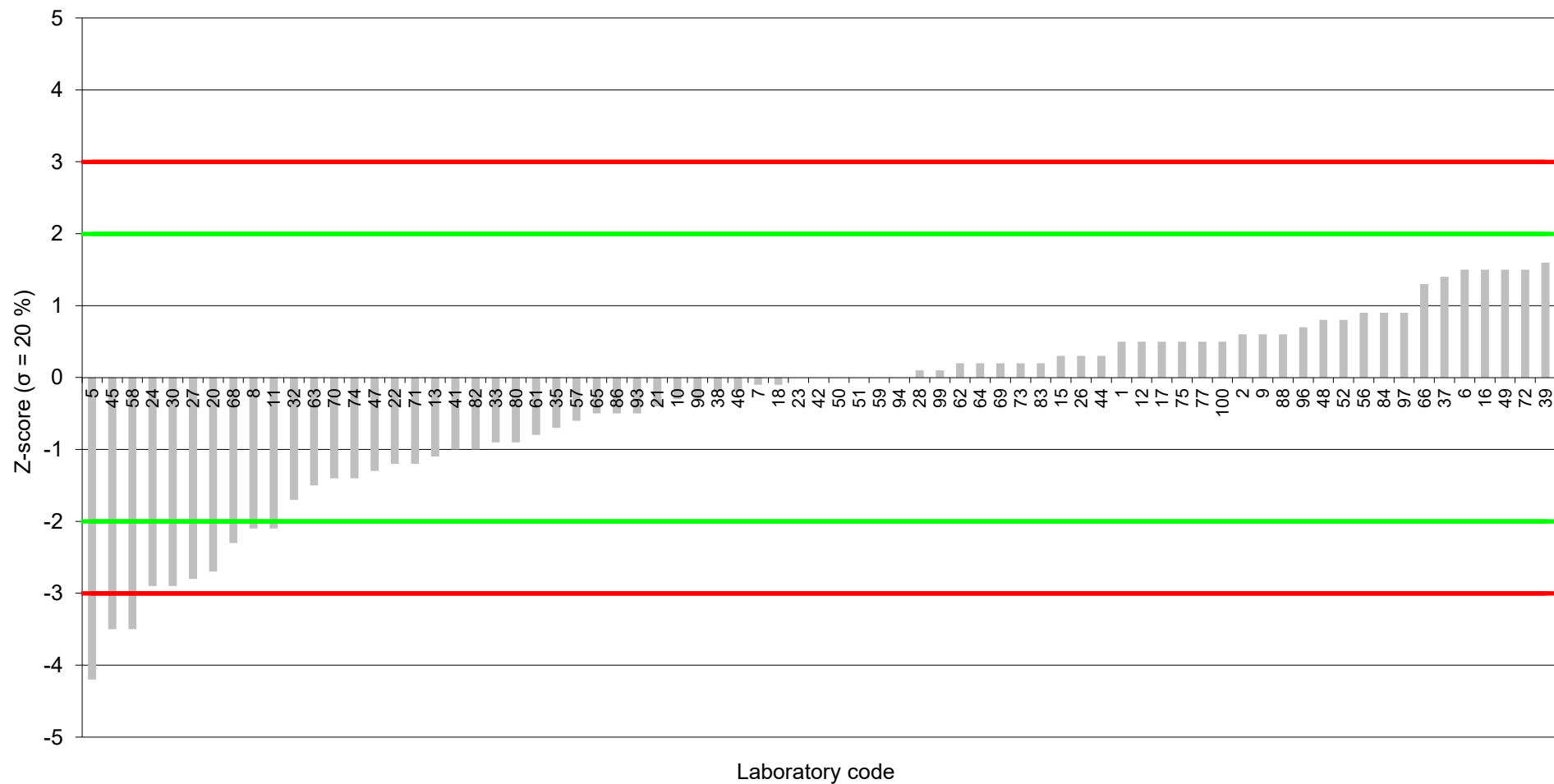
Assigned value: 9.91 ng/g wet weight



Fish Fillet (2501-FF)

PCB 153

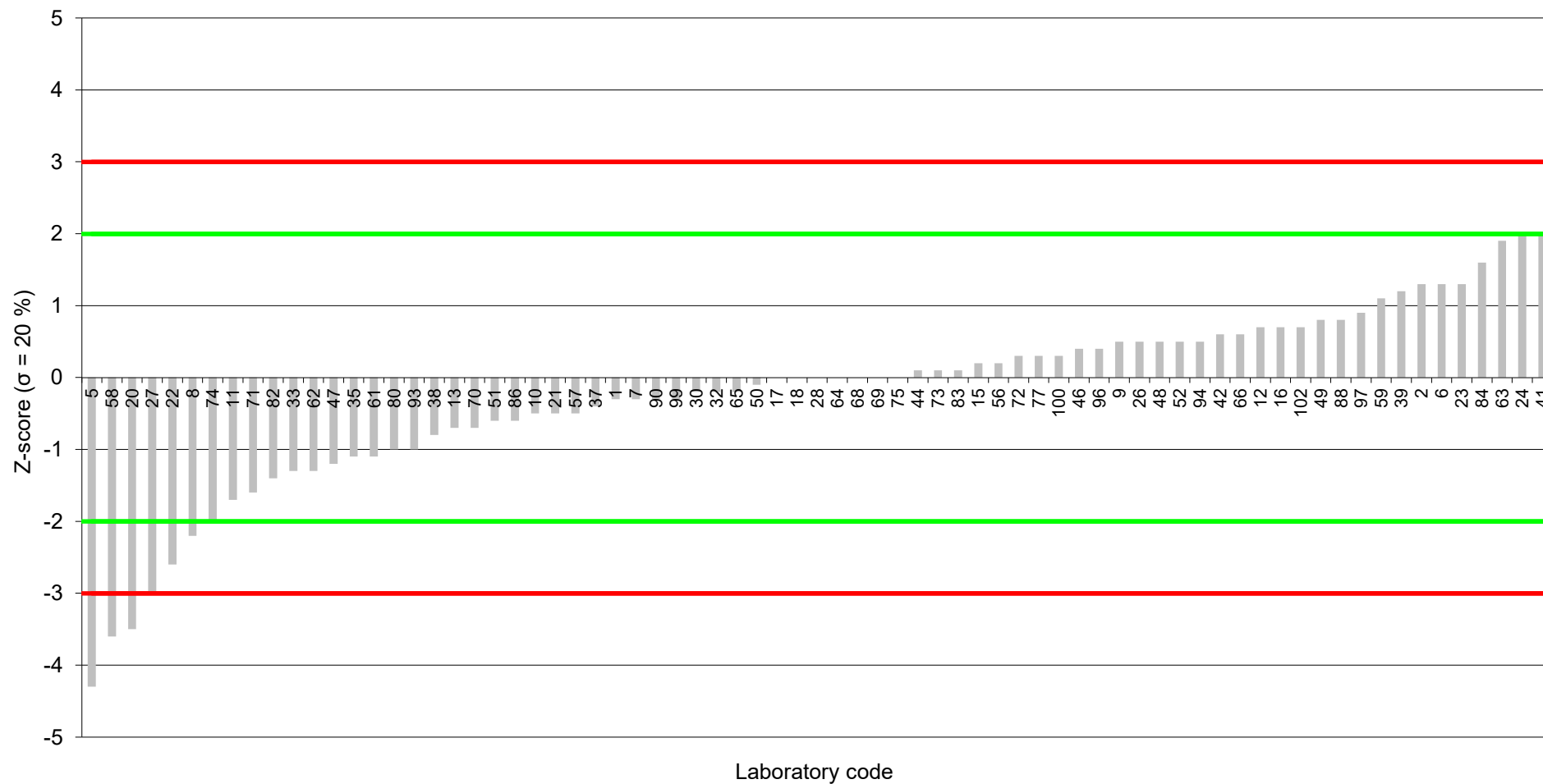
Assigned value: 15.5 ng/g wet weight



Fish Fillet (2501-FF)

PCB 180

Assigned value: 6.08 ng/g wet weight





EURL Proficiency Study on the Determination of PCDD/Fs, PCBs, PBDEs, HBCDDs and PFAS in Fish Fillet 2025 [EURL-PT-POP_2501-FF]

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

28 January 2026

Annex 5: Scoring system for PCDD/Fs and PCBs

Test sample - Fish Fillet (2501-FF)

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:

$$\text{Maximum score} = \Sigma \text{max. score}(> 10 \%) + \Sigma \text{max. score}(3-10 \%) + \Sigma \text{max. score}(< 3 \%)$$

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

$$\text{Participant's score} = \Sigma \text{score}(> 10 \%) + \Sigma \text{score}(3-10 \%) + \Sigma \text{score}(< 3 \%)$$

- Calculation of achieved scoring percentage for each participant:

$$\text{Participant's scoring percentage} = \text{Participant's score} / \text{Maximum score} \cdot 100$$

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
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.

Fish Fillet (2501-FF)
Summary Scoring system

LC	Sample	Scoring system	WHO-PCDD/F-PCB-TEQ*	WHO-PCDD/F-TEQ*	WHO-PCB-TEQ	Sum Indicator PCBs	Sum Parameters	PCDD/F congeners*	DL-PCB congeners	NDL-PCB congeners	Calculation of sum parameters	Evaluation	Successful participation	Reason for not successful participation				
			z-score	z-score	z-score	z-score	(≤ 1 parameter with lz-scorel ≥ 2, no parameter with lz-scorel ≥ 3)	(≥ 75 % of max. score)	(≥ 75 % of max. score)	(≥ 75 % of max. score)	(deviation ≤ 10 %)			Sum parameters	PCDD/F congeners	DL-PCB congeners	NDL-PCB congeners	Calculation sum param.
1	2501-FF		0.1	1.9	-0.1	0.0	Passed	100%	100%	100%	yes		yes					
2	2501-FF					1.2	Passed			100%	yes		yes					
5	2501-FF		-3.7	14.3	-6.4	-5.5	Failed	20%	12%	0%	yes		no	x		x	x	
6	2501-FF		1.0	0.9	1.0	1.5	Passed	100%	100%	100%	yes		yes					
7	2501-FF		0.9	0.0	1.0	-0.4	Passed	92%	100%	100%	yes		yes					
8	2501-FF					-2.5	Passed			63%	yes		no				x	
9	2501-FF					1.6	Passed			88%	yes		yes					
10	2501-FF		0.5	-0.5	0.6	-0.6	Passed	83%	100%	100%	yes		yes					
11	2501-FF					-2.7	Passed			76%	yes		yes					
12	2501-FF		0.2	1.9	-0.1	0.5	Passed	100%	100%	100%	yes		yes					
13	2501-FF		-1.3	-1.3	-1.3	-1.4	Passed	100%	100%	100%	yes		yes					
15	2501-FF		0.9	-0.1	1.0	0.4	Passed	100%	100%	100%	yes		yes					
16	2501-FF		0.1	-2.1	0.4	0.9	Passed	100%	100%	95%	yes		yes					
17	2501-FF		1.7	0.3	1.9	0.8	Passed	96%	88%	84%	yes		yes					
18	2501-FF		1.0	1.9	0.8	-0.1	Passed	100%	100%	100%	yes		yes					
20	2501-FF		-0.4	1.1	-0.6	-3.8	Failed	100%	100%	24%	yes		no	x			x	
21	2501-FF					-0.4	Passed			89%	yes		yes					
22	2501-FF		7.1	9.8	6.7	0.6	Failed	50%	65%	66%	yes		no	x		x	x	
23	2501-FF		0.8	-3.8	1.5	0.3	Passed	92%	88%	100%	yes		yes					
24	2501-FF		4.6	9.3	3.9	-1.0	Failed	60%	66%	85%	yes		no	x		x		
26	2501-FF		-0.2	-0.7	-0.1	0.4	Passed	100%	100%	100%	yes		yes					
27	2501-FF					-3.6	Failed			50%	yes		no	x			x	
28	2501-FF					-0.1	Passed			100%	yes		yes					
30	2501-FF		1.9	6.9	1.1	-1.5	Passed	100%	100%	88%	yes		yes					
32	2501-FF		0.5	4.3	-0.1	-1.3	Passed	58%	100%	100%	yes		yes					
33	2501-FF					-1.3	Passed			100%	yes		yes					
34	2501-FF			0.6				83%			no							x
35	2501-FF					-1.2	Passed			100%	yes		yes					
37	2501-FF		-1.0	-0.4	-1.1	0.5	Passed	91%	100%	100%	yes		yes					
38	2501-FF					0.2	Passed			100%	yes		yes					
39	2501-FF		1.0	0.6	1.1	1.6	Passed	100%	100%	100%	yes		yes					
41	2501-FF		-1.9	-0.1	-2.2	1.3	Passed	92%	92%	71%	yes		no				x	
42	2501-FF		0.4	1.1	0.1	0.4	Passed	100%	100%	100%	yes		yes					
44	2501-FF					0.0	Passed		100%	100%	yes		yes					
45	2501-FF					-3.2	Failed			0%	yes		no	x			x	
46	2501-FF		0.6	-0.7	0.8	-0.1	Passed	96%	100%	100%	yes		yes					
47	2501-FF		-1.9	-0.5	-2.1	-1.6	Passed	100%	100%	95%	yes		yes					
48	2501-FF					1.7	Passed			100%	no		no					x
49	2501-FF					1.5	Passed		100%	100%	yes		yes					
50	2501-FF		-0.9	0.4	-1.1	0.3	Passed	90%	92%	100%	yes		yes					
51	2501-FF		0.3	1.3	0.1	-0.3	Passed	100%	100%	100%	yes		yes					
52	2501-FF					0.9	Passed			100%	yes		yes					
54	2501-FF		-1.8	-4.0	-1.4		Passed	79%	100%		yes		yes					
56	2501-FF					0.9	Passed			100%	yes		yes					
57	2501-FF		-1.6	-4.6	-1.1	-1.0	Passed	85%	100%	100%	yes		yes					
58	2501-FF		-6.2	-2.5	-6.7	-4.6	Failed	0%	4%	11%	yes		no	x		x	x	
59	2501-FF		1.1	1.1	1.1	0.2	Passed	93%	100%	100%	yes		yes					
61	2501-FF					-1.2	Passed			100%	yes		yes					
62	2501-FF		-1.0	1.0	-1.4	-0.7	Passed	93%	96%	100%	yes		yes					
63	2501-FF		1.1	0.9	1.1	0.2	Passed	100%	100%	100%	yes		yes					
64	2501-FF		0.3	1.3	0.1	0.9	Passed	96%	92%	90%	yes		yes					
65	2501-FF		0.1	0.8	0.0	-0.6	Passed	100%	100%	100%	yes		yes					
66	2501-FF									90%								
68	2501-FF		-7.7	-2.9	-8.4	-1.1	Failed	0%	0%	85%	no		no	x		x		x
69	2501-FF		0.6	0.3	0.7	0.4	Passed	100%	100%	100%	yes		yes					

Fish Fillet (2501-FF)
Summary Scoring system

LC	Sample	Scoring system	WHO-PCDD/F-PCB-TEQ*	WHO-PCDD/F-TEQ*	WHO-PCB-TEQ	Sum Indicator PCBs	Sum Parameters	PCDD/F congeners*	DL-PCB congeners	NDL-PCB congeners	Calculation of sum parameters	Evaluation	Successful participation	Reason for not successful participation					
			z-score	z-score	z-score	z-score	(≤ 1 parameter with z-score ≥ 2, no parameter with z-score ≥ 3)	(≥ 75 % of max. score)	(≥ 75 % of max. score)	(≥ 75 % of max. score)	(deviation ≤ 10 %)			Sum parameters	PCDD/F congeners	DL-PCB congeners	NDL-PCB congeners	Calculation sum param.	
70	2501-FF		-0.6	-4.0	-0.1	-1.3	Passed	58%	92%	100%	yes		yes						
71	2501-FF		-3.1	-3.1	-3.1	-2.0	Failed	100%	100%	100%	yes		no	x					
72	2501-FF		1.2	0.8	1.3	1.3	Passed	100%	100%	100%	yes		yes						
73	2501-FF					0.0	Passed			95%	yes		yes						
74	2501-FF		1.0	0.3	1.1	-1.9	Passed	100%	84%	100%	yes		yes						
75	2501-FF		0.6	1.5	0.5	0.4	Passed	88%	92%	100%	yes		yes						
77	2501-FF		2.3	1.2	2.5	0.1	Passed	82%	88%	100%	yes		yes						
78	2501-FF																		
80	2501-FF		-2.0	-4.7	-1.5	-1.5	Passed	71%	100%	95%	yes		yes						
82	2501-FF		-1.8	2.7	-2.5	-1.0	Passed	92%	100%	90%	no		no					x	
83	2501-FF					1.2	Passed			63%	yes		no				x		
84	2501-FF					1.2	Passed			100%	yes		yes						
86	2501-FF		-0.7	4.3	-1.7	-0.7	Passed	60%	100%	100%	yes		yes						
87	2501-FF		0.4	0.3	0.1		Passed	100%	100%		yes		yes						
88	2501-FF		2.7	4.7	2.4	0.9	Passed	33%	88%	100%	yes		yes						
90	2501-FF		-2.1	-5.5	-1.5	-0.5	Passed	58%	100%	100%	yes		yes						
92	2501-FF		-1.5	-2.3	-1.3		Passed	95%	100%		yes		yes						
93	2501-FF					0.6	Passed			100%	yes		yes						
94	2501-FF		-0.7	-0.8	-0.7	0.0	Passed	100%	100%	100%	yes		yes						
96	2501-FF					1.0	Passed			100%	yes		yes						
97	2501-FF		0.9	1.1	0.9	0.8	Passed	83%	100%	100%	yes		yes						
99	2501-FF					-0.1	Passed			100%	yes		yes						
100	2501-FF					2.5	Passed			100%	yes		yes						
102	2501-FF		3.9	-1.8	4.8	0.8	Failed		91%	84%	100%		no		no	x			x
*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																			



EURL Proficiency Study on the Determination of PCDD/Fs, PCBs, PBDEs, HBCDDs and PFAS in Fish Fillet 2025 [EURL-PT-POP_2501-FF]

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

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

Test sample - Fish Fillet (2501-FF)



EURL Proficiency Test on the Determination of PCDD/Fs, PCBs, PBDEs, HBCDDs and PFASs in Fish Fillet 2025 [EURL-PT-POP_2501-FF]
EURL for halogenated Persistent Organic Pollutants (POPs) in Feed and Food

Fish Fillet (2501-FF)
Sum parameters - Homogeneity test - Data

Analyte	Result pg/g wet weight	Mean (n = 10, duplicate analysis)	Median (n = 10, duplicate analysis)	Relative standard deviation [%]
WHO-PCDD/F-PCB-TEQ upper bound		1.92	1.95	4%
WHO-PCDD/F-PCB-TEQ middle bound		1.92	1.95	4%
WHO-PCDD/F-PCB-TEQ lower bound		1.92	1.95	4%

EURL Proficiency Test on the Determination of PCDD/Fs, PCBs, PBDEs, HBCDDs and PFASs in Fish Fillet 2025 [EURL-PT-POP_2501-FF]

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

Fish Fillet (2501-FF)

PCDD/F - Homogeneity test - Data

Analyte	Result pg/g wet weight	Mean (n = 10, single analysis)	Median (n = 10, single analysis)	Relative standard deviation [%]
WHO-PCDD/F-TEQ upper bound		0.267	0.266	4%
WHO-PCDD/F-TEQ middle bound		0.267	0.266	4%
WHO-PCDD/F-TEQ lower bound		0.267	0.266	4%
2,3,7,8-TCDD		0.0429	0.0433	8%
1,2,3,7,8-PeCDD		0.0447	0.0436	10%
1,2,3,4,7,8-HxCDD		0.0146	0.0143	22%
1,2,3,6,7,8-HxCDD		0.0440	0.0434	12%
1,2,3,7,8,9-HxCDD		0.00912	0.00931	22%
1,2,3,4,6,7,8-HpCDD		0.0458	0.0455	18%
1,2,3,4,6,7,8,9-OCDD		0.0943	0.0846	25%
2,3,7,8-TCDF		0.914	0.917	6%
1,2,3,7,8-PeCDF		0.105	0.105	7%
2,3,4,7,8-PeCDF		0.234	0.237	3%
1,2,3,4,7,8-HxCDF		0.0326	0.0313	11%
1,2,3,6,7,8-HxCDF		0.0172	0.0171	12%
2,3,4,6,7,8-HxCDF		0.0163	0.0156	18%
1,2,3,7,8,9-HxCDF		<0.001		
1,2,3,4,6,7,8-HpCDF		0.0106	0.0103	22%
1,2,3,4,7,8,9-HpCDF		<0.001		
1,2,3,4,6,7,8,9-OCDF		<0.02		



EURL Proficiency Test on the Determination of PCDD/Fs, PCBs, PBDEs, HBCDDs and PFASs in Fish Fillet 2025 [EURL-PT-POP_2501-FF]

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

Fish Fillet (2501-FF)

DL-PCB - Homogeneity test - Data

Analyte	Result pg/g wet weight	Mean (n = 10, duplicate analysis)	Median (n = 10, duplicate analysis)	Relative standard deviation [%]
WHO-PCB-TEQ upper bound		1.64	1.63	6%
WHO-PCB-TEQ middle bound		1.64	1.63	6%
WHO-PCB-TEQ lower bound		1.64	1.63	6%
PCB 105		839	807	10%
PCB 114		50.2	50.1	4%
PCB 118		4220	4230	4%
PCB 123		45.9	44.6	6%
PCB 156		896	883	6%
PCB 157		112	109	7%
PCB 167		615	612	3%
PCB 189		107	105	4%
PCB 77		42.4	43.6	14%
PCB 81		1.88	1.95	12%
PCB 126		13.4	13.6	10%
PCB 169		1.62	1.66	9%



EURL Proficiency Test on the Determination of PCDD/Fs, PCBs, PBDEs, HBCDDs and PFASs in Fish Fillet 2025 [EURL-PT-POP_2501-FF]
 EURL for Halogenated Persistent Organic Pollutants (POPs) in Feed and Food

Fish Fillet (2501-FF)
 NDL-PCB - Homogeneity test - Data

Analyte	Result ng/g wet weight	Mean (n = 10, duplicate analysis)	Median (n = 10, duplicate analysis)	Relative standard deviation [%]
Sum Indicator PCBs upper bound		38.7	37.4	10%
Sum Indicator PCBs middle bound		38.7	37.4	10%
Sum Indicator PCBs lower bound		38.7	37.4	10%
PCB 28		0.528	0.554	15%
PCB 52		1.48	1.58	13%
PCB 101		5.80	5.54	11%
PCB 138		8.32	8.54	8%
PCB 153		14.5	14.6	4%
PCB 180		5.91	6.01	5%



EURL Proficiency Test on the Determination of PCDD/Fs, PCBs, PBDEs, HBCDDs and PFASs in Fish Fillet 2025 [EURL-PT-POP_2501-FF]

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

Fish Fillet (2501-FF)

Selected congeners - Homogeneity test - Data

Sample	Replicate	Result pg/g / ng/g wet weight	WHO-PCB-TEQ ub	PCB 118	PCB 153
34	1		1.49	4002	14.0
	2		1.59	4430	14.5
61	1		1.64	4521	14.9
	2		1.61	4239	13.7
74	1		1.63	4133	13.7
	2		1.74	4380	15.2
100	1		1.55	4389	15.6
	2		1.45	3789	15.5
111	1		1.56	4192	14.4
	2		1.71	4226	14.2
114	1		1.75	4325	14.7
	2		1.63	4139	14.9
118	1		1.75	4255	14.6
	2		1.75	4236	13.9
167	1		1.74	4230	14.5
	2		1.55	4193	15.0
192	1		1.73	4304	14.6
	2		1.70	4032	14.2
200	1		1.57	4070	14.0
	2		1.54	4367	14.6
Cochran's C-test					
C			0.313	0.408	0.575
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 $\bar{x}$			1.63	4223	14.6
Standard deviation of sample averages s_x			0.081	72.8	0.40
Within-sample standard deviation s_w			0.073	210.2	0.46
Between-sample standard deviation s_s			0.063	0.00	0.24
Standard deviation for proficiency assessment σ_{PT}			0.245	844.511	2.9
s_s / σ_{PT}			0.26	0	0.081
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 Fillet 2025 [EURL-PT-POP_2501-FF]

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

Fish Fillet (2501-FF)

Selected congeners - Stability test - Data

Sample	Replicate	Result pg/g wet weight	WHO-PCDD/F-TEQ ub	PCB 118	PCB 153
35	1		1.66	4109	14.5
	2		1.65	4241	14.6
108	1		1.64	4172	14.2
	2		1.68	4226	14.5
197	1		1.65	4174	15.1
	2		1.67	4265	14.6
Stability test					
General average (stability test) $\bar{y}$			1.66	4198	14.60
General average (homogeneity test) $\bar{x}$			1.63	4223	14.6
Standard deviation for proficiency assessment σ_{PT}			0.245	845	2.92
$ \bar{y} - \bar{x} $			0.025	25	0.0
Test for stability ($ \bar{y} - \bar{x} \leq 0.3 \sigma_{PT}$)			passed	passed	passed



EURL Proficiency Study on the Determination of PCDD/Fs, PCBs, PBDEs, HBCDDs and PFAS in Fish Fillet 2025 [EURL-PT-POP_2501-FF]

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

28 January 2026

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

Test sample - Fish Fillet (2501-FF)

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	
1	2501-FF	2.7	YES	YES	YES				
2	2501-FF	3.03	no	no	yes				
5	2501-FF	10	yes	yes	yes				
6	2501-FF	53.4	yes	yes	yes				
7	2501-FF	25	yes	yes	yes				
8	2501-FF	2.0		yes	yes				
9	2501-FF	2	no	no	Yes			PCB198 + DDTd8 PCB-111 (injection standard)	
10	2501-FF	10.0	yes	yes	yes				
11	2501-FF	10	no	no	no			PCB 29 and PCB 206	
11	2501-FF	10	no	no	no			PCB 29 and PCB 206	
12	2501-FF	15.0	yes	yes	yes				
13	2501-FF	30.00	yes	yes	yes				
15	2501-FF	20	yes	yes	yes	all 13C-: CB70, CB111, CB138, CB178, 1378-TCDD, 12478-PeCDD, 123468-HxCDD, 1234679-HpCDD 1,2,3,4- TCDD	moPCBs: all 13C-: CB60, CB70, CB111, CB127, CB159, CB170 (for noPCBs see PCDD/Fs) PCB 111	all 13C-: CB60, CB70, CB111, CB127, CB159, CB170 PCB 111	
16	2501-FF	37	yes	yes	yes				
17	2501-FF	39.0	YES	YES	YES				
18	2501-FF	7.8							
20	2501-FF	50	yes	yes	yes				
21	2501-FF	1			no	yes	yes	no	
22	2501-FF	2	yes	yes	yes				
23	2501-FF	64.71	yes	yes	yes				
24	2501-FF	10	yes	yes	yes				
26	2501-FF	15.15	yes	yes	yes				
27	2501-FF	5			yes				
28	2501-FF	3.5			YES			C13-PCB-178 SYRINGE STANDARD PCB-155-13C12	
30	2501-FF	24.7	Yes	Yes	Yes				
32	2501-FF	25.89	Yes	Yes	Yes				
33	2501-FF	10						epsilon-HCH, PCB 167	
34	2501-FF								
35	2501-FF	20	N/A	N/A	Yes	N/A	N/A	3,3',4,4',5-Pentachlorobiphenyl 13C12	
37	2501-FF	20.897	yes	yes	yes				
38	2501-FF	5	no	no	no			PCB 209, to check the extraction, not used for quantification	
39	2501-FF	30.53	yes	yes	yes				
41	2501-FF	74.17	Yes	Yes	Yes				
42	2501-FF	25	yes	yes	yes				
44	2501-FF	23.06	yes	yes	yes				
45	2501-FF	5			yes				
46	2501-FF	60.68	yes	yes	yes				
47	2501-FF	10	yes	yes	yes				
48	2501-FF	5			no			tetrachloronaphthalene (TCN)	
49	2501-FF	5.00		yes	yes				
50	2501-FF	10.0	yes	yes	yes				
51	2501-FF	9	yes	yes	yes				
52	2501-FF	20							
54	2501-FF	56.7	yes	yes		13C-1,2,3,4-Ci4DD, 13C- 1,2,3,4,6-Ci5DF, 13C -1,2,3,4,6,9-Ci6DF, 13C-1,2,3,4,6,8,9-Ci7DF			
56	2501-FF	10			yes				PCB-198
57	2501-FF	1	yes	yes	yes				
58	2501-FF	20	Yes	Yes	Yes				
59	2501-FF	11232	yes	yes	yes				
61	2501-FF	2		no				PCB 207	
62	2501-FF								
63	2501-FF	62.37	No (were used 15 labelled congeners)	Yes	Yes				
64	2501-FF	25	yes	yes	yes				
65	2501-FF	20.0	yes	yes	yes				
66	2501-FF	2.00							
68	2501-FF	10.0	YES	YES	YES				
69	2501-FF	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	
70	2501-FF	40.15	yes	yes	yes				
71	2501-FF	20	yes	yes	yes				
72	2501-FF	23.05	yes	yes	yes				
73	2501-FF	0.26			yes				
74	2501-FF	15.00	yes	yes	no			PCB-155 and PCB-54	
75	2501-FF	10	yes	yes	yes				
77	2501-FF	5	yes	yes	yes				
78	2501-FF								
80	2501-FF	20	yes	yes	yes				
82	2501-FF	5.0	yes	yes	yes				
83	2501-FF	5			no			PCB 209	
84	2501-FF	15.03			yes				
86	2501-FF	30	yes	yes	yes				
87	2501-FF	54	yes	yes	yes	1,2,3,4-TCDD, isotope-labelled	PCB 80, isotope-labelled		
88	2501-FF	30.9695	YES	YES	YES				
90	2501-FF	120	yes	yes	yes				
92	2501-FF	10.492	yes	yes	no				
93	2501-FF	3			yes				
94	2501-FF	5	Yes	Yes	Yes	-	-	-	
96	2501-FF	5			yes				
97	2501-FF	1.97	yes	yes	yes				
99	2501-FF	1.03			yes				
100	2501-FF	10			yes				
102	2501-FF	30.796	yes	yes	yes				

LC	Sample	Extraction					
		Sample preparation/pre-treatment	Extraction technique	Extraction solvent	Extraction time [h]	Extraction temperature [°C]	Extraction pressure [MPa]
1	2501-FF	FREEZE-DRYING	ASE	TOLUENE	0.5	135	1500
2	2501-FF	freeze-dring	ASE	toluene/acetone (7:3 (v/v))	0.33	100	14
5	2501-FF	no	ASE	Hexan	0.3	80	10. Jan
6	2501-FF	homogenize	shaking with solvent	hexane/acetone 50/50	0.1 for each step (4 consecutive extractions)	20	
7	2501-FF	mixing with drying agent	ASE	hexane:dichloromethane 1:1	0.25	100	
8	2501-FF		ASE	hexane	40 min	80°C	
9	2501-FF	no	ultra turrax	hexane/acetone 50/50 (v/v)	0.017	ambiente	ambiente
10	2501-FF		cold extraction	DCM/Cyclohexane 1/1			
11	2501-FF	20g anhydrous sodium sulfate and 10g sand	Soxhlet	n-Hexane	0.42	180	
12	2501-FF	homogenisation	shaking out	butanon and ethylacetate	1	rt	no
13	2501-FF	drying with PAA	Twisselmann	Cyclohexan / Toluol (1:1, v/v)	6	boiling point	
15	2501-FF		ASE350	EtOH:Tol (7:3)	2*7 min	100 degC	1500 psi (=10MPa)
16	2501-FF	freeze drying	ASE	dichloromethane/hexane (50/50)	0.3	100	10
17	2501-FF	Freeze Drying	SOXHLET	FOODS: DCM: TOLUENE: CYCLOHEXANE (1/1/1) NULFOD: HEXANE: DCM (1/1/1)	24H		
18	2501-FF						
20	2501-FF	drying	Soxhlet	Toluen	4h	120	
21	2501-FF	homogenisation	shaking	DEE	2x 1/2 hours	ambient	normal
22	2501-FF	homogenisation, drying	ASE	N-Esano/Dichlorometano(1/1)	0.5	120	1000
23	2501-FF	drying	ASE	HEXANE	0.33	100	10.13
24	2501-FF	Drying under vacuum	ASE	50:50 Toluene : Cyclohexane		130	1700
26	2501-FF	Blending with anhydrous sodium sulfate		cyclohexane/dichloromethane (1,1, v/v)	1h		
27	2501-FF	/	cold extraction	MeOH + hexane + H2O		room temperature	atmospheric pressure
28	2501-FF	OVEN DRYING (45°C)	ASE	ACETONE:HEXANE 1:1	1/3	100	10.34
30	2501-FF	Yes, Freeze-Drying	ASE	Toluene	45 minutes	135	
32	2501-FF	Drying	ASE	Toluene/Ethanol (90/10)	1	100	10.34
33	2501-FF	none	cold extraction	Acetone/Petroleum ether/water (40/50/40)	0.05 h; (3 min.)	20°C (room temperature)	
34	2501-FF						
35	2501-FF	Homogenisation	NBN EN 1528-2: mix sample with sand and anhydrous Na2SO4, place the mixture in a column and extraction by passing the extraction solvent through the column.	2/1 (v/v) ,n-hexane/acetone	1	Room temperature	Atmospheric pressure
37	2501-FF		Solvent extraction				
38	2501-FF	rub with sodium sulphate and sea sand	Soxtherm	Ethylacetat/Cyclohexan (1000/985; v/v)	2,5	190	atmospheric
39	2501-FF		cold extraction	Hexane/Ethanol/Diethylether (3/1/1)			
41	2501-FF		Soxhlet	Dichloromethane	18 h	Boiling point	
42	2501-FF	drying	ASE	toluene(85%)/Ethanol (15%)	20 min	120	10
44	2501-FF	Freeze-drying	ASE	Hexane	2 cycles a 5 min	100	10
45	2501-FF	-	quechers	acetonitrile + 1% acetic acid	1 h	room temperature	
46	2501-FF		Soxhlet	Hexane:Acetone (41:59)	24		
47	2501-FF	Drying by Steamroom	solid/liquid extraction	Hexane/PA (60/40) + Toluène/Acétone (70/30)	/	/	/
48	2501-FF	solid extraction with acetone, aceonitrile and hexane	liquid-liquid extraction in separating funnel	water / hexane 150 / 50		ambient temperature	
49	2501-FF	homogenise in ultraturrax with solvent (water/ethanol)	liquid-liquid	TBME/Hexane (1/1)	ultraturrax 30" (twice)	ambient	ambient
50	2501-FF	Drying with sodium polyacrylate	ASE	(1) Toluene - (2) Toluene:Ethanol 90:10	0.25	100°C	10.3
51	2501-FF	drying	PLE	Toluene/Acetone (70/30)			
52	2501-FF		Cold extraction	Petroleum ether / acetone (2/1)	2	22	
54	2501-FF	freeze drying	Soxhlet	toluene	overnight	boiling	
56	2501-FF	mixed with sodium sulfate, sand	column cold extraction	n-Hexan/Aceton (2/1)		room temperature	
57	2501-FF	freeze drying	cold solvent extraction	hexane/acetone 2/1	2	room temperature	atmospheric pressure
58	2501-FF	Drying - Microwave	ASE	Hexane 100%	0.3	125	
59	2501-FF	Na-sulphate	Soxhlet	Hex/DCM 1/1	6		
61	2501-FF	homogenisation	soxhlet	Cychlohexane/ethyl acetate (1:1)	6 h	reflux	
62	2501-FF						
63	2501-FF	sample mixed with sodium sulphate before extraction	Soxhlet	DCM:Hexane (50:50)	24 h		
64	2501-FF		soxhlet	toluene	12		
65	2501-FF	PAA	twisselman	Cyclohexan/Toluol (50/50)	8	boiling point	
66	2501-FF	none	mechanical shaking	Ethyl acetate / acetic acid (99/1)	0.25	25	
68	2501-FF	DRYING	SOXHLET	HEXANE	3	68	
69	2501-FF	thorough homogenization, drying with anhydrous Sodium Sulfate	Soxhlet (ultrasonic bath, agitate)	cyclohexane:2-propanol 2:1 (dichloromethane:acetone 2:1)	21 (2.5)	109 (20)	0.1
70	2501-FF	drying	Soxhlet (hot extraction)	Hexane/acetone 80/20	1	50	Atmospheric
71	2501-FF	Homogenisation	LLE (Jensen method)	iso-propanol, diethylether, n-hexane	1h	ambient T	ambient P
72	2501-FF	drying with sodium sulfate	cold	cyclohexane / dichloromethane (1:1)		ambient	ambient
73	2501-FF	lyophilisation	ASE	toluene/acetone 70/30	0.75 h	120	100 bar
74	2501-FF	freeze-drying	ASE	n-hexane:dichloromethane	0.75	100	10 aprox
75	2501-FF	drying	ASE	Hexane/Acetone (70:30)	1	125	10.3
77	2501-FF	drying with sodium sulphate	Soxhleth	DC/hexane (1/1,v/v)	24	reflux	ambient
78	2501-FF						
80	2501-FF	freeze drying	twisselman	Cyclohexan/Toluol (50/50)	8	boiling point	
82	2501-FF			nhexan/acetone/dichlormethane- 1/1/1/			
83	2501-FF			acetone/ethyl acetate	1	23	
84	2501-FF	freeze drying	ASE	toluene/acetone 70/30	Approximately 1 hour	120	10
86	2501-FF	none	Soxhlet	Toluene; Toluene/Ethanol	40		
87	2501-FF	homogenizing	cold extraction	petrolether/acetone 3/1		room temperature	
88	2501-FF	Freeze-drying	ASE	hexane:acetone 3:2	1	110	1500 psi
90	2501-FF	Freeze-drying	Twisselman	Toluene / Cyclohexan (50/50)	6		
92	2501-FF	hydromatrix added in the extraction cell; sand added as dispersant	ASE350	Hexane:Acetone 5:1	0,333	100	10,34
93	2501-FF	none	quechers				
94	2501-FF	Drying	ASE	Toluene / Acetone (70/30)	0.25 h	120 °C	10 Mpa
96	2501-FF		ASE	Ethylacetate	0.25	100	10
97	2501-FF	drying	ASE	Toluene/acetone (70/30)	0.5	120	10
99	2501-FF	drying	Speed Extractor Buchi	toluene/acetone (70/30)	1	100	10
100	2501-FF	drying	high speed stirrer	n-hexan/Aceton (2/1)	0.05	room temperature	Ambient
102	2501-FF	yes	ASE	Esano-Acetone	0.30	120	1000

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	2501-FF		no	yes	no	yes	yes		10	80	80	80
2	2501-FF		yes	yes	yes	no	no					50
5	2501-FF		yes	yes	no	yes	yes		50	50	100	100
6	2501-FF		no	yes	no	yes	yes		25	100	100	100
7	2501-FF		no	yes	yes	yes	no	no	50	50	500	1000
8	2501-FF							Sodium sulfate anhydrous				
9	2501-FF		no	yes	no	no	no					1000
10	2501-FF		no	yes	no	yes	yes		25	25	100	100
11	2501-FF		yes	no	no	no	no	glasswool/activated silica/anhydrous sodium sulfate				1000
11	2501-FF		yes	no	no	no	no	glasswool/activated silica/anhydrous sodium sulfate				1000
12	2501-FF		no	yes	no	yes	yes	no	20	200	200	200
13	2501-FF		no	yes	no	yes	yes	no	20	25	500	500
15	2501-FF		no	yes	no	yes	yes	Silver nitrate column	300 µl	300 µl	200 µl	200 µl
16	2501-FF		no	yes	yes	no	yes	carbon/florisil	10	20	50	50
17	2501-FF		NO	YES	YES	YES	YES	NO	10	10	10	50
18	2501-FF											
20	2501-FF		no	yes	no	yes	yes		120000	90000	90000	5000
21	2501-FF		no	no	no	no	no					500
22	2501-FF		yes	yes	no	yes	yes	yes silica B/N	50	50	50	50
23	2501-FF		NO	YES	YES	YES	YES	NO	30	non-ortho DL-PCBs are in the PCDD/F fraction	100	Indicator PCBs are in mono-ortho DL- PCB fraction
24	2501-FF		no	yes	no	yes	yes	no	10		50	500
26	2501-FF		no	yes	yes	yes	yes	no	15	15	25	25
27	2501-FF		no	yes	no	yes	no	no	/	/	/	500 µl
28	2501-FF		NO	YES	NO	NO	NO	SPE SILICA COLUMN 1g/6mL				250
30	2501-FF		No	Yes	Yes	Yes	Yes		10	20	20	20
32	2501-FF		no	Yes	no	yes	yes		10	10	200	200
33	2501-FF		yes	no	no	no	no	silica column				1000
34	2501-FF											
35	2501-FF		Yes	Yes	No	Yes	No	N/A	N/A	N/A	N/A	100
37	2501-FF		No	Yes	NO	Yes	Yes	No	500	500	500	500
38	2501-FF		yes	no	no	no	no	-	-	-	-	1000
39	2501-FF		no	yes	yes	yes	no		10	50	50	50
41	2501-FF		No	Yes	No	Yes	Yes		50	50	50	50
42	2501-FF		no	yes	no	yes	yes		20	20	500	500
44	2501-FF		no	yes	no	yes	yes	silver nitrate column	15	15	20	20
45	2501-FF		no	no	no	no	no	d-SPE C18, PSA, MgSO4				500
46	2501-FF		yes	yes	no	no	yes	no	15	15	75	75
47	2501-FF		no	yes	no	yes	yes	no	20	20	125	125
48	2501-FF		no	yes	no	no	no					1000
49	2501-FF		yes	no	no	no	no	styrene divinylbenzene			50	50
50	2501-FF		no	yes	no	yes	yes	-	9	9	100	100
51	2501-FF		No	Yes	Yes	No	Yes		12	12	50	50
52	2501-FF		yes	yes								1500
54	2501-FF		no	yes (Dextech)	no	yes (Dextech)	yes (Dextech)		10	10	80	
56	2501-FF		yes	no	no	no	no	silica column				1000
57	2501-FF		no	yes	no	yes	yes		30	30	30	30
58	2501-FF		No	Yes - Miura	Yes - Miura	Yes - Miura	Yes - Miura	N/A	25 µl	25 µl	500 µl	500 µl
59	2501-FF		yes	yes	no	no	yes		30	30	30	30
61	2501-FF		yes	yes	no	no	no					1000
62	2501-FF											
63	2501-FF		no	yes	no			basic set of "power-prep system" columns	20	40	40	40
64	2501-FF		no	yes		yes	yes		15	50	50	50
65	2501-FF		no	yes	no	yes	yes	no	30	30	400	400
66	2501-FF		no	no	no	no	no	no		no	no	
68	2501-FF				YES	YES	YES		50	20	20	20
69	2501-FF		yes	yes	no	yes	yes	basic silica, silver nitrate silica	10	10	50-100	1000
70	2501-FF		no	yes	no	yes	yes		25	25	60	60
71	2501-FF		no	yes	no	yes	yes	Power-Prep FMS (silica/alumina/carbon columns)	10	10	20	20
72	2501-FF		no	yes	no	yes	yes	AgNO3 (MIURA)	20	20	20	20
73	2501-FF		no	yes	yes	no	no					50
74	2501-FF		no	yes	no	yes	yes		20	50	50	500
75	2501-FF		no	yes	no	yes	yes		20	20	100	500
77	2501-FF		yes	yes	yes	no	yes		10	50	50	200
78	2501-FF											
80	2501-FF		no	yes	no	yes	yes	no	30	30	400	400
82	2501-FF							no	25ul	1500ul	1500ul	1500ul
83	2501-FF		no	yes	no	no	no					1000
84	2501-FF		no	yes	yes	no	no					50
86	2501-FF		no	yes	no	yes	yes	Silica/AgNO3	50	50	100	100
87	2501-FF		yes	yes	no	yes	yes		30	30	30	
88	2501-FF		YES	YES	NO	YES	YES		20	20	20	20
90	2501-FF		no	yes	no	yes	yes	acidic treatment	25	25	50	50
92	2501-FF		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	
93	2501-FF		no	no	no	no	no					1000
94	2501-FF		No	Yes	Yes	No	Yes		10	10	50	50
96	2501-FF		yes	no	no	no	no	Silica 10% water				1000
97	2501-FF		no	yes	no	yes	yes		10	20	50	50
99	2501-FF							florisil + silica + silica/sulfuric acid 22% + silica/sulfuric acid 44%				50 (toluene)
100	2501-FF		yes	yes								5000
102	2501-FF		yes	yes	No	yes	yes	no	25,0	50,0	50,0	50,0

LC	Sample	PCDD/F				Dioxin-like PCB (non-ortho-PCB)				Dioxin-like PCB (mono-ortho-PCB)				Indicator PCB			
		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	2501-FF	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
2	2501-FF													splitless	1	Restek RXI-XLB capillary column (fused silica)	LRMS
5	2501-FF	PTV	5	DB-5MS UI	MS/MS	PTV	2	DB-5MS UI	MS/MS	PTV	2	DB-5MS UI	MS/MS	PTV	2	DB-5MS UI	MS/MS
6	2501-FF	splitless	1	DB5MS	APGC-MSMS	splitless	1	DB5MS	APGC-MSMS and HRMS	splitless	1	DB5MS	APGC-MSMS and HRMS	splitless	1	DB5MS	APGC-MSMS and HRMS
7	2501-FF	PTV	5	DB-5; SLB	HRMS	PTV	5	HT-8	HRMS	PTV	3	HT-8	HRMS	PTV	3	HT-8	HRMS
8	2501-FF													PTV- Split	1 µl	Rtx-5MS 30 mx0.25 mm ID 0.25 µm	MS-PRM
9	2501-FF													Splitless	1	Rxi-XLB	LRMS: GCMSMS
10	2501-FF	splitless	2	DB 5 MS	HRMS	splitless	2	DB 5 MS	HRMS	splitless	2	HT 8	HRMS	splitless	2	HT 8	HRMS
11	2501-FF													PTV	1	TG-5 SiIMS	MS/MS
11	2501-FF													PTV	1	TG-5 SiIMS	MS/MS
12	2501-FF	MMI	4	DB 5 MS	GC-MSMS	MMI	4	DB 5 MS	GC-MSMS	MMI	4	DB 5 MS	GC-MSMS	MMI	4	DB 5 MS	GC-MSMS
13	2501-FF	PTV	5	DB5-MS	HRMS	PTV	5	DB5-MS	HRMS	SSL	1	HT8-PCB	HRMS	SSL	1	HT8-PCB	HRMS
15	2501-FF	PTV	100 µl	Rtx-Dioxin2	HRMS	PTV	100 µl	Rtx-Dioxin2	HRMS	PTV	5 µl	Rtx-Dioxin2	HRMS	Splitless	1 µl	Hi8	HRMS
16	2501-FF	PTV, splitless	2	DB-5MS	HRMS	PTV, splitless	1	DB-5MS	HRMS	PTV, splitless	1	DB-5MS	HRMS	PTV, splitless	1	DB-5MS, HT-8	HRMS
17	2501-FF	SPLITLESS	2	DB5MS	HRMS	SPLITLESS	1	DB5MS	HRMS	SPLITLESS	1	DB5MS	HRMS	SPLITLESS	1	DBXLB	HRMS
18	2501-FF																
20	2501-FF	splitless	2	5% phenyl-95% dimethyl polysiloxane	GCMSMS TQ	splitless	2	5% phenyl-95% dimethyl polysiloxane	GCMSMS TQ	splitless	2	5% phenyl-95% dimethyl polysiloxane	GCMSMS TQ	split/splitless	3	5% polysilarylene-95%polydimethylsiloxane	GCMSMS TQ
21	2501-FF													splitless	2	crosslinked 5% PH ME Siloxane	ECD
22	2501-FF	splitless	1	db5ms 60mx0,25mmx0,25um	HRMS	splitless	1	db5ms 60mx0,25mmx0,25um	HRMS	splitless	1	db5ms 60mx0,25mmx0,25um	HRMS	splitless	1	db5ms 60mx0,25mmx0,25um	HRMS
23	2501-FF	Splitless	1	5% DiPhenyl 95% Dimethyl Polysiloxane	LRMS/MS	Splitless	1	5% DiPhenyl 95% Dimethyl Polysiloxane	LRMS/MS	Splitless	1	5% DiPhenyl 95% Dimethyl Polysiloxane	LRMS/MS	PTV	1	8% Phenyl (equiv) Polycarbonate-siloxane Phase	LRMS/MS
24	2501-FF	Splitless	2	TR - 5MS	HRMS	Splitless	2	TR - 5MS	HRMS	Splitless	2	TR - 5MS	HRMS	Splitless	2	TR - 5MS	HRMS
26	2501-FF	splitless	2,0	60 m DB-5 MS capillary column	HRMS	splitless	1,5	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
27	2501-FF	/	/	/	/	/	/	/	/	/	/	/	/	splitless	1 µl	XLB	LR-MS
28	2501-FF													SPLITLESS	1	HT8 SGE	GC-MS TRIPLE QUAD
30	2501-FF	Splitless	1	DB5MS	HRMS	Splitless	1	DB5MS	HRMS	Splitless	1	DB5MS	HRMS	Splitless	1	DB5MS	HRMS
32	2501-FF	Splitless	2	HP-5-MS	APGC-MS-MS	Splitless	2	HP-5-MS	APGC-MS-MS	Splitless	2	HP-5-MS	APGC-MS-MS	Splitless	2	HP-5-MS	APGC-MS-MS
33	2501-FF													PTV, split ratio 1:100	1	5% Phenylpolysiloxane	GC-MS/MS (Triple quadrupol)
34	2501-FF																
35	2501-FF	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	splitless	2	TR-PCB-8MS Thermo-scientific	MS-MS
37	2501-FF	PTV	100	DB-5 MS	HRMS	PTV	100	DB-5 MS	HRMS	Splitless	2	DB-5 MS	HRMS	Splitless	2	DB-5 MS	HRMS
38	2501-FF													splitless, PTV	1	HP-5MS Ultra Inert, 2x 15m x 0,250mm x 0,25µm; Backflush	Triple-Quadrupole (GC-MS/MS), HES Source
39	2501-FF	Splitless	1	VF-Xms	LRMS	Splitless	1	Rxi 5SiI MS	LRMS	Splitless	1	Rxi 5SiI MS	LRMS	Splitless	1	Rxi 5SiI MS	LRMS
41	2501-FF	Splitless	1,5	DB-5MS	HRMS, DFS	Splitless	1,5	DB-5MS	HRMS, DFS	Splitless	1,5	DB-5MS	HRMS, DFS	Splitless	1,5	DB-5MS	HRMS, DFS
42	2501-FF	PTV	2	DB5-MS (5%-phenyl)methylpolysiloxane	MS/MS	PTV	2	DB5-MS (5%-phenyl)methylpolysiloxane	MS/MS	PTV	2	DB5-MS (5%-phenyl)methylpolysiloxane	MS/MS	PTV	2	DB5-MS (5%-phenyl)methylpolysiloxane	MS/MS
44	2501-FF	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	MS/MS	Pulsed splitless	1	DB-XLB	MS/MS
45	2501-FF													Splitless	1	HP 5MS	LRMS (QqQ)
46	2501-FF	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
47	2501-FF	Splitless	2	DB5	APGC	Splitless	1	DB5	APGC	Splitless	1	DB5	APGC	Splitless	1	DB5	APGC
48	2501-FF													PTV	10	HP 5MSI 30 m x 250 µm x 0.25 µm	MS/MS
49	2501-FF													splitless	1	DB-XLB	LRMS (QqQ)
50	2501-FF	PTV	5	VF5-MS	HRMS	PTV	5	VF5-MS	HRMS	splitless	2	HT-8	HRMS	splitless	2	HT-8	HRMS
51	2501-FF	Splitless	2	DB5MS	HRMS	Splitless	2	DB5MS	HRMS	Splitless	1	HT8PCB	HRMS	Splitless	1	HT8PCB	HRMS
52	2501-FF													split ratio 7,0	1	Rxi®-5SIL MS w/Integra-Guard®	ECD
54	2501-FF	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				
56	2501-FF													PTV	2	DB-xlb	GC-MSMS
57	2501-FF	PTV	1	Rtx-Dioxin2	HRMS	PTV	1	Rtx-Dioxin2	HRMS	PTV	1	SGE-HT8-PCB	HRMS	PTV	1	SGE-HT8-PCB	HRMS
58	2501-FF	PTV in Splitless mode, PTV in Large Volume mode	6 µl	RTX Dioxin 2	HRMS	PTV in splitless mode, SSL in Splitless mode	2 µl	HT 8/RTX Dioxin 2	HRMS	PTV in splitless mode	2 µl	HT 8/RTX Dioxin 2	HRMS				
59	2501-FF	splitless	5	DB5 MS	MS/MS	splitless	1	DB5 MS	MS/MS	splitless	1	DB5 MS	MS/MS	splitless	1	DB5 MS	MS/MS
61	2501-FF													pulsed Splitless	2		ECD
62	2501-FF																
63	2501-FF	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)
64	2501-FF	splitless	2	DB-5MS	HRMS	splitless	2	DB-XLB	HRMS	splitless	2	DB-XLB	HRMS	splitless	2	DB-XLB	HRMS
65	2501-FF	PTV	5	DB5	HRMS (DFS)	PTV	5	DB5	HRMS (DFS)	PTV	2	DB5	HRMS (DFS)	PTV	2	DB5	HRMS (DFS)
66	2501-FF													PTV	3	Agilent DB-5 MS UI	MS/MS
68	2501-FF	SPLITLESS	1,5	DB-5MS	GC-MS/MS	SPLITLESS	1,5	DB-5MS	GC-MS/MS	SPLITLESS	1,5	DB-5MS	GC-MS/MS	SPLITLESS	1,5	DB-5MS	GC-MS/MS
69	2501-FF	splitless	45691	DB-5MS	HRMS (R>10000)	splitless	1	DB-5MS	HRMS (R>10000)	splitless	1	DB-5MS	HRMS (R>10000)	splitless	1	HT-8	µECD, MS/MS
70	2501-FF	PTV	1	5% Polysilarylene - 95% Polydimethylsiloxane (Zebtron-dioxins)	HRMS	PTV	1	5% Polysilarylene - 95% Polydimethylsiloxane (Zebtron-dioxins)	HRMS	PTV	1	low polarity si-arylene column (Zebtron-XLB)	HRMS	PTV	1	low polarity si-arylene column (Zebtron-XLB)	HRMS
71	2501-FF	splitless	3	DB-5MS	HRMS	splitless	3	DB-5MS	HRMS	splitless	2	DB-5MS, HT8	HRMS	splitless	2	DB-5MS, HT8	HRMS
72	2501-FF	PTV Large Volume	5	DB-5MS	HRMS	PTV Large Volume	5	DB-5MS	HRMS	splitless	1	HT8-PCB	HRMS	splitless	1	HT8-PCB	HRMS
73	2501-FF													splitless	2	HT8 PCB 60m DI 0.25	MS MS
74	2501-FF	splitless	2	TG-Dioxin	HRMS	splitless	1	TG-Dioxin	HRMS	splitless	1	TG-Dioxin	HRMS	PTV	2	DB-XLB	GC-MS/MS
75	2501-FF	splitless	1	DB-5MS 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
77	2501-FF	splitless	1	ZB-DIOXIN	HRMS	splitless	1	ZB-5MS	HRMS	splitless	1	ZB-5MS	HRMS	PTV	1	ZB-50	MS/MS
78	2501-FF																
80	2501-FF	PTV	5	DB5	HRMS (DFS)	PTV	5	DB5	HRMS (DFS)	PTV	2	DB5	HRMS (DFS)	PTV	2	DB5	HRMS (DFS)
82	2501-FF	PTV	5	DB 5ms		PTV	5	DB 5ms									
83	2501-FF													splitless	2	DB-1701	GC-ECD SCIION

LC	Sample	PCDD/F				Dioxin-like PCB (non-ortho-PCB)				Dioxin-like PCB (mono-ortho-PCB)				Indicator PCB			
		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
84	2501-FF													splitless	2	DB-XLB	MS MS
86	2501-FF	PTV	45874	DBDIOXIN, DB-5	HRMS	PTV	2	DBDIOXIN, DB-5	HRMS	PTV	2	DBDIOXIN, DB-5	HRMS	PTV	2	DBDIOXIN, DB-5	HRMS
87	2501-FF	splitless	2	DB-5MS	HRMS	splitless	1	DB-5MS	HRMS	splitless	1	DB-5MS	HRMS				
88	2501-FF	SPLITLESS	2	DB-5ms	HRMS	SPLITLESS	1	DB-XLB	HRMS	SPLITLESS	1	DB-XLB, DB-5ms	HRMS	SPLITLESS	1	DB-XLB	HRMS
90	2501-FF	splitless	1.8	DB-5MS	HRMS (Autospec Ultima Waters)	splitless	1	HT8-PCB	HRMS (Autospec Ultima Waters)	splitless	1	HT8-PCB	HRMS (Autospec Ultima Waters)	splitless	1.0	HT8-PCB	HRMS (Autospec Ultima Waters)
92	2501-FF	splitless	1	DB5ms		splitless	1	HT8		splitless	1	HT8					
93	2501-FF													PTV	1	DB-5MS UI	
94	2501-FF	Splitless	2	RTX-PCB 40m	HRMS	Splitless	2	RTX-PCB 40m	HRMS	Splitless	2	RTX-PCB 40m	HRMS	Splitless	2	RTX-PCB 40m	HRMS
96	2501-FF													splitless	1	HP 5ms UI (5%Phenyl - 95% Dimethylpolysiloxan)	MSMS
97	2501-FF	splitless	2	DB-5MS	HRMS	splitless	2	DB-5MS	HRMS	splitless	2	HT8-PCB	HRMS	splitless	2	HT8-PCB	HRMS
99	2501-FF													splitless	1	HT8 - 8% phényl-polysiloxilane-carborane	LRMS (GC-MS/MS)
100	2501-FF													splitless	1	DB-5MS	MSMS
102	2501-FF	MMI	6	DB-5MS	Triple Quadrupole	MMI	3	DB-5MS	Triple Quadrupole	MMI	3	DB-5MS	Triple Quadrupole	MMI	3	DB-5MS	Triple Quadrupole

Bioanalytical screening methods PCDD/Fs and PCBs - Clean-up and Separation

		Clean-up (PCDD/Fs and PCBs)						Clean-up (Separate analysis of PCDD/Fs and PCBs)			
LC	Sample	Silica/sulfuric acid column	Alumina column	Florisol column	Carbon/celite column	Others	Separate analysis of PCDD/Fs and DL-PCBs	Alumina column	Florisol column	Carbon/celite column	Others
10	2501-FF	yes	no	no	no						
16	2501-FF	yes	no	no	yes	no	yes	no	no	yes	no
21	2501-FF	yes	no	no	no		no				
37	2501-FF	yes	no	no	no	overnight pretreatment with sulphuric acid, then extracted with hexane/DEE 97/3	no	no	no	no	no
78	2501-FF	yes	no	no	no	-	no	-	-	-	-

EURL Proficiency Study on the Determination of PCDD/Fs, PCBs, PBDEs, HBCDDs and PFAS in Fish Fillet 2025 [EURL-PT-POP_2501-FF]

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

Fish Fillet (2501-FF)

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
10	2501-FF		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	76.00		
16	2501-FF		H1L6.1c3, XDS Inc.	yes	duplicates	TCDD, PCB 126	4-PL	SSR	yes	yes	GC/HRMS confirmed	fish oil	6,96	2,33	4,63
21	2501-FF		rat hepatoma cells Pgudluc1.1	yes	triplicate	TCDD	linear	SSR	yes	yes	GC/HRMS confirmed		yes-BRM05 from BDS Holand		
37	2501-FF		rat H4IIE (Wageningen University, now BDS)	yes	triplicates	reference samples milkfat	exponential	no	yes, automatically	yes, automatically	reference samples	milkfat	0.59/1.0/2.6/3.5/6.6 pg TEQ/g		
78	2501-FF		H4IIE, rat hepatome wild type, from Helmholtz-Zentrum Neuherberg/Germany	yes	triplicates	TCDD	S-Curve, 4-Parameter-Fit	SSR	yes	yes	EURL-PT-2001-FI	Fish	2,1 pg WHO2005-PCDD/F+dlPCB-TEQ/g fresh weight	0,22 pg WHO2005-PCDD/F+dlPCB-TEQ/g fresh weight	1,8 pg WHO2005-PCDD/F+dlPCB-TEQ/g fresh weight
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									
10	2501-FF		no	yes	no	no									
16	2501-FF		yes	no	no	no	no								
21	2501-FF						2/3 of limit								
37	2501-FF		no	no	no	no	Using 2/3 of ML PCDD/Fs								
78	2501-FF		no	no	no	no	Cut off = 2/3 of concentration of interest								

LC	Sample	Additional information	
		Physical-chemical methods	Bioanalytical methods
15	2501-FF	Treatment of the extract with MTBE and drying with Na2SO4 after extraktion and prior to fat determination	CB123 was quantified with the indicator PCBs on the Ht8 column due to a potential coelution ont the Rtx-Dioxin2 column.
33	2501-FF	internal standards are not used for quantification	
35	2501-FF	Weighed sample= massmeat weighed at the start before fat extraction	
37			Lipid was extracted from 40g fish and 2,0 gram used for the analysis. With 5,6% fat this corresponds to 35,83 g fw fish.The sample gave a near maximum response, was above the highest reference sample 6.6 pg BEQ/g and as a result the estimated level is not very accurate. The estimated level might be underestimated.We do not analyse fish routinely with DR CALUX, despite that the sample might be underestimated, the ML of 6.5 will not be exceeded when corrected for the wet weight.
44	2501-FF	Results for PCDD/Fs and non-ortho-PCBs could not be reported within the deadline due to downtime on the HRMS instrument. The sample will be analysed as soon as the	
72	2501-FF	Significantly lower results are obtained when using freeze-drying as sample preparation.	
92	2501-FF	after Miura purification there are obtained two fractiones: fraction (1) containig PCDD/Fs+mono-ortho-PCBs and fraction (2) containig other DL-PCBs	
100	2501-FF	the Lipid concentration has only been estimated and is 6,2%.	